Proceedings of the 18th National Meeting of the
Public Health Conference on Records and Statistics

NEW CHALLENGES FOR VITAL AND HEALTH RECORDS

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES • Public Health Service • Office of Health Research, Statistics, and Technology • National Center for Health Statistics

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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Every two years, the National Center for Health Statistics sponsors the Public Health Conference on Records and Statistics (PHCRS) to encourage improvement in health information systems in the United States. These systems provide the background facts--vital and health statistics --that guide public health decisions. Therefore each step we take to better our data systems directly assists in improving the quality of health in our Nation.

A most important accomplishment of the PHCRS is providing a national forum where a wide range of public health specialists can exchange information and ideas. Statisticians, registration executives, health planners, data services specialists and others gather at the PHCRS for mutual consultation. Not only are many occupational areas represented, but also a diversity of employers, including Federal, State, and local governments as well as private organizations and universities. This multifaceted group lends the PHCRS a rich variety of insights to current progress, problems, and solutions.

The 1980 Conference

Ever-changing needs for health data constantly challenge our health information systems. With this in mind, we chose "New Challenges for Vital and Health Records" as our 1980 Conference theme. The program included, for example, sessions on the current challenges presented by data needs in the areas of environmental and occupational health, health promotion, and health care technology assessment. Other session topics included new uses for existing records, methodological issues, and the 1980 census.

This year we commemorated a very special event that coincided with the 18th National Meeting of the PHCRS: the 20th anniversary of the National Center for Health Statistics. At the First Plenary Session, former directors Dr. Forrest E. Linder and Mr. Theodore D. Woolsey gave tributes to the Center. Our third former director, Dr. Edward B. Perrin, sent his regrets that he could not be present and his best wishes for a successful Conference.

Judging from the compliments we have received both verbally and through the evaluations, the 1980 PHCRS was indeed a success. A vast majority of attendees who returned evaluations stated that the Conference gave them new information that they can put to practical use in their work. In addition, the sessions were given very good ratings in terms of the clarity of presentations. (A summary of the evaluation results can be found in the Appendix.)

As always, we welcomed the joint participation of the Association for Vital Records and Health Statistics (AVRHS), formerly called the American Association for Vital Records and Public Health Statistics (AAVRPHS). AVRHS members held their Annual Meeting following the Conference, on August 7 and 8.

Our thanks to all who contributed to the 1980 Conference to make it the informative, beneficial interchange that it was. By publishing these Proceedings, it is our hope that the communication and understanding fostered by the 18th National Meeting of the PHCRS will continue far beyond the closing of the final Conference session.

Dorothy P. Rice

Dorothy P. Rice
Director, National Center for
Health Statistics

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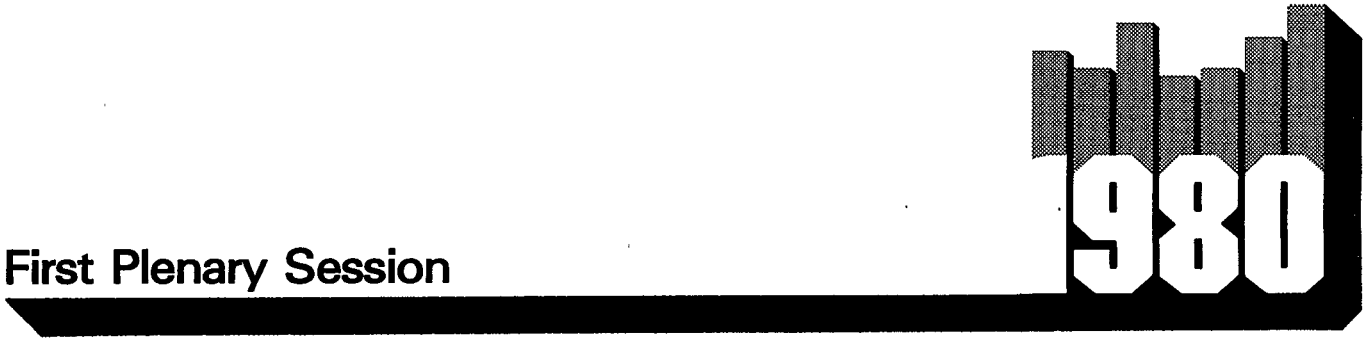

First Plenary Session

CALL TO ORDER AND
NATIONAL CENTER FOR HEALTH STATISTICS 20th ANNIVERSARY COMMEMORATION

Dorothy P. Rice, Director, National Center for Health Statistics

Good morning, and welcome to the 18th National Meeting of the Public Health Conference on Records and Statistics. It is such a great pleasure for me to be here in person to greet you. As many will remember, two years ago I spoke to you from my hospital room. I am pleased to report that I have had a complete recovery and I am delighted to be here in person. Let me tell you, this is better, much better.

The biennial meetings of the PHCRS are always a very special event for us in the National Center for Health Statistics. They are an opportunity to see many old friends and colleagues and to meet new workers in the field of vital and health statistics as well as representatives of our clientele, the Nation's data users. We hear about your problems and projects and share with you information on the Center and its activities.

I have been involved with three Conferences now as Director of the Center, and before that I participated in several others. Each one, I am convinced, is better than the one before. This year we offer what I feel is truly an exceptional program. Our three days together are packed with stimulating sessions on "New Challenges for Health Statistics," the theme of our Conference.

These challenges include methodologic advances as well as new applications of traditional data systems. To a considerable degree, we deal with two overriding issues in these sessions. One of these issues is data needs and applications in the area of environmental health. The other issue is data and data systems needed to track our national initiatives in health promotion and disease prevention. Throughout the Conference, the emphasis is on new uses of existing data systems; on making the most of what we have.

Before we begin our formal program, we invite you to share with us in NCHS a most noteworthy and exciting anniversary. This year our Center is 20 years old. I would like to review briefly the trends of those past 20 years, and then to introduce to you our special guests for this commemoration, two of the three former directors of the Center.

It was in June 1960 that the Surgeon General's study group on mission and organization of the Public Health Service reported that "the needs of the nation . . . require broad regional and national data with respect to the character and dynamics of health problems, their trends, and implications." The study group went on to recommend the creation of "a center for the collection, evaluation, analysis, and interpretation of data from many sources" that would serve as the statistical arm of the Public Health Service.

In August 1960, exactly 20 years ago, the National Center for Health Statistics was formally established. Incorporated into the new Center were two existing program units: the National Health Survey Division and the National Vital Statistics Division (formerly the National Office of Vital Statistics).

I am not going to give you a step-by-step history of the Center in the years since 1960. A few comparisons will suffice to indicate our growth in responsibilities and resources.

In 1960, the Center's budget, as best we can construct, was $3 million and its staff totaled 243. In 1980, the budget is $43 million and the staff stands at more than 500. Those are not constant dollars, unfortunately, and we are now encountering some set backs. Even so, the increase in resources is substantial.

In 1960, there were two well-established data systems: the National Vital Registration System, dating back to about 1900; and the original "National Health Survey" of the 1956 legislation, which we now call the National Health Interview Survey. The health examination survey was relatively new. In 1980, in its continuing nature, this survey remains unique in all the world.

During the 1960's the Center expanded from those basic statistical systems which focused on the people as the source of information on their health into a third area--health facilities and manpower. It initiated studies of patterns of utilization of hospitals and other facilities as well as studies of the institutional population.

This movement continued into the 1970's, when the establishment of the National Ambulatory Medical Care Survey provided the first continuing study of that segment of the health care system where most of our people get most of their health care. A nutrition component was added to the health examination survey and two data collection cycles of the expanded survey have been completed. Partly at the urging of an advisory group set up to evaluate the nutrition component, we are looking ahead now to examination surveys of subgroups of the population--specifically, next year, the Hispanic population--and we are very excited about this new undertaking.

Another new direction in data collection systems in the 1970's is represented by the periodic National Surveys of Family Growth, which provide information needed to interpret trends in the birth rate and to predict patterns of population growth. Most recently, we have been charged with significant responsibilities in the area of environmental health and the data needed to monitor and measure the health consequences of environmental hazards. In addition, this year we are conducting the first of what we expect will be periodic national surveys of medical care utilization and expenditures.

The Center moved in two other significant directions during the 1970's. We greatly expanded our analytic capability. One result is the annual report, Health, United States, issued by the Secretary for use of the President, Congress, and the public. Second, we have moved ahead on the Cooperative Health Statistics System, a national network of public and private organizations cooperating to produce data for multiple users at the national, State, and local levels. We now are changing our directions from component support to emphasizing the development of the capacity of State CHSS agencies to perform coordination; data collection, processing, and analysis; user services; and research and development.

In sum, in 1980 our agenda has evolved considerably. The collection and dissemination of

the Nation's basic health data remains our primary mission and we are responsible for more than 20 separate data collection systems. Increasingly, we are charged with the interweaving of data into the health information and intelligence required for policy decisions.

Growth of program and resources is one measure of the Center's success. Another is the use of its data. That is where our reward comes. We recently had occasion to put together some examples of uses, and I would like to share a few of them with you.

- Data from the Health and Nutrition Examination Survey (HANES) bearing on the prevalence of hypertension have been used to allocate funds to States for hypertension control activities. Other HANES findings bearing on geographic differences in the prevalence of skin lesions were used by the National Academy of Sciences to determine the parameters of the relation between geographic latitude and skin cancer. This contributed to the analysis of the problem of ozone layer depletion.
- Data on geographic variation in cancer mortality rates have provided clues to environmental causes of cancer. It is expected that our review of data on geographic differentials in mortality from other causes will also provide etiological leads.
- Data from the Health Interview Survey on smoking and the incidence and prevalence of respiratory disease have been used to ascertain the morbidity consequences of smoking.
- Cost-of-illness determinations play a role in the allocation of research resources. Data from a variety of NCHS data systems enter into such cost-of-illness calculations.
- In children, growth and development are important indicators of health and nutritional status. Growth charts based on data from the examination surveys of children and youth have been developed. These charts are used by maternal and infant care programs and by private physicians. More than 20 million copies have been distributed to pediatricians in this country.
- Data have been collected from diabetics concerning problems in their adherence to a regimen. Since patient compliance is the weak link in the continuum between medical advances and their successful application, information concerning patients' difficulties is invaluable in redesigning regimens and in developing educational programs for both professionals and patients.

These are only a few specific examples. Over the past 20 years, NCHS data have provided the basis for improvement in medical care, identification of needed areas of health, more efficient use of funds, better planning of health services, and more accurate market research for new health products, drugs, and equipment. We are proud of the range and the quality of data and the uses to which they are applied.

Two of the people who laid the foundations of the National Center for Health Statistics are our special guests today, and we have asked each of them to speak to us. I shall introduce them in order of seniority as Center directors: first Dr. Forrest E. Linder, followed by Mr. Theodore D. Woolsey. Our third director, Dr. Edward B. Perrin, is unable to be with us. He sends his regrets and best wishes for a successful conference.

TRIBUTE TO THE NATIONAL CENTER FOR HEALTH STATISTICS

Forrest E. Linder, Former Director, National Center for Health Statistics

As we have heard, the National Center for Health Statistics was born just 20 years ago. As its first Director, I saw the Center grow through its pre-school ages. Mr. Woolsey, the next Director, led the still-infant Center during elementary school, and Dr. Perrin was responsible for it during the teen-age high school period. Now Dorothy Rice leads the Center through its post-graduate ages and on to full adulthood. Hers is the greatest responsibility!

I think that psychologists still believe that habits formed in early years may persist throughout life. There is one special practice that the Center started from the beginning that I believe has persisted throughout its 20 years and which, I hope, will never be abandoned. This practice relates to a point of view which was expressed some years ago by the British colonial official, Sir Joseph Stamp.

Sir Joseph said, "The government is extremely fond of amassing great quantities of statistics. These are raised to the nth degree, the cube roots are extracted, and the results are arranged into elaborate and impressive displays. What must be kept in mind, however, is that in every case the figures are first put down by a village watchman, and he puts down what he darn well pleases."

Of course, the analogy is not perfect--not many of the Center's data sources go back to a village watchman--although it may still be true that some of its respondents put down anything they please.

However, the healthy skepticism of Sir Joseph's quotation has been represented in the Center by a continuous series of methodological studies, investigations of response and sampling errors, and general appraisals of the reliability and validity of its data.

This self-criticism by the Center has been one of its outstanding characteristics and has established its reputation as a truly scientific institution rather than just a sloppy data collecting agency. Long ago the Center realized that if you do not criticize yourself, someone else will, and it is better to do it yourself rather than always being on the defensive.

A very important feature of the United States statistical system which is different from that in most developed countries is that, with one exception, each of its principal statistical agencies collects the basic data related to the action programs which are the responsibility of the Department within which it is located. The one exception is the U.S. Bureau of the Census. Because of its location, independent of program management, the Census Bureau has always been able to hold a world-wide reputation for presenting its data completely, fairly, critically, and without any program bias.

The younger members of this audience may not realize the strong hereditary roots that the NCHS has with the Census Bureau, but many of the Center's "old-timers" came from the Census Bureau. They carried into the Center the strong conviction that correct policy decisions on the increasingly political topic of the Nation's health needed above all an objective nonpolitical data base.

It is a source of real satisfaction to me to believe that this conviction continues, but as the Center moves into its adulthood there may be strong forces acting to erode this position.

As I said before, the leadership responsibility for the Center is now under the astute direction of Dorothy Rice. It is interesting to note that of the five major statistical agencies in the U.S. system, three of them are headed by women. They can console themselves by what is called the "Women's Equation." This says: "Whatever women do, they must do twice as well as men to be thought half as good. Fortunately, this is not difficult."

TRIBUTE TO THE NATIONAL CENTER FOR HEALTH STATISTICS

Theodore D. Woolsey, Former Director, National Center for Health Statistics

What to say about the years 1967 to 1973? Was it only 6 years? As I look back it seems like 20, and my principal recollection is that they were awfully hectic years. I know that the absurd and unreasonable restrictions on the number of people you could hire (in addition to, and completely unrelated to, the normal limitations on the budget for health statistics) were becoming more stringent, making it increasingly difficult to keep up with our work. And during that period our publication of vital statistics fell farthest behind, and did I ever hear about that from the users!

However, we also turned the corner in our "catchup" program and started on the way back, but in the course of doing so I made one of my worst mistakes--insisting on the coding of cause of death on only a 50-percent sample of the certificates. It is only now that I realize how serious an error that was! Ah, me!

Nevertheless, we did initiate some good things during that 6-year period. For one thing, we really started the Cooperative Health Statistics System, which I still think is the right way to go, at least in its original format, and it saddens me--I must be frank--to see the responsibility for it being split up, and its emphasis changed in many ways.

There were other advances, too. The National Ambulatory Medical Care Survey was launched and has been, in my view, a great success, though I'd like to see its coverage broadened. The National Survey of Family Growth had its origins during that 6-year period, too, though it did not come into full operation until later. Still another new development of that period of which NCHS can be very proud, though I can claim absolutely no credit for myself, was the original formulation of the program for computer assignment of the underlying cause of death. The program was designed down at the Health Statistics Developmental Laboratory at the Research Triangle Park.

Finally, the distinguished Committee to Evaluate NCHS was appointed, met, and rendered its far-reaching report during this period. You should all re-read it sometime.

Attempting to place these and other events in a time scale is not easy, I have found, and that leads me to conclude my remarks with a plea for the restoration of a couple of small elements of the NCHS program (and relatively inexpensive ones, Dorothy). I really think they were both good ideas--particularly helpful, I believe, to that large and scattered group of people outside NCHS, of which I have now become a member, and which you might call "the Friends of NCHS."

One of them was what we called the Panel of Advisors. During the time I was Director, there was a governmentwide effort to lower the number of advisory committees. Therefore we set up something called a Panel of Advisors, which never met, and consequently did not meet the criteria for an advisory committee.

The members of the panel became qualified advisors by agreeing to review the materials that were sent to them and occasionally to write commentaries and criticisms on the materials and on the Center in general. At one time, we had several hundred correspondents who got mailings from the Center--questionnaires or new plans, all kinds of materials--and they were asked to send us their comments. I found it an extremely helpful activity.

And then there was this little report, and some of the old-timers here may remember it, called "Activities, National Center for Health Statistics Report," and following the title, the fiscal year.

These activities reports, as we called them for the years 1968 to 1974, were a very valuable way of reporting the history of the Center, but they were principally designed for the use of the aforementioned Panel of Advisors. In other words, at the end of each fiscal year, we wrote to them a little account, maybe 30 or 40 pages, of the various things that happened in the Center that year; developments in each of the divisions and programs.

And incidentally, in looking at the activities for the fiscal year 1968, the first during which I was Director, I was reminded of something that I had almost forgotten while I was preparing these notes, and I want to read a brief paragraph:

"Ground was broken in February 1968 for the Health Statistics Developmental Laboratory, a three-building complex in Research Triangle Park. These buildings will serve as headquarters for the Office of State Services, and will also house the part of the Division of Data Processing that handles the Center's data preparation activities. We are also proud of our new IBM System 360, model 50 computer," and so on.

That very important development was the creation of my predecessor who should take the credit, but I represented NCHS at the ceremony, and it was a very proud moment.

Many happy returns to NCHS--a great organization!--one of the really few in government, in my belief, that knows what its business is, and performs it very well.

DIRECTOR'S REMARKS

Dorothy P. Rice, National Center for Health Statistics

NCHS owes our previous directors a great deal for their expert leadership. I do regret very much that Ed Perrin, my predecessor as the Center's director, could not be here today.

We are going to continue this celebration tonight and we will light the birthday candles--all 20 of them--at the Conference Mixer. But right now, if you think 20 years is a lot, hold on. We are taking note of another anniversary today. It is not for an organization, it is for a person, and I would like to call William Donald Carroll to join me on the podium.

Don Carroll, as he is known to all, will begin his 50th year in the Bureau of Vital Statistics of the State of Texas on September 1. While a sophomore at the University of Texas, he started with the Texas Department of Health working as a part-time clerk after school and on holidays and Saturdays.

Upon his graduation in 1934, he was appointed Assistant State Registrar. He attended the Harvard School of Public Health in 1938 and 1939. In 1948, he was appointed State Registrar and Chief of the Texas Bureau of Vital Statistics.

In addition, he served as chairman of the Public Health Conference on Records and Statistics from 1956 to 1958. At the 7th National Meeting of the PHCRS, he was presented a scroll of appreciation for his chairmanship.

Fifty years, we thought, deserved more than a scroll, and we are here to give him a plaque. I would like to read the plaque to you: "To W. D. "Don" Carroll, in recognition of his 50th year of distinguished service in vital records and statistics in Texas and the United States. Presented by his friends at the 18th National Meeting of the Public Health Conference on Records and Statistics, Washington, D.C., August 4, 1980."

I would also like to take this opportunity to introduce some of our foreign visitors. We are honored to have in attendance Dr. Ramsis Gomaa from Egypt; Dr. John Donovan from Australia; Dr. Boga Skrinjar from the World Health Organization in Geneva, Switzerland; Mr. John Davis of Statistics Canada; Dr. Hans Bruch from the Pan American Health Organization; and Dr. Emundo Beruman from Mexico.

GREETINGS AND OPENING REMARKS

Ruth S. Hanft, Office of the Assistant Secretary for Health

On behalf of Dr. Richmond, the Assistant Secretary for Health, and myself, I would like to welcome you to the 18th National Meeting of the Public Health Conference on Records and Statistics.

In addition to representing our normal biennial period for this meeting, 1980 also represents two events important to our professions and the subject matter of this meeting: the 20th anniversary of the legislative recognition of the National Center for Health Statistics (NCHS); and the International Year of the Health Record.

A great deal will be said during our sessions over the next few days about both these events, so we would simply like to offer to the NCHS--its leadership, Mrs. Rice, the past directors who are here today, and its superb technical and administrative staff--our appreciation of their contributions to all of us over the past years and our anticipation of their continued major contributions through statistics to health services policy and program.

In terms of the International Year of the Health Record, we hope this conference with its theme of "New Challenges for Vital and Health Records" will be one of many of a similar note this year, both nationally and internationally. While the health record is in itself inanimate, it can, with appropriate methods and analytic skills, become a powerful tool to assist in health planning, monitoring, evaluation, and policy formulation. We would hope the efforts of this international year raise the level of consciousness as to the value of the health record in assisting in the improvement of health and the delivery of health care to people.

New challenges in the decade of the 80's to the health record is a focus of this conference, and therefore I do not intend to preempt speakers that will follow during the next days. Rather, I would like to devote a few minutes to a review of events that have occured in the past two years since we last met for a biennial conference. In a sense, several of these events have already, and will continue, to affect our performances and the availability and utility of health statistics.

The period from 1978 to 1980, at least from a Federal perpective in reference to health statistics, has been, as Charles Dickens once observed: "The best of times and the worst of times." We like to focus first on the "best of times."

(1) During the past two years the Office of Health Research, Statistics, and Technology (OHRST) was established. The Office encompassed under one administrative umbrella the National Center for Health Statistics, the National Center for Health Services Research (NCHSR), and the new National Center for Health Care Technology (NCHCT). While such an organizational grouping has administrative advantages, its major virtue lies in the area of blending and strengthening technical skills and resultant products of the three centers and their functions. As an example, certain of these have been seen most explicitly in Health, United States as an increasingly joint product of the NCHS and the NCHSR, and certain dimensions of this biennial conference program, especially those related to the NCHCT. This latter aspect we hope you find especially beneficial since the NCHCT was established subsequent to our last biennial meeting.

In brief, the combination of these three centers has created a critical mass of expertise and reciprocal program that could only, in the past, be partially realized through previous and less unified organizational arrangements.

(2) Subsequent to our last meeting, the U.S. National Committee on Vital and Health Statistics (NCVHS) suffered a hiatus due to requirements of Committee rechartering. This was unfortunate, especially due to the active and challenging posture of that group during the period from 1975 to 1978. However, the Committee has been rechartered and revitalized in the past 18 months. You will shortly be hearing from the Committee's chairman, Dr. Breslow, so my comments on the current Committee as the principal external advisory group on health statistics to the Department will be brief.

The Committee has once again become a valuable asset as an advisory force on the Department's perspective of health statistics. In early 1978 the former U.S. Committee also became the principal advisory mechanism to the Department on the Cooperative Health Statistics System (CHSS) after the termination of a separate CHSS advisory committee.

(3) The past two years have seen not only the renaissance of the NCVHS but also the Department's Health Data Advisory Committee (HDAC) as the principal internal advisory mechanism on health statistics to the Department.

On common matters of interest between the National Committee and the HDAC, such as minimum uniform health data sets, a reciprocal system of review and recommendation is being developed. Such a system is strengthening the roles of these advisory mechanisms and beginning to assure greater uniformity among the Department's agencies in the collection of health statistics and greater consideration of the role of State and local units in such collection and use.

(4) The National Committee's efforts in the past several years in reference to uniform minimum health data sets have been brought to successful conclusion with the public release of the Committee's recommendations on the Uniform Hospital Discharge Data Set and information needs for national health insurance scheduled for release in the near future as their reports on data sets for ambulatory and long-term care.

Many of these data set products are now under consideration by the HDAC and we are optimistic that Department policy and standards will soon result from such review. Along with this should be a reduction in reporting burden, less duplicative collection, and more statistical products for the Departmental, State, local, and other users.

(5) In the past two years, most central to the growing Departmental cohesiveness in health statistics has been the development of an extremely cooperative and productive relationship between the Health Care Financing Administration (HCFA)

and the Public Health Service (PHS) in many areas, but especially for your interests, in the area of health statistics and research.

This relationship evolved from a formal memorandum of understanding between the two agencies some 18 months ago and has expanded to include:

- Development of the Annual Hospital Report, especially those sections concerning hospital facilities data needed by State and local units;
- Cooperative planning of a role for State CHSS units in the collection and dissemination of Annual Hospital Report information when the system becomes operational;
- Cooperative participation in the HCFA integrated data system demonstration grants program. This program now has positively affected several CHSS States and the present State CHSS demonstrations. In addition, ongoing demonstration activities of both HCFA and the NCHS Division of CHSS are receiving greater integration of both program and products;
- Finally, we are cautiously optimistic that in the near future we may see some pooling of the very scarce fiscal resources of PHS and HCFA to the benefit of State CHSS agencies.

(6) In specific reference to CHSS, the past two years have seen new legislative strengthening of the program; the redirection of the program to strengthening the role and functions of State CHSS agencies; the development and release through the Federal Register of the first guidelines for State CHSS agencies; the initiation and broadening of the State Demonstration Programs; and finally, the completion and public release of the evaluation of CHSS initiated by OHRST. This report is being used to guide the redevelopment of CHSS in a manner similar to the use of the "Hauser Committee" report on the evaluation of NCHS several years ago. We are optimistic that the same organizational benefits will result.

(7) Finally, the past two years have seen the institution of the 9th revision of the ICD and the ICD-9 CM. This activity affected us all and we all contributed considerable resources to development, training, and now use.

The preceding are very quick observations of many positive efforts of the past two years. Most of them are by no means completed. However, we now feel a solid base has been established for further productive evolution in the coming years and in areas that will positively affect us all at local, State, and national levels.

On a less optimistic note, it is no secret that our fiscal resources have been severely and suddenly constrained. A paradox obvious to us all results. We must produce considerably more with considerably less. This is not easy to do, but it can and must be done. The fiscal outlook for the future is not good and therefore we must all pool our resources, fiscal and professional, through greater cooperation both across and among national, State, and local geopolitical levels.

Our common statistical products are important and are accepted as valuable tools for both health and health services delivery to people. We know the years ahead will not provide us with the fiscal flexibility necessary to maximize our effectiveness. We therefore must use greater imagination to identify alternatives for developing our services, greater cooperation in collection and processing, improved techniques for analytic products emerging from smaller and less current data bases, and stronger and more productive relationships with the growing population of users of health statistics.

Certain points of the years ahead will also be the "worst of times." However, our commitment remains strong personally to the State and local level health statistics program. We shall continue to provide as much support as is possible in that direction. Such support we know will increasingly be a people effort requiring commitment, imagination, and cooperation. If we all can continue to strengthen our growing health statistical efforts, we can, I know, anticipate mutually at least, some "best of times."

THE INTERNATIONAL HEALTH RECORD YEAR

William H. Kincaid, Case Western Reserve University School of Medicine

I very much appreciate the opportunity and the honor of being able to spend a few minutes talking about the International Health Record Year together with a few of my personal thoughts on its implications.

First of all, I bring you greetings from Liliane Gauthier of Quebec, who this year is completing her four-year term as President of the International Federation of Health Record Organizations; and J.J. Velthoven of the Netherlands, who this year begins his term as President. It was Madame Gauthier and the Board of the Federation who, acting upon a suggestion of the Association for Health Records here in the United States, designated 1980 as the International Health Record Year. Its goal is to build and increase recognition of the importance of health records first among those many professions depending upon records for carrying out their own professional duties, and second among patients and others in the public sector who must also be deeply concerned about the major issues of the quality of patient care and its cost. The Federation is encouraging its members in each nation to develop educational activities during this year in order to publicize the many values and uses of health records, and special activities of this sort are going on throughout the world. Here in the United States the American Medical Record Association will carry the theme of the International Health Record Year into its meeting to be held in Chicago in October.

I bring to this platform my own personal view of the importance of health records, and that is in their role in measuring quality in health care. When I entered this field a generation ago, I was taught that medical records, particularly in the hospital field, had three major purposes: 1) to protect the patient by providing an organized memory of what was happening to him; 2) to protect the physician and the hospital, particularly against the potential malpractice claim; and 3) to serve the functions of research and education of many different kinds. It was several years before I came to the realization that these three purposes of the health record in hospitals were subsets of the overall goal of assuring quality in health care. In the first case, the record helps protect the patient by documenting the quality of care he receives. In the second case, the documenting of the quality of care is the fundamental protection for the physician and the hospital against malpractice claims. In the third case, research and education uses of the record are aimed at defining quality and seeing that the principles of quality care form the basis of our medical education, both in medical schools and in continuing medical education programs.

In short, in questions of health care, quality is the ultimate issue. As much as we are distracted today by what many consider the chief issues of cost containment, planning, and the use of limited resources, and as much as we are beset by issues of a social, political, or ethical nature, and by the technological explosion, each of these issues has as its fundamental assumption that first of all we are seeking quality in health care--even though at times we may be seeking what may be termed a minimal level of quality.

As the pressures increase, for example for cost containment (and can any of us think they will not increase in the foreseeable future?), physicians, hospitals, and other providers will begin to complain that quality may be reduced. When we ask them to tell us what they mean by quality and exactly how it is being affected by cost containment, they will find themselves unprepared to deal with these issues unless they have dealt with the basic and specific issues of defining quality in health care. In relation to what should be done in the area of defining quality, it is my opinion that we are doing very little to prepare for that day of the crunch when we will need definitions of quality that can be understood by consumers and public agencies as well as by the providers themselves.

I have been using the future tense here, but we all know these things are going on today, with such controversies as whether we have too many hospital beds in this country, how much CT scanning is proper, and we can all add to the list. The latest publications from the National Center for Health Statistics indicate that lengths of hospital stay are on the average up to 44 percent higher in one area of the country than another, a phenomenon which has remained fairly constant since the National Hospital Discharge Survey began 15 years ago. In addition, the rate of use of hospital days per thousand population is almost 60 percent higher in one region than another. I predict difficult days ahead for the providers in their attempts to define quality of care which allow for such extraordinary and persistent variations--when and if we decide to get tough on this issue.

Not only is quality the ultimate issue in health care, but also by far the most effective way of measuring quality is looking at the record. No other method of matching actual practice with our definitions of quality can compete with looking at documentation of what happened. Other methods are too expensive or too impractical to compete on a large scale.

Vital statistics records, too, play an important role in giving us insight to quality. For example, I am now engaged in planning for an evaluation of the Cleveland Perinatal Network, which helps discover and care for high-risk pregnancies. Without base-line vital statistics, such an evaluation would be almost impossible. We look forward to having available data from the Center's National Natality Survey and the National Fetal Mortality Survey, going on now, as a measure of what progress we are making in quality care in those areas.

In hospital and ambulatory care, methods for quality assurance which in my opinion are most promising from the point of view of effectiveness, are those that depend on the record, starting with the problem-oriented medical record as organized by Weed. Other promising methods include: 1) greater use of computers as suggested by Barnett, McDonald, and others; 2) more use of

carefully worked out protocols as advocated by Komaroff and others; 3) concurrent quality assurance as developed by Sanazaro's study in the Private Initiative in Professional Standards Review Organizations; 4) criteria mapping as demonstrated by Greenfield at UCIA; 5) form design based on decision analysis as reported by Frazier and Brand at Yale in a study of the treatment of lacerations; 6) areawide medical care evaluation studies now being done by some PSRO's; and 7) giving the patient easy access to his health record.

These are, in my opinion, some of the most important developments of the last few years in finding effective ways to help improve quality, and all depend on the record itself. It is almost as though we cannot have quality without its accompanying record. But one thing is certain: we cannot prove we have quality without the record, and it is this proof which is coming into greater and greater demand.

In closing, I would like to emphasize that in my opinion, we must restate the value of records in a way that will recognize their essential contribution to the definition and determination of quality in health care. And if we have started on that road in 1980, the International Health Record Year will have served its purpose well.

ISSUES IN DEVELOPING ROUTINE DATA SOURCES FOR HEALTH PLANNING

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The subject of this presentation is clearly not a new one. We are not faced with a new set of conditions in health planning for which unanticipated demands for data are being made, but rather with a need to sort out from old demands those that could be met, in part or fully, by information from routine data sources and to examine under what conditions this might be accomplished.

This is a repetitive process in which many people in and out of government have struggled over long periods pre-dating the current era of health planning and regulation, and the issues involved will never be fully resolved. We are unlikely ever to be satisfied that we have gone as far as possible with routine data sources to meet information needed for planning. This should not be interpreted as a pessimistic view of the future. It is simply a recognition of several realities including the complexity and uncertainties associated with many of the issues in health planning and the implausibility of achieving a state of sufficiency with available data in such a situation. Within these constraints, there is a large opportunity for movement as illustrated by the topics scheduled for discussion at this conference.

Some reference will be made in this presentation to these and other developments. The approach I am taking is to proceed from a consideration of the nature of the demand for information to a discussion of routine data sources that have been identified as resources to meet the demand, and finally to an assessment of the issues to be dealt with in effectively joining demand and capacity.

Health Planning

It is now about 6 years since the enactment of PL 93-641, the National Health Planning and Resources Development Act (1) which authorized the establishment through Federal funding of 205 local area Health Systems Agencies (HSA's) and 57 State Health Planning and Development Agencies (SHPDA's). In the arena of national planning, earlier efforts that have been underway for many years, such as State and local planning efforts by official health agencies and other planning bodies, are distinguished from this legislation by the comprehensiveness of its mandate, the requirement for setting guidelines that direct the planning effort, and the provision of a defined structure for meeting the goals and objectives.

Klarman captured the significance of PL 93-641 as "the establishment of pervasive, elaborate, and intricately balanced structures of planning joined to regulation; a linkage among Federal programs for planning, resource development, and purchase of health care services; a distribution of authority and responsibility between the Federal government and the States, between State governments and local areas, between public employees and advisory groups at the Federal and State levels and between governmental auspices and voluntary, nonprofit auspices at the local or areawide level." (2)

It is worth refreshing our memories about some of the aims of the legislation and areas later identified for concentrated attention. In broad terms, the HSA's and SHPDA's were charged with responsibility to increase accessibility, acceptability, continuity, and quality of health services provided; to improve health status; to restrain increases in the costs of providing health services; and to prevent unnecessary duplication of health resources. Priority areas covered initially such matters as primary care services for the underserved, multi-institutional arrangements, developing group practices and HMO's, increasing the supply of physician assistants, advancing health promotion and disease prevention programs, and improving quality of care. Supply, distribution, and organization of health resources, and certificate of need determinations are key elements.(3)

Imbedded in all of these objectives is the requirement for the local agency to know what and where the current needs and deficits are and how effective the actions taken are in producing change. A quantitative base is required for making these assessments and for this purpose, at the local level the dependency is primarily on available sources of data. The expectation is that new attention will be given by others to the production of data and the resolution of problems of content, quality, measurement, and timely availability. The resulting descriptive information is expected to be adequate for many planning and assessment purposes. However, there is often a gap in knowledge about the relationship between structural and process changes being advanced and effects being sought, and if the stakes are high, nothing short of special research will meet the need for information.

To further the development of available sources the National Center for Health Statistics (NCHS) was authorized legislatively to develop a Cooperative Health Statistics System, which in 1978 was recognized in statutory form as the CHSS. Other provisions of legislation were designed to strengthen the capacity of the National Center for Health Services Research (NCHSR) in advancing the conduct of research useful for policy and planning purposes, and to create a new locus for technology research through the establishment of a National Center for Health Care Technology.

An additional factor is the emergence in the past few years of the Health Care Financing Administration (HCFA) with its fiscal responsibilities for cost-effective delivery of publicly funded health services, as a strong force in developing available sources of related data and in furthering research. Other government agencies, notably the Bureau of Health Professions and the National Institute of Mental Health, as well as voluntary agencies such as the American Hospital Association, American Medical Association, and American Nurses Association, have been important sources for relevant data.

From the standpoint of health planning agencies, some of the potential for contributing to the planning process is being realized; much of it is still a promise. The March 1980 report of a committee of the Institute of Medicine (IOM) on "Health Planning in the United States, Issues in

Guideline Development," makes the following sharp criticisms of the current situation.(4)

While the proper development of health planning guidelines is dependent on a firm empirical base, the committee is concerned about the absence of sufficient quantitative information and sound analyses for health planning. Health planning and regulation have been hampered by (a) an inadequate data base (for example, virtually no small area morbidity data or data on hospital discharges); (b) limitations in the applicability of analytic techniques and appropriate research methods (for example, functional classifications for long-term care patient placement assessment, and the concept of medical need for individual health problems to estimate the need for services or equipment on an areawide basis); (c) insufficient knowledge of the efficacy of services or appropriate conditions or circumstances under which services are useful (for example, electronic fetal monitoring and coronary by-pass surgery)."

The report also comments that "the base of data and knowledge about the collection and use of statistics could be expanded in several ways: existing data systems could be sources of data which are routinely shared with planning agencies. This is already occurring with some data from the NCHS, HCFA's Medicare files, and the Bureau of Health Manpower's Area Resource File. While this is a step forward, such data are not current and are most useful as benchmarks. Analysis of such data would help to identify problems that would require special studies. Because they are part of national data sets, they produce data on the local areas that can be compared with regional, State, and national figures to identify how an area stands in relation to other areas."

These statements appear toward the end of a critical appraisal of past performance and future requirements for the "process of national guidelines development (from agenda development through evaluation and revisions)." They are not elaborated upon to define the issues in planning for which routine data sources by themselves would be relevant and where they would have to be linked to products of special studies or other sources of information. It is not my intention to perform this function but rather to probe somewhat more fully into the nature of routine data sources and the potential for enhancing their utility in the planning process, avoiding too many overstatements.

Routine Data Sources

There are, of course, guideposts for approaching the subject. Of great importance is the content, past experience and possible future direction of the Cooperative Health Statistics System, which has also been critically reviewed by an independent panel. Another guidepost consists of several developments in recent years that increase the liklihood of routine data sources contributing to planning. To be clear about our frame of reference, routine data sources in the health field are defined as information systems in which data are recorded or collected continuously or periodically for program, legal, operational, or reimbursement reasons. The CHSS designated 6 components for a broad-based health data system that meet this criterion, i.e., vital statistics, health facilities, health manpower, hospital care, long-term care, and ambulatory care statistics; a seventh component, the health interview survey, would be classifiable as "routine" under an extended definition that placed heavy emphasis on reasonable assurance of periodic data collection. Potential or realized application from these data sets cover a variety of interests; direct application to the health planning under PL 93-641 is only one, and that, in many instances, is a relatively recent addition.

The components identify subject areas of prime concern to health planners at all three levels of jurisdiction, Federal, State, and local. Vital statistics represent the single source of information on health status that can be examined over a long period of time, geographically disaggregated to the county and city level and down to sub-areas within a city or aggregated across civil subdivisions for medical market analysis. This in no way detracts from the importance of seeking ways to develop morbidity data and other non-fatal measures of health status for local areas, as pointed out by the IOM committee.

However, we do not have such information and in any event, vital statistics are not quite the insensitive measures we often make them out to be. Birth statistics tell us a great deal about adolescent pregnancies, what segments of the population are receiving poorly timed prenatal care, and many of the circumstances related to prematurity. Measures of infant morality, particularly when derived from matched birth and death records, are still usable, even in our society, as indicators of broad health status, health behavior, and resource problems; this is in addition to what they tell us about the intensity and characteristics of a specific problem. Further, the effects of actions to change the situation can be rapidly determined, a possibility that is not realizable for many other health conditions whether the measure is mortality, morbidity, or functional status.

The ability to examine trends and conduct inter-area comparisons for mortality in childhood ages and causes of death among adults adds great power to any assessment of where and what type of new resources may be needed. The fact that mortality from ischemic heart disease and cerebrovascular diseases can be reduced, as evidenced by the downward trends in the past 10 years, leads to questioning the situation in an HSA or sub-area where such reductions are not occurring, including the role of available or new resources. This application can be broadened to other causes of death that are indicators of adverse health conditions in specific geographic areas. It requires the resolution of technical problems in the production of information that identifies "hot spots," an issue that is currently being dealt with through a contract from NCHS to a group of investigators from Johns Hopkins, led by Alan Gittelsohn. (5) Among the objectives is the development of efficient computer systems for the surveillance of variations in mortality rates over time and space in order to identify patterns indicative of emerging health problems. While the original intent was to make available a procedure for national use by NCHS, this methodology and an alternative approach developed by Lerner (6), also at Hopkins, are being applied to the Central Maryland HSA's planning areas and the

city of Baltimore's health districts with promising results.

The new set of interests in routine mortality statistics has also led to publication of Statistical Notes for Health Planners by NCHS (7), and to work aimed at new uses for mortality data bearing directly on planning agencies' responsibilities in the prevention area. The Working Group on Preventable and Manageable Diseases chaired by Rutstein has proposed the use of "sentinel events," i.e., unusual events, principally causes of deaths that are preventable, as an alert to conditions in a particular area requiring action.(8) The methodology being developed by Gittlesohn really represents a next phase, i.e., solving practical problems in implementing this concept. Ted Woolsey in a forthcoming paper, "Towards an Index of Preventable Mortality," has some interesting, new approaches to the use of mortality statistics in identifying achievable levels of improvement and a consideration of statistical issues involved that will certainly attract a great deal of attention.(9)

Hospital care statistics when aggregated for total discharges or on a large sample and when available for analysis by patient origin, represent another highly relevant data source for planning purposes despite many problems in accuracy of reported diagnostic information that have been identified by investigations of the Institute of Medicine.(10) The major advances being made in classifying discharges into homogeneous diagnostic categories are providing an assortment of approaches to case mix that are being used with increased effectiveness by cost review commissions. They also offer a useful tool to planning agencies in assessing variations in utilization and examining alternative ways of meeting need in potentially less costly settings.

There is justifiable impatience with the slow progress in the development of such data for local areas on a nationwide basis. HCFA now has the responsibility for expanding coverage of hospital statistics but it is likely that this will not come quickly. In the meantime, there is the possibility that the hospital experience of Medicare beneficiaries which is part of the ongoing data collection system in HCFA can provide valid indicators of the utilization of hospitals by the total population in the community. This routine data source cannot replace a system that covers all age groups when the need is for rates of hospitalization for such conditions as T & A and hysterectomy. But the aim would be to overcome the present inadequate supply of data through broad measures of hospital utilization by patient origin. The exploratory studies of Wennberg and Gittelsohn in relatively small States encourage further examination of possible use of Medicare data on a wider scale.(11)

The importance for planning of health facilities and health manpower statistics needs no elaboration. The mandate to improve the supply and distribution of health resources and the decision-making authorities given to planning agencies are dependent on detailed information on facilities and manpower. This extends beyond the institutional sector to ambulatory care. An example of the saliency of this issue is the requirement that HSA's include in their 5-year Health Systems Plans now being prepared a detailed examination of the number (and rates per unit population) of primary care physicians required to meet health care demands in their areas. Manpower data generated from routine sources such as licensure systems or periodic surveys suffer from limitations that justify supplementation through special studies, e.g., in the case of primary care physicians, the lack of data on the movement of users of services across geographic boundaries. But, these restrictions do not obviate the applicability of what is derivable from routine sources for planning purposes.

Interest exists in other types of information that, in the long run, could emerge as important resources for a wide range of health planning and program development functions at the State and local levels. Long term care and ambulatory health care statistics fall into this category.

With the recent appearance of the first recommendations for a Minimum Data Set for Long Term Health Care, the ground is being broken for creating a new "routine data source."(12) The primary focus of the data set is on "people in the health care system, their problems, and the use of their services." Prominent among the general functions or purposes are "public monitoring and regulations of services" and "health planning and policy making." There are compelling reasons for paying a great deal of attention to this area. The sector of the population and the health services system affected has reached substantial proportions and will continue to increase. Alternatives to nursing home care are being tested for their cost-effectiveness and the outlook is that planning agencies will increasingly be faced with the need to make difficult decisions regarding community resources for long-term care.

The minimum data set includes a more extensive set of items on health status than do the corresponding data sets for hospital and ambulatory care. They cover measures of physical, social, and psychological function as well as diagnosis, representing a scope many of us would not have contemplated as feasible. The arguments for moving this way are stong but there are uncertainties that will need to be examined over several years through the type of studies on quality, feasibility, costs, and utility recommended by the Panel that prepares the minimum data set.

Ambulatory care statistics have been on the agenda longer than long-term care with the first minimum data set now about 8 years old and a new set of recommendations under review. Many reporting systems are in effect to meet requirements for utilization and cost information in publicly funded programs. However, what is generally contemplated as a need for health planning and program development on a community level goes beyond the capacity of such data sources. Whether this can or should be satisfied through a repetitive information system that has national coverage will be a debatable issue until there appears a more compelling reason than now exists. The recent excellent report of the National Committee on Vital and Health Statistics on Information Needs for National Health Insurance (NHI) advances 10 principles that provide the rationale and requirements for a routine data system.(13) But we are a long way off from NHI and the need for some data on utili-

zation of ambulatory care is a pressing matter for planning agencies.

The Public Health Conference on Records and Statistics in 1978 directed attention to the role of health interview surveys in filling the gap and several areas have moved in this direction. (14) An idea that is now being explored centers on the derivation of synthetic estimates for small areas from the National Health Interview Survey (HIS). Early results to be reported next week at the American Statistical Association Annual Meeting suggest that these estimates are likely to be crude and subject to fairly high relative errors. (15) This conclusion comes, in part, from comparisons with data from a telephone survey of a sample of 2,500 families in Baltimore and surrounding counties, modeled on the HIS questionnaire. A more encouraging result is the demonstration of the feasibility of a relatively low cost telephone methodology for obtaining information bearing on accessibility, utilization, and health status.

Issues

Clearly, the issues of data needs for health planning and the capacity of the various routine data sources just discussed requires far greater detail at both ends, i.e., a more explicit identification of the policy and planning questions faced by planning and regulatory bodies and a more specific assessment of how these questions translate into data requirements. The guides for data usage and sources issued periodically by the Health Resources Administration are designed to perform this function, in part. The Statistical Notes for Health Planners and reports from those close to the scene at the State and local levels have also made important contributions. However, the reality is that we are still fairly early in the development of targets and the application of measurement tools.

Two complementary approaches would help move to a different level. One is exemplified by this Conference and other meetings where those responsible for health policy, planning, regulation, and programs join with methodologists and producers of data. The second consists of demonstration, research, and evaluation supported by special funding to advance the state of the art in health planning which includes the identification of issues and the effective application of data. There is nothing new in these ideas, but there is an urgent need for a comprehensive reassessment of what, in light of experience, it is we know about planning needs, the effectiveness of available routine sources of data, and the technical and analytical issues in bringing together the data elements from several sources of information. Working material could include HSA's Area Resource File with its easily accessed user tapes.(16) The timing of such an activity for the near future is particularly appropriate because of the availability within the next 6-12 months of population statistics for small areas from the 1980 Decennial Census. From a longer term standpoint, it is disappointing that the efforts by many interest groups including those in the health sector to assure a mid-decade Census face defeat because of Congress's decision not to provide funds for planning a 1985 mid-decade Census.

Important as the process of reassessment and resulting guidelines is, it will be effective only to the degree that is is linked to resources (personnel and funds) and mechanisms within the States and at the national level directed at multiple functions of health statistics. The dominant factor, here, is the Cooperative Health Statistics System. This is reinforced by the recent report of a panel established by the Assistant Secretary for Health to evaluate the CHSS in light of experience over the past 10 years and an assessment of changes directed by the health planning, PSRO, and manpower legislation of the 1970's.(13)

The observations and recommendations of the Panel are both broad and specific. They cover the uneven development of key components in the System, except for vital statistics, problems of quality and lags in availability of data, shifts in location within the Department of Health and Human Services of responsiblity for several components, and decision criteria that should guide the setting of priorities for selecting components to be included in a joint Federal-State collection system. For present purposes, I want to refer only to the following broad conclusions of the Panel.

"The CHSS should be perceived as a nationwide Cooperative network of public and private agencies linked together to meet their respective needs for health statistics. The network has a central coordinating agency in each State (the State CHSS Agency) and at the national level (NCHS), but many agencies at every level are active or potential members of the network, either contributing to the production of certain health data or in using these data, or both."

A distinction is made betweeen CHSS, a mixture of public and private interests having largely a State-level orientation, and a Federal program, the Cooperative Health Statistics Program, in which the States participate and which is the vector for support to the States.

"The CHSP coordinates the flow of national data into and out of the system; provides Federal support for State CHSS agencies; takes the lead in developing and updating minimum data sets, and provides professional and technical assistance in statistical methods, data handling, and data use. Management of Federal participation is delegated to NCHS with collaboration of other Federal agencies."

A major conclusion is that because many Federal programs as well as State health programs increasingly require a strong State capacity, a fairest priority of the CHSP is to strengthen the ability of the States to identify health data needs, to develop appropriate collection mechanisms, and to build the capacity for analysis and use of health data. There is no activity for which the call for building State capability in health statistics is more pertinent than health planning under PL 93-641.

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THE CHALLENGE TO HEALTH STATISTICS IN THE EIGHTIES

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To appear on this platform today is for me a great honor. It is especially pleasing to be here with the two distinguished, earliest leaders of the National Center for Health Statistics, Forrest Linder and Theodore Woolsey--both old friends. It is also very gratifying to join the present leadership, Ruth Hanft and Dorothy Rice, and all of you in attendance, to celebrate the 20th anniversary of the Center.

At present it is my good fortune to serve as Chairman of the National Committee on Vital and Health Statistics, particularly with the new charter of that Committee. That situation provides the opportunity to work with an outstanding group of Committee members. The Committee is charged with advising the National Center for Health Statistics, the Health Care Financing Administration, and all the other elements of the Department with health statistical activities for which the Secretary of Health and Human Services carries responsibility. Substantial progress is underway, based on the effective relationships being established.

My remarks today will reflect experience on the Committee, but they are not intended to represent the views of the Committee. They are my own views.

The challenge to health statistics in the U.S. during the 1980's will be at least four-fold:

1. To delineate clearly the changing health problems in the Nation.
2. To reveal things about health that people want to know, and important things they might not know to ask.
3. To help discern and measure the factors that endanger and that promote health.
4. To develop and apply the methods and technology that will enable health statistics to meet these major challenges.

Changing Health Problems

As recently as 15 years ago our Nation's health problems, and particularly their trends, appeared quite different from the picture today. For example, into the mid-1960's coronary heart disease had been rising steadily as a cause of death. First described in the early part of this century, coronary heart disease was accounting for 35 percent of all deaths by 1965. Then we passed the peak and have observed a decline of more than one-fourth in the mortality rate from coronary heart disease since 1965. For many years regarded as a so-called degenerative disease, coronary heart disease has now been shown by health statistics to be a modern epidemic that has extended and is now turning downward over several decades, rather than over the few weeks or months in which epidemics of most acute communicable diseases are measured.

Also during the most recent 15-year period, health statistics have tracked the rise and decline of another modern epidemic, cancer of the uterus; and the extension of the lung cancer epidemic to women.

Again focusing on the mid-1960's, health statistics had for ten years previously been demonstrating America's failure to keep pace with other advanced nations in respect to infant mortality. Whereas the death rate of infants in Scandinavian and other countries was dropping well below 20 per 1,000 live births, the rate in the U.S. was 26 in 1955 and 25 in 1965. Many will remember how such data were used to highlight America's health situation at that time. During the past 15 years, however, our infant death rate has been cut in half and it is still going down steadily--a fact not yet sufficiently appreciated.

These examples indicate the relatively rapid shifts in the trend of health problems, shifts that can be observed through health statistics well within a decennial period.

What changes will the 1980's bring? Will we be able to catch up with the Scandinavians, whose infant death rate has kept on declining below ours? Will the black people of our country continue to suffer substantially more deaths among infants, and substantially higher mortality from coronary heart disease among men below 65 years of age than do white people? Will our recent reversals in health, such as the striking increase in mortality among young people in the late 1970's, be turned back? What new epidemics will arise?

To delineate clearly the Nation's changing health problems, of course, requires more than keeping mortality statistics and publishing annual reports of them.

It is necessary, first of all, to go beyond deaths--the infant deaths, the cancer deaths, the heart disease deaths--as the measure of health. Avoiding premature end of life and its specific causes no longer expresses the goal of health for Americans. The words "adding life to years not merely years to life" take on meaning when one considers that life expectancy at birth has increased from 47 years in 1900 to 74 years now, and that it has increased about three years in just the 1970's. Do they constitute years of healthful life, or merely existence? How healthy are those extra years, and how healthy can they be--for all who have them? That is a question which will no doubt increasingly rise in the 1980's. The agenda of this biennial conference indicates that leaders in health statistics recognize and are responding to this changing emphasis in health. Our measures of health, as distinguished from those of life and death, are still fairly crude, but at least there is substantial agreement on the direction we must go. Those who struggled to initiate morbidity surveys in the 1930's and 1950's can see the progress; we must move faster, however, to complete the mission. Devising and using more acceptable measures of health, measures that reflect the realities and concerns and goals about health in our time will be an important challenge of the 1980's. I will return to that theme later.

Another aspect to delineating the health problems of our time is to present clearly, in a fashion that will attract appropriate attention and achieve comprehension, the data about health. Publication of the annual volumes of Health U.S., including the soon-to-be-released 1980 volume, is a major step in that direction. Similar activities are underway in several States. Thus far, however, we have by no means conveyed the understanding of America's health problems that is possible even

with present data based on current concepts. We have not adequately brought that understanding to the general public or to the important special groups that particularly need to comprehend our health problems--legislators; health officials; health professionals of all types; business, labor, ethnic, minority, and other social leaders. Public health leaders in the past, and they were often health statisticians, used the data of their times effectively to capture attention and arouse action on the major health problems of the day. We must do the same. One challenge in the 1980's then is to delineate fully and carefully what the health problems are, not just for the experts but for all who should know.

Things That People Want to Know About Health and Should Know

Closely related is a second challenge, namely, to find out the things people want to know about health and also the things they might not know to ask. Developing and reporting health statistics is essentially a service, a service to many groups in our society. Hispanics want to know about their health, just as blacks are beginning to know about theirs. They both want to know how they compare with the majority white population of the country and what progress is occurring. What neither of them yet know to ask, and neither do the majority whites, is how they compare with those enjoying the best health record of any ethnic group in the U.S.--the Japanese.

Let us turn to some more statistically sophisticated groups, those who plan and administer hospital and medical services, and governmental officials who deal with the planners and administrators. They want to know in some standardized and otherwise sensible format the nature, extent, and cost of services that are provided by the hospitals, physicians, dentists, pharmacists and other elements of the health care delivery system with which they are concerned.

Health statisticians are beginning to supply such data, stimulated by national slogans such as cost containment and sometimes stronger pressures closer to home. Again, providing what these users of health statistics want does not fulfill the responsibility of the health statistician. The latter also carries the duty of bringing to attention the need for population-based statistics as a more significant basis for planning and administering hospital and medical care services than the institution-based statistics that are commonly used.

Data on average length of stay and percent occupancy of hospitals, which indicate certain aspects of what is happening in individual hospitals, do not delineate what is happening to the people who presumably are supposed to be served by the hospitals. Such institution-based statistics do not adequately reveal the cost implications. Wennberg and his colleagues, for example, are showing in some elegant studies of New England experiences that nearly identical percent occupancy and average length of stay in hospitals can exist despite very large differences in parameters that are much more significant for hospital planning; for instance, more than 50 percent differences in patient days of care per 1,000 persons and in allocated per capita expenditures. Computing these latter statistics on a proper area-population basis yields the picture that we really want to have for planning, a picture that is concealed when we stick to institution-based statistics.

Furthermore, focusing as much attention as we do on the average price per day of care and per medical service in different institutions as a target of cost containment is a serious mistake. In fact, it is the frequency of the service per population unit--not the price per service--which often accounts for extreme variation in medical service expenditures among population groups in different areas.

Thus, while health statisticians must continue to be responsive to people's particular wants for information, that is not sufficient. The mission, especially for the 1980's, includes perceiving through statistical expertise and the production and analysis of data the knowledge that bears most significantly on the problems at hand. Even though the existence of that knowledge and how to use it are not yet understood by non-statisticians, a challenge to health statistics is to create and convey that understanding.

Factors That Endanger and That Promote Health

From the standpoint of throwing light on current health problems and what to do about them, I believe our health statistical plans and reports throughout the 1970's have been grossly out of focus. To correct this major imbalance in health statistical efforts, in the United States and in the industrialized world generally, presents what is probably the most important challenge to the field for the 1980's.

Documents with such titles as "Health Statistics Plan" or "Planning for Health" or "Priority Health Problems" have reflected in recent years the most significant new work in health statistics. A glance through such documents is revealing. Typically they focus on just two aspects of health. One is health status in the traditional sense, for example, measures of infant mortality; the communicable diseases; and the chronic diseases such as cardiovascular diseases, cancer, mental illness. Attention is often given to distribution of these health problems among various segments of the population, people of different age, sex, race or ethnicity, income, and residence. The second topic, and the one that has been receiving the lion's share of attention, is medical and hospital care. Coverage of the latter topic usually includes health care resources, i.e., numbers of hospital beds, physicians, dentists and the like; use of health care services, for example, hospital admissions and physician visits; and financial aspects of health care services, such as the price of a day in hospital and the distribution of expenditures among private and public sectors of the economy. Measures of health care resources and use of health care services, to indicate access, by various geographic, racial, and income groups have commonly been included in health statistics.

This concentration of effort on health care services is quite understandable. In the mid-1960's our Nation made a decision to achieve equity in use of health care services as a major approach to health, particularly to enhance the access to health care services by previously disadvantaged groups. The twin aims of that decision were to improve the health of the Nation and to advance social equity. Health statistics, albeit with many serious imperfections, have served to monitor what happened after that decision. Several significant

things have happened. The increasing proportion of the Gross National Product devoted to health care services has accelerated: 4% in 1940; 4.5% in 1950; 5% in 1960; 6% in 1965; 7% in 1970; 8.5% in 1975; and probably more than 10% in 1980. Black people have received more physician visits, and old people more nursing home care. Overall, health status as commonly measured has improved.

In recording all of this and displaying some of the problems, however, health statistics has mainly accepted as its principal focus and perpetuated the basic assumption, namely, that health care services constitute essentially the only factor in health about which modern society can do anything. That assumption is false, and the fallacy is becoming ever more obvious. Take one specific, well-known example. Cancer is a much-feared health problem, the second leading cause of death. Lung cancer is becoming the top component, causing at present a fourth of all deaths from cancer. Health care services, both existing and foreseeable, can provide little help for that problem. Cigarette smoking is the overwhelming factor and has been known as such for many years.

At this point some may protest: But health statistics found that out! True. My point, however, is that health statisticians have not included in their central plans and reports the systematic collection and presentation of data about cigarette smoking. It has been a peripheral matter.

The same relative neglect during the 1970's has characterized the treatment in health statistics of other behavioral factors in health, such as excessive caloric intake in relation to bodily energy needs, excessive intake of sugar and salt, and excessive use of alcohol. It is becoming generally understood that the cigarettes, calories, alcohol, sugar, and salt people consume has more impact on their health than the various types of health care services. Fortunately in America some governmental leaders, voluntary health agencies, and professional bodies, influenced by a few epidemiologists and health statisticians, have begun to highlight various behavioral factors in health. Health statistics reports, however, generally do not yet reflect these problems or even the trends in their recognition.

Environmental factors in health were also relegated during the 1970's to a minor position in health statistics. Yet the importance of exposure to ionizing radiation, noise, new chemicals, and other features of the environment--in the workplace and elsewhere--is increasingly understood. It is heartening, therefore, to see at the beginning of the 1980's Environmental Health, a plan for collecting and coordinating statistical and epidemiologic data, issued by the National Center for Health Statistics. Efforts intended to protect and enhance health through environmental control measures are rapidly spreading through the country, at all levels of government and the private sector. These current efforts to improve the environment for health are essentially a renewal of the moves undertaken in the early part of the last century when another set of environmental factors in health became apparent, though today's environmental health measures are appropriately directed against the present hazards, chemical and physical as well as infectious agents.

Concern about health care services largely dominated health statistics during the 1970's. That concern, though not its domination, is still justified. Health statistics should do more, though, than tag along after the prevailing mode of health care services and anxieties about them and their costs. There is reason for this anxiety, but moves to relieve the underlying problems will not be aided by statistics which reflect merely accounting procedures required in dealing with fee-for-service payments to individual hospitals and other providers. So long as that is the prevailing mode, obviously detailed account must be kept of all transactions involving payment. Information system that will really guide the development of health care services toward improving health, however, will have to include more than an orderly arrangement for reporting and analysis of the services, providers, and dollars that are involved. Such health care information systems should include data, for example, about:

1. Populations eligible for services.
2. Health status of those populations.
3. Extent of selected services indicating the quality of care actually received by those populations, such as:
   (a) Proportion with certain conditions that have been seen by a physician at least once in the past year,
   (b) Proportions of various age groups adequately immunized, and
   (c) Proportion of women at various ages who have had a Pap smear and a breast examination by a physician, and when last.
4. Extent of services received by those populations that may not be needed, for example, proportions of various segments of the populations that receive certain types of injections, surgery, and other procedures.

These kinds of data could, of course, be obtained through the well-designed and well-conducted sample surveys in which the Federal government has developed considerable competence.

The most far-reaching challenge to health statistics in the 1980's, I believe, is to present a balanced picture of people's health status and of the factors that endanger and promote good health status. That will require more appropriate measures of current health status than the ones heretofore used. It will also require balanced collection and presentation of data concerning the three principal ways that modern society can protect and improve health status, namely, through influences on behavior, through environmental control measures, and through health care services. All three are important and should receive careful attention in health statistics.

With the focus of health statistics shifted onto the population of an area rather than on the institutions or other providers of health care, it would be possible to achieve a coherent and comprehensive view of the population's health status along with the three main sets of factors influencing it--health care, environmental conditions, and personal behavior. Socially desirable moves to improve health would then become apparent in perspective, to guide us toward a more rational health policy.

Health information systems with this aim would include population-based data on the same population of the kind previously mentioned concerning health care services; environmental hazards in the water,

air, food, workplaces, and homes; and the health-related behavior, such as cigarette smoking, obesity, and alcohol use. Relating health status to these sets of factors would provide a basis for setting priorities among various efforts, for example, to assure the safe use of automobiles, to build more nursing home beds in an area, or to curtail obesity. Even within the attack on one disease problem, coronary heart disease, for example, data of the sort envisaged here would help decide how much emphasis should go to coronary care units, emergency medical services, finding and treating high blood pressure, curtailment of cigarette smoking and obesity, and reducing the animal fat content of the food supply.

The quest of the 1980's for health statistics, in respect to factors that endanger and those that promote health, will be to develop and exploit a set of information systems which will support a more rational health policy, a data-based policy that makes systematic use of behavioral influences, environmental control measures, and health care services to improve health.

Methods and Technology

Technologic advances during recent years such as in computers, and improved methods such as in sampling, have greatly expanded the potential in health statistics. For example, the feasibility of linking computerized records of the health-related data from the 21 percent sample of the 1980 census with the National Death Index initiated in 1979 opens tremendous possibilities. That record linkage will permit study of factors associated with mortality on a magnitude never before available in the United States.

It is reasonable to anticipate that methodology and technology for health statistics will continue to improve through the 1980's. Health statisticians will no doubt be participating in these developments. For health statisticians a continuing demand is to devise methods and technique that will solve problems and advance the field. I will mention only one problem, one that is usually put aside because it seems so huge and amorphous, i.e., the concept and measurement of health.

After peace among nations and human freedom, one of the most fundamental searches of our time is, "how shall we define and measure health?" Certain points are of interest in this regard. The World Health Organization advanced the notion that health is "physical, mental, and social well-being, not merely the absence of disease or infirmity." Yet in the three decades since that WHO pronouncement, relatively few serious attempts have been made to make that concept operational, to reduce it to quantifiable terms. Some say it is impossible. I disagree and suggest that it is time to start.

The fact that such terms as "wellness" and "holistic" are gaining popularity indicates striving for a concept of health beyond the one that has guided us heretofore. Measurement of health should soon begin to reflect something positive, to be maintained, to be promoted--as well as something whose loss we fear. We must learn how to measure the entire spectrum, not merely the negative end, the deterioration of health.

An interesting point is that two groups of nations have proposed what they call Social Indicators, as distinguished from indicators of national economic status and progress. Both groups of nations, the Organization for Economic Cooperation and Development countries of the West and the Warsaw Pact countries of Eastern Europe, have devised very similar sets of Social Indicators and in both health appears high on the list.

It is well known that the leading and 14 competing industrialized nations of the world have joined and participate in the World Health Organization. Not so well known is the fact that within the frameworks of their continuing intense rivalries the two major groups have recognized the necessity of measuring social as well as economic and military status and trends. Of great significance, it seems to me, they propose to develop and use social indicators in very similar terms, with health a leading component. Measurement of social, including health, status for purpose of discerning national trends and international comparisons appears to be a potentially very significant step forward in industrialized society. This little known and unheralded development opens the possibility of international competition of a new sort, competition in social and especially health status.

The 1980's could be the time when social advance will become an important even the most significant focus of competition among nations. That may seem to be an overly optimistic view of the current international scene. Whether or not it is justified, however, the two major groups of industrialized nations have agreed on the World Health Organization definition of health. They have also agreed in effect (in separate documents, of a very similar nature) that we should explore the development and use of Social Indicators, and that health is a top Social Indicator.

That does seem a sufficient basis on which health statisticians throughout the world--extending into the developing nations as well as the industrialized nations--should now construct and apply more appropriate measures of health than those of the past. We will need them for the rest of this century and into the next as a contribution to international as well as national progress in health.

To summarize, the 1980's may well be the most challenging decade ever for health statistics.

In this past decade we measured the extension of longevity, more than 50 percent since 1900. In this coming decade we must find the ways to delineate the new and rapidly changing health problems of advanced industrial society--clearly, so that all may understand them.

Also, we face the task of making health statistics a responsive service, and, in addition, one that reveals what people should know about health as well as what they want to know. This calls for the health statistician to become an educator and leader, beyond serving as source of desired information.

Moreover, in the 1980's we must develop a well-rounded system of health statistics covering all major factors that promote or endanger health. In particular, this means expanding data concerning environmental and behavioral influences on health, bringing knowledge of these factors at least up to the level of current data about health care services. For maximum usefulness it also will require focusing on all three sets of factors as they exist among populations in geographically defined areas. Only in this way can the potential for improving health be understood and guidance

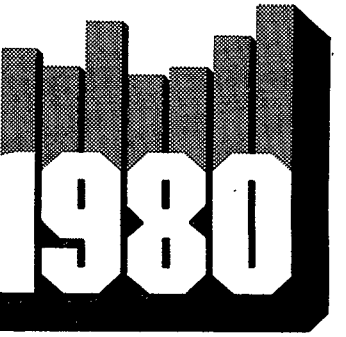
to action for improvement be provided.

Finally, we need to develop further the methods and technique that will elucidate the major issues in the field, taking into account global as well as micro-problems and opportunities.

In closing, I want to say one thing that has troubled me greatly in recent years and months. Our country has made a tremendous and increasing budgetary commitment to health. Unfortunately, as realized in this room, a great deal of that investment is not well made. Yet the very means of guiding that investment, directing it into channels for the greatest return, are being squeezed down to dangerously low levels in the budgetary process. We must expose that discrepancy and its cost implications, in health and in dollars, vigorously and promptly.

New Challenges to Vital Records

Concurrent Session A



GROWING DEMANDS FOR VITAL STATISTICS

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A few years ago, a noted health researcher made the statement that we should stop putting the nation's resources into counting the dead. According to him, more resources should be allocated in data systems that he felt would better measure health status and utilization of health services. At that time, the Cooperative Health Statistics System was touted to be the answer to the state, local and national health data needs. Most states were just developing systems to collect manpower and facilities data and improve upon the vital statistics system. But to the researcher I am referencing and possibly many others, the real systems of value were hospital care, health interview, health expenditure survey, long-term and ambulatory care surveys. To these people the vital statistics system which had its beginnings over 300 years ago in this country had outlived its usefulness.

Indeed the vital statistics system has had a long history which can be traced back at least to 1538 in England when parish clergy were first required to keep a weekly record of christenings, marriages, and burials. The data system in the course of time has emerged from records which were almost solely designed for registration purposes to records which fill dual legal and statistical needs. For example, the first model birth record in 1910 had only five items which could be considered non-legal; whereas, the present birth record has 35 non-legal items. It is because of the ability of the system to change with the needs of the time that it remains a high priority data system to describe the status of health in the United States. In fact, in the recent publication, Health United States 1979, nearly two-thirds of the tables used to describe health status used vital statistics data. So while some may feel we no longer need to count the dead, it is obvious that the vital statistics system is in the prime of its life and there is no reason to believe it will suffer a premature death.

Vital statistics record and measure most trends of our modern day society. Some of the issues which are making the headlines, going want for answers or which the nation is spending millions of dollars on include: hazardous waste dumps, breakup of the traditional family, new lifestyle of teen-agers, hospitals closing OB wings because of low utilization rates, continuing interest and concern for minorities, new diseases such as SIDS and legionnaires disease, nuclear reactors, increasing trend of home deliveries, over-utilization of hospital procedures such as cesarean sections, health risk of smoking, and effects of women's liberation movement. Vital statistics provide data to a greater or lesser degree on all of these issues.

The people who are using vital statistics in trying to find answers to our modern day problems can be categorized into three groups: health planners and administrators, epidemiologists, and social planners. I would like to briefly describe how each of these three groups are using vital statistics.

There are several issues with which health planners and administrators are faced and which can be addressed through vital statistics data. One of the main concerns of health planning is hospital facility planning. While the data needs for this activity are broad, they often center around patient origin studies. The vital statistics data can be used as a proxy measure of patient distribution. Certainly for OB units within hospitals, the birth system is available to describe the geographic utilization of hospitals. But even for total patient origin studies, the vital statistics system can be used. As Van Tuinen[1] et al have shown, combining birth and death data with PSRO data produces patient origin reports with an average error rate less than 2%. Since vital statistics and PSRO data should be readily available in all states, this modeling procedure provides an easy, accurate, and inexpensive substitute for comprehensive hospital discharge data.

Health planners are concerned with developing population based health status indicators. I expect that like national publications, most Health Systems Agencies rely heavily upon vital statistics to describe the health status of the people in their respective areas. Vital statistics provide several measures of health including the leading causes of death by different demographic characteristics, life expectancy, years of life lost by different diseases and injuries, different measures of fertility, and family planning needs.

Of primary concern also to health planners and public health officials is preventing diseases and unnecessary or untimely death. Rutstein[2] has developed a list of sentinel health events which represent unnecessary diseases, unnecessary disability, and unnecessary untimely deaths which can be prevented or managed under many circumstances. While this list of deaths has limitations, it provides a first order of magnitude of the health status of a population.

The second group which has growing demands for vital statistics data is the epidemiologists. Epidemiological research using both birth and death certificates is of course not new. Traditionally, investigation of maternal deaths, tuberculosis and other communicable diseases deaths has used the death certificate as the basic record of analysis. Today's epidemiologist has broadened his scope to chronic diseases such as cancer, hypertension, diabetes, and others. Because of the lack of good prevalence and incidence data for local population groups, the birth and death certificates become critical in the epidemiological analysis of these diseases.

Of growing concern to the general public and public health officials are the health effects of nuclear reactors, chemical waste disposal sites, occupational related diseases and injuries, air pollution, sound pollution, water pollution, and other environmental health hazards. It is becoming commonplace to read on page 1 of local newspapers the environmental health risk as measured through infant deaths, congenital anomalies, cancer mortality, etc., of the Love Canal Area,

Three Mile Island, nuclear testing grounds in Utah or farms in Michigan. In Missouri we have buried on a farm two hundred and forty 55-gallon barrels which are leaking dioxin. If you are not familiar with it, dioxin is said to be 10,000 times as toxic as cyanide. As you might imagine, there is great concern for the health risks. Several studies are being conducted looking at liver cancer mortality, malformation rates, prematurity rates, etc. I am sure each state is faced with a health hazard related to the environment. The vital statistics data will be more frequently utilized to discern the health effects of modern day environmental exposures.

A third segment of society which is placing more demands for vital statistics data includes many diverse people whom I have grouped together as social planners. Society has grown in its concern of equal rights for all peoples. This desire for equality has meant new demands for data to either prove or disprove that equality is being achieved in health. Specialized data is needed for race and ethnic groups, economic groups, age groups and geographic groups. In some instances traditionally, vital statistics has been analyzed for these subpopulations. For example, it is quite routine to provide mortality data by sex, age, and some racial categories. But more demands are being placed for data which have not routinely been collected or analyzed. For example, data is needed for Spanish Americans and Indians. Twenty-two states have added to their birth and death certificates an item on parent's origin or descent. This item was not part of the original minimum data set. But the keen interest for this information by Spanish American organizations and states with a significant percentage of Spanish Americans led to its inclusion on the certificates.

As I have mentioned, health planners, epidemiologists, and social planners are all developing new demands for data, much of which can be answered through vital statistics. Because of these data needs, the vital statistics system itself is having to change to respond adequately. I would like to describe several areas where the vital records system is changing or must be prepared to change in the future. I will first address the changes from the input point of view, that is the record itself; and secondly look at the changes from the output point of view, that is the analysis of the data.

There are several ways the new demands for vital statistics are impacting upon the source document and the collection process. First, there are increasing pressures for new items on birth and death certificates. The last revision of the standard certificates in 1978 successfully or unsuccessfully, depending on your point of view, defeated efforts to add too many additional items. Apgar score was the only addition on the birth record and items on armed forces and status of patient in an institution on the death record. Part of the reason for few changes in 1978 was because several changes were made in 1968 and most states did not want to contend with another major change. However, another reason for little enthusiasm for making additional changes was the lack of good data on the quality of the new items on the 1968 standard and the expected quality of items which could be added. When 1978 certificates were being considered, each state was asked to comment on their feelings toward the quality of each item. Because limited followback studies had been conducted and most states did not have good query programs at that time, there was limited factual information to gauge upon. I mention this because I feel we are in a better position for the 1988 revisions. Most states have improved upon their quality control program under CHSS. Several states have done various types of studies on the quality of the records. A vital statistics evaluation protocol has been developed to establish a framework for evaluating the records. It is now time to start drawing these various resources together so that a more objective review can be made for the next revision.

While the content of the national standard certificate has not changed much recently, the states have responded to various user needs. Almost all states have added additional items to their vital records beyond minimum data sets.

Nearly half of the registration areas have an item concerning the mother's blood being tested for syphilis. A large number of states also have an item concerning the use of a prophylactic drug in the baby's eyes. Other tests on some certificates include blood type of the mother and PKU testing of the child. The changing technology and obstetrical procedures are being monitored by some areas with questions on the type of delivery and indication for C-section, amniocentesis, electronic monitoring, scalp sampling, and ultrasound. Another group of supplementary questions relate to nutrition and health habits. These include height and weight of the mother, usage of alcohol, drugs and tobacco during pregnancy. Several states continue to collect data on the occupations of the mother and father. There are many additional items being collected not on the standard certificate. The diversity of the items beyond the standard provides opportunity to study current obstetric and fertility patterns from several different vantage points. We can also be making use of the different state experiences to determine what is most practical and useful for the next standard certificate revision.

Sometimes the growing demands don't require new items but rather capturing data which was not normally placed in the computer. For example, with the environmental epidemiological issues, it is very critical to have data which is specific to the geographic area being effected. This may require coding smaller geographic areas than what was formerly needed or keying the address so that the DIME system can geocode the data.

The new demands for vital statistics data not only mean new items but also place new quality control requirements. After working with many different data systems, I have come to the conclusion that if a datum in a data system is not used you can be guaranteed that its quality renders its useless. The quality of data mainly improves through use which brings new requirements of acceptability.

Fortunately, the new demands for vital statistics have paralleled in time the availability of funds through the CHSS to improve the vital statistics system. In Missouri, for example, the number of unknowns for most items is now well

under 1%; whereas, before CHSS, a large number of items had high non-response rates. I am sure this is true for most states that have participated in the CHSS for several years.

There are other quality issues which the NCHS and states will be faced with in the future. For example, my guess is that most states presently do not put much effort in insuring a complete coverage of social security numbers on the death certificate. However, as the National Death Index makes use of this item more frequently and other epidemiological studies increase the use of this item, we will find more pressure to insure better reporting. The same is also true for the occupation and industry items. Only a few states presently capture these items in their computer files. However, with more attention being drawn towards occupation-related deaths, more states will start capturing this data which will in turn bring new quality control standards. I expect with more women working and being exposed to environmental hazards, we will see in the future more demands for adding occupation on the birth record. It is interesting to note that mother and father's occupation was on the birth record up until 1948. I am not certain of all the reasons for dropping the item at that time, but I expect we will see a revitalized interest in it in the future.

Another item which is becoming increasingly important is the malformations section on the birth record. The effect of many environmental hazards will first show up through the developmental stages of a fetus. However, many studies[3,4,5] have shown that birth records underreport malformations on the order of 50-70%. With such severe underreporting and the heightened demand for the information, it is incumbent upon the vital statisticians to find ways to increase the quality of the data or steer researchers away from using it. If the quality of the item cannot be increased, then we may be doing more harm than good by collecting the data and making it available for potential misuse.

It is obvious that the new demands for vital statistics are requiring the vital statistician and vital records registrar to work even closer together than what they have here before. Each state and local area must institute the best methods of training the makers of the records, developing manual and computer edit checks, implementing query programs, and updating the statistical files so they can be used to answer today's challenging questions.

The new societal issues along with new items, improved quality, and easier data retrieval systems are increasing the demands for analysis of vital statistics data. In most cases, the analysis needed is not new but those using the data are new. This creates new concerns for the vital statistician. One of the problems which emerges is the interest in using vital statistics data for small areas. For example, a health planning agency sets a goal of reducing the infant death rate for a specific county or group of counties within a specified time. The agency then naturally wishes to compute the rate for the area the year the plan was written and the target year. It becomes the vital statistician's lot to inform them that they will have to aggregate three, five or even ten years of data depending on the size of the county if the standard deviation is going to be less than the rate itself.

This problem has become even more critical with all the self-appointed researchers from newspaper reporters to citizen groups to unacquainted university personnel who are interested in the health effects of some environmental exposure. I am sure each state has its own horror story of a study ending up in a newspaper showing some rate doubling or tripling after an environmental exposure because of some misuse of vital statistics. The vital statistician must be prepared and willing to point out the simple facts of vital statistics analysis--you can't add neonatal and infant deaths together, you shouldn't compare two areas using crude rates, you can't add or subtract resident and recorded data. These are all common work-a-day concepts to the vital statistician but we are no longer the only ones doing the analysis and these simple concepts must be communicated. Otherwise, we will find ourselves trying to discredit a study through the newspaper or courtroom neither of which are very appealing.

Some of this education can be accomplished through regular annual vital statistics publications. Because more use is being made of the data by less trained individuals, the published sources of the information need to be designed for their use. If tables are published with several cross classifications so that the numbers are small and there is no warning in the appendix, or if only crude rates are presented and no age-adjusted rates are available, or if only single year rates are published for infrequent events in small areas, then the statistician could be considered part of the problem. With the new arena of users, the published reports must be scrutinized even more carefully to make sure that the chances of misunderstanding and misuse are minimized.

Some of the traditional ways of presenting data are also no longer relevant to today's problems and must be reconsidered. For example, one traditional manner of reporting vital events is by five or ten year age groups. However, for the family planner or educator concerned with teenage problems, grouping births by <14 and 15-19 is not very helpful. They need births by single years of age or grouped differently for the teenage years. While this is a simple example, it points out that the social and health issues may require the statistician to rethink the traditional procedures of the past.

One of the growing areas of analysis is conducted through linkage of files. This has become more feasible with the increased computer resources now available. Linking birth and infant death records is certainly not a new concept. The registrars and many statisticians have been doing it for years.

However, vital statistics file linkage has grown beyond linking infant deaths and births. With the legalization of induced abortion, there have been questions raised regarding the reproductive history of women after an abortion. New York has conducted a comprehensive study of this issue by linking birth, abortion, and fetal death records.

The emergence of emergency medical services

planning has placed new demands for solid data to evaluate the EMS system. One of the techniques being promoted is a tracer system which tries to link the data of the various levels of care. The birth and death data are critical areas of this system.

Cohort studies of employees or people receiving a particular medical treatment such as renal dialysis require linking of the death certificate with a roster of names. It is for this reason that the National Death Index has received widespread support and will be made operational hopefully in the near future.

As the knowledge of the ability to link birth and death files increases, there will be even more demands for this type of analysis. Some of the proposed studies will be questionable as has already happened with the National Death Index. There will be more and more pressure to use the vital statistics files in a manner for which they were not intended. Even some well intended studies may need to be scrutinized much more carefully to insure that proper confidentiality controls are available and that the researcher possesses the capabilities to insure proper analysis.

One of the rising stars on the scene of vital statistics analysis has been for several years the ACME system. The jury is still out whether this system will solve purported data needs of program planners and administrators or is it just an expensive quality control system for determining the underlying cause of death. We hope it is the former but the results to date tend toward the latter. In the future as much time and effort needs to be given to the use of the data generated by ACME as has been given to the development of the system.

With the increased publicity for health promotion, another rather recent interesting use of death data is the health risk assessment. In the last few years, numerous for-profit and not-for-profit organizations have provided computerized health risk assessments. Typically, these assessments provide information on the person's risk of dying of certain diseases based upon their health habits. The appraisals also compare the person's chronological age with the health appraisal age and attainable age if health lifestyle factors are changed. These concepts need to be interpreted to the person by a health educator who has a general knowledge of vital statistics concepts. This again means that the vital statistician must be concerned with educating as well as analyzing.

In conclusion, vital statisticians and the data with which they work are becoming more important rather than less important. The advent of health planning, concern for health risks related to the environment and social issues have all placed more demands upon the vital statistics system.

These demands emerge in terms of requirements for new data items, better quality control systems, refined analytical techniques, and more education on the use of vital statistics data. The systems to count the dead and the alive are still the main sources of health information. Their roles are not diminishing but rather expanding in answering many of the new complex health issues of today's society.

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CURRENT ISSUES IN VITAL REGISTRATION

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If I had to single out one "current issue in vital registration" it would have to be how to do more work with less staff. I see many old timers in the room who are probably saying that this has been a problem for as long as they can remember. However, the problem has never been more serious than it is today. Not only are we faced with more work, we are being asked to do it with less staff. Since Roots was published, everybody is suddenly a genealogist. Vital records offices are being inundated with requests and pressure is being put on legislatures to make vital records public. In those states where the records are already public individuals are insisting that they be permitted to do their own searching. Adopted adults are asking that sealed files be opened. In Minnesota, for example, a law was recently passed allowing an adoptee access to the original birth record if the parents can be located and give their consent. Of course the bill did not contain an appropriation which has resulted in yours truly becoming the State's highest paid clerk typist. An increasing number of home births, voluntary acknowledgements and adjudications of paternity, fraudulent registration and use of vital records place increasing demands on an already overworked staff. On top of all this have have come hiring freezes because of the cutback in 314d funds and proposition 13 types of legislation in many states.

Registrars should be devoting their time and resources to streamlining their operations and planning for the future. Instead, we are forced to spend most of the day trying to keep 50 ping pong balls under water at the same time. Or, to put it another way, it is difficult to remember that your initial objective was to drain the swamp when you are up to your fanny in alligators.

It is more important today than it has ever been for us to work together and maximize the use of dollars and talents available at both the State and Federal levels.

This point was made in Directions for the '80s, the final report of the panel to evaluate the cooperative health statistics system, and I quote, "The concept of a Federal/State partnership is at least as important now as it was ten years ago; the need for strong State capacities have become greater. Many Federal programs as well as State health programs, are increasingly dependent on a strong State capacity. It is essential that the CHSS have as its primary objective development of a core of statistical competence within each State. Therefore, the Panel recommends that the first priority in the Cooperative Health Statistics Program be to strengthen the ability of the States to identify health data needs, to develop appropriate collection mechanisms, and to build capacity to analyze and use health data to plan, manage, evaluate, and enhance the performance of the health care planning, delivery, and regulatory systems. The Panel recommends that a long-term funding plan to support State CHSS agencies be developed and justified, with the objective of providing basic assistance to essentially all States by 1985. Direct Federal support of State agencies should take several forms: a fixed amount per State to develop a basic competence and to bring all States to some minimum level of capability; an additional matching grant based on population and perhaps other factors unique to each State in order to encourage States to develop their capability above this basic level; and contracts to purchase data at an agreed upon unit rate. (Sounds like a cost sharing formula, doesn't it? Where have we heard that before?) This is being done in the procurement of data for the National Death Index. (I might add that this has also been done for years in the procurement of microfilm copies of vital records.) The vital statistics component of the cooperative health statistics program has evolved over many decades. Affiliation with CHSP has strengthened this data collection process, enabling the States to develop and implement more effective quality control and to increase the completeness of the vital records. The collection of vital statistics as a product of the legally mandated registration system in the States is a demonstrably efficient procedure that exemplifies the best features of a cooperative system."

Let me add one word of caution to those recommendations. The base of the statistical pyramid is the vital registration system. We cannot continue to build on that pyramid without also adding adequate strength to the base.

There are two things which need to be done to strengthen the registration system. I hate to use an already overworked phrase, but we must learn to communicate. And secondly, a mechanism must be developed to provide the states with much needed technical assistance. To use another overworked phrase, we cannot continue to independently invent the wheel.

There are a number of examples which demonstrate a lack of communication. As a registrar, I must question the decision to spend 1.1 million dollars to fund one time, one year development contracts in a handful of states. With adequate state input, these dollars could have been used to enhance the capabilities of all states. Could the hundreds of thousands of dollars which have been spent developing the philosophical concept of designation of state centers been put to more practical use? I think so. Another example; a contract was let by the Center to develop a vital statistics field and query manual. This contract was awarded prior to the issuing of an RFP for an evaluation of the effect of field and query programs on the quality of data. Isn't this proposing a solution prior to identification of the problem? Again, this could have been avoided if the partners had a more formalized method of talking to each other.

The distressing fact is that the few avenues for communication which once existed are being closed or narrowed. The Cooperative Health Statistics System Advisory Committee has been abolished. Only one of the 15 members of the National Committee on Vital and Health Statistics is a vital registrar or health statistician employed by a state health department. We have repeatedly emphasized this lack of representation, yet none of the most recent 5 appointees to the National Committee are members of the AAVRPHS. This, despite the fact

that our membership has been expanded to include individuals engaged in the operation of all components of the Cooperative Health Statistics System. In addition to adequate representation on the National Committee, I strongly urge that the CHSS Advisory Committee be reestablished and that the Executive Committee of the AAVRPHS be appointed ex officio members.

As indicated earlier, we must find ways to do a better job with less staff. This can only be accomplished by developing a mechanism for the provision of additional technical assistance to the States. The Registration Methods Branch is doing a commendable job considering the limited resources at their disposal. With the cutback in CHSS funding and the attempt to balance the Federal budget, it is unrealistic to expect that additional staff will be added in the foreseeable future, and I don't think that additional staff is necessarily the answer.

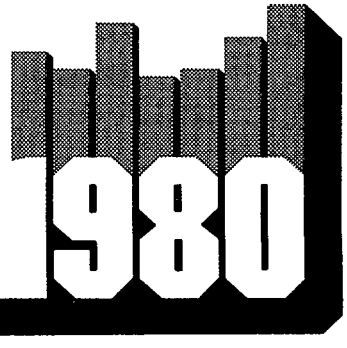
During the past two years, the International Statistics Branch of NCHS has provided technical assistance in vital registration and health statistics to developing nations through a contract with the AAVRPHS. This contract has been renewed for an additional three years. Total dollars expended during the five years will approximate $170,000 and consultation provided to ten to fifteen countries.

A similar contracting mechanism, either individually with a State or with an organization, could be used to assist states in solving specific problems. It is more important than ever before that states share their specific areas of expertise with other states. ASTI seminars have proved to be an excellent way to exchange information. However, more is needed. For example, in Minnesota we have been working with our centralized micrographics division in the Department of Administration to develop a microfilm system. After several meetings, I have concluded that while they may be able to do routine high volume jobs, they do not have the expertise necessary to develop a system for vital records. Several states have excellent systems and a contracting mechanism could provide on site consultation and allow this expertise to be shared. This holds true in other areas such as word processing and automation of record systems.

We keep referring to the registration system in this country as a model. I'm afraid, however, that if we continue to take it for granted, if we continue to ignore it, we will no longer point to the system with pride. It will be a mass of paper and an example of "bureaucracy" at its best.

New Uses of Traditional Health Records and Data Applications

Concurrent Session B



ISSUES IN THE APPLICATION OF DISCHARGE DATA TO AN EXAMINATION OF HOSPITAL COSTS

Donald M. Steinwachs, Health Services Research and Development Center

Hospital cost issues and the impact of new cost containment efforts have recieved increasing attention due to high rates of cost inflation. Among the complexities encountered in examining these issues has been the lack of uniform, comprehensive and detailed sources of cost data, plus the variety of perspectives from which costs are being examined. Among these perspectives are those represented by the consumers, third party payors and the hospitals. For example, one perspective considers the hospital the primary unit of analysis and asks questions concerning:

- What does it cost for a patient day or per case?
- What influences these costs?
  - Teaching programs
  - Prospective reimbursement mechanics
  - Organization and medical staff composition
  - Case mix
- What are factors that contribute to the rate of cost inflation?

Another perspective is represented by third party payors who are primarily concerned with their portion of costs. For insurers, costs are a function of the level of hospital use by the beneficiary population and the extent of benefit coverage provided. Cost related issues include those listed above, but focus on factors likely to affect beneficiaries. Furthermore, if coverage extends to ambulatory care and long term care, then their cost questions are not limited to the hospital sector alone.

A third perspective is represented by the population or consumer of health care. Here costs can be examined for users or on a per capita basis for those at risk of use. Some of the questions being asked include:

- What accounts for differences in:
  - admission rates?
  - hospital days per 1,000?
  - cost per capita?
- What proportion of costs are paid by the consumer?

The one unit of analysis that ties these three perspectives together is the patient's hospital admission and stay. This has been one of the reasons for the early emphasis on developing a uniform hospital abstract.(1) Hospital discharge data provide the conceptual linkage among three perspectives; however, there have been a variety of practical problems in applying discharge data to all the questions above. Specifically three issues will be discussed that have implications for examining cost questions.

(1) comprehensiveness of discharge data
(2) definition of costs
(3) utility of discharge data for examining cost issues.

Comprehensiveness of Discharge Data

The development of comprehensive and comparable discharge data systems was one of the objectives of the Cooperative Health Statistics System, and a current interest of the Health Care Finance Administration. This has not proven to be simply accomplished, as evidenced by the minority of states with unified discharge data systems. Among those that have established such systems, military, Veterans Administration and Public Health Service Hospitals are not routinely included. However, these federal hospitals do have their own discharge abstract system. In states such as Maryland, the examination of population based measures of costs and admissions requires integration of federal and non-federal hospital data to avoid very substantial biases. Other potential biases arise from individuals being hospitalized in adjoining states and to a lesser extent, from major referral centers that attract patients on a regional or national basis. Some of these limitations can only be addressed through a national system for discharge data collection.

Defining Relevant Cost Elements

Defining costs can be an equally difficult issue. To the hospital, costs are those things paid for and typically exclude physician services, except for residents or hospital based and salaried physicians. Achieving comparability of cost data may be quite complex. One hospital may include the professional component of radiology and pathology while the other does not. Teaching costs are included for hospitals having residency training programs. In contrast, from the perspective of the third party reimburser, an examination of costs may be limited to services covered. Even so, coinsurance, deductibles, and any maximum on the level of professional reimbursement will further reduce the insurer's costs to a fraction of the total. The third perspective is represented by the consumer. To him, costs may be most appropriately defined as all out-of-pocket payments for insurance and medical services. The substantial differences in approaches to defining costs suggest that different methodologies are needed to capture data. Special survey methodologies have typically been required to obtain information on out-of-pocket costs.(2) Aggregate hospital costs have been available through Medicare Cost Reports but few hospitals can provide accurate estimates of costs for specific patients, unless charges are kept closely in line with operating costs.(3) Only the third party reimbursers are typically in a position to indicate their costs, which usually have some relationship to hospital charges. This relationship may, however, be derived on an adjusted cost basis which excludes selected cost items.

Utility of Discharge Data for Examining Costs

The utility of hospital discharge data in examining hospital costs has several elements to be considered. Before discussing these, Table 1 shows the data elements recommended for the uniform minimal hospital discharge date set. This set includes demographic data (age, sex, race,

TABLE 1

RECOMMENDED HOSPITAL DISCHARGE DATA SET

Demographic Characteristics

- Patient ID
- Date of Birth
- Sex
- Race
- Residence
- Expected Principal Source of Payment

Inpatient Episode Characteristics

- Hospital ID
- Physician (Attending and Operating) ID
- Admission and Discharge Dates
- Diagnoses
- Procedures and Dates
- Disposition of Patient

and residence) the identification of principal source of payment and characteristics of the inpatient episode.(1) The episode is described by admission and discharge dates, diagnoses (principal and secondary), procedures and dates, and disposition at discharge (death, transfer, or home). The hospital, attending physician, and patient are uniquely identified. However, only the hospital knows the identity of patient and physician. Although this protects confidentiality, it does not permit linkage of patients across hospitals. It should be noted that no charge or cost information is captured on the minimal data set. This is a result of earlier decisions to propogate uniform billing systems which would also capture this data set. For purposes of further discussion, it is assumed that total charge data are captured with the other elements of the minimal data set.

There are three issues in the application of hospital discharge data to an examination of hospital costs that will be discussed. First, method for estimating costs from charge data will be suggested. Second, the extent to which the minimal data set captures variables that are cost influential will be examined. Lastly, some of the issues that arise in applying discharge data to an analysis of hospital costs will be discussed.

Estimating costs from charges: It has long been appreciated that charges are not necessarily reflective of costs. One source of discrepancies has been the cross-subsidization of costs among hospital services. Frequently the hospital OPD is subsidized by inpatient revenues while laboratory and radiology have been net revenue producing departments. Table 2 shows the cost and charges of ancillary services generated in one Maryland hospital over a four year period. These data were abstracted from the Medicare Cost Reports of this hospital. The cost has predictably increased as have the charges. However, the ratio has changed by over 30 per cent from .67 to .89. This reflects two problems in using charges as a surrogate for costs: costs may not be closely related to charges and this relationship may change over time.

TABLE 2

EXAMPLE OF CHARGE-COST RATIO'S FOR ANCILLARY SERVICES IN ONE HOSPITAL

	Cost (000's)	Charges (000's)	Ratio
1976	8,865	13,240	.67
1977	10,372	13,819	.75
1978	11,299	13,461	.84
1979	14,834	16,759	.89

A simple method for adjusting charges to a cost base can be applied. The ratio of costs to charges can be computed for routine and ancillary areas based on Medicare Cost Reports. Also taken from MCR's is the ratio of total routine charges and total inpatient days. This forms the ratio of average routine charges per day. Using these ratios, total hospital charges can be broken into components, routine and ancillary, and each can be adjusted to a cost base and added to estimate total costs as follows:

= (LOS) [charges/day] [routine ratio] +

[(Total Charges) - (LOS) (charges/day)] (ancillary ratio)

= (Total Charges) (ancillary ratio)

+ (LOS) (charges/day) (routine-ancillary ratios)

This is a simple and effective method but has a number of inherent limitations. First, routine charges (costs) do not reflect variations in the intensity of nursing care. Nursing research has demonstrated a close relationship between direct nursing care and the level of patient dependency, e.g., mobility, feeding, bathing.(4) It would be interesting to consider capturing routinely a measure of dependency on the discharge abstract (e.g., patient days of immobility) and use this as a base for distributing nursing costs which account for a substantial proportion of total hospital costs.

A second limitation of this allocation formula is that it does not separate intensive care days from acute care days. Capturing the number of days in intensive care would provide a basis for estimating this component instead of the assumption that intensive care days are distributed proportional to the overall length of stay (LOS).

Third, ancillary costs are biased if the ratio of costs to charges is not uniform across all ancillaries. This may be a bias that is more tolerable if the ratios are not widely disparate. What is probably of greater consequence is the use of charges greater than costs for high volume low cost ancillaries to subsidize high cost low volume ancillaries.

In the remainder of the paper, charges will be used instead of the proposed cost estimates to discuss the extent to which items captured by the discharge abstract have explanatory power, and the potential utility of these items for

evaluative and management purposes.

Relationship of diagnosis and charges: Table 3 shows two examples of efforts to explain variations in charges per case using different sets of discharge characteristics. The analysis includes only discharges from the Department of Medicine, Johns Hopkins Hospital for a one year period. The first method is based on the Yale Diagnostic Related Groups that were developed to be clinically meaningful and to be homogeneous in length of stay.(5) The DRG's (383 in number) are being considered as a method for case mix adjusting Medicare limits on total hospital reimbursement per day of care. The categories are developed using primary and secondary diagnoses, primary and secondary procedures and age. Applying this categorization to the charge data on discharges shows 23 per cent of variability explained with the 6,698 cases distributed across roughly 300 of the 383 categories. For comparison, a classification was developed based on 6 age groups, 2 sexes, 2 types of admissions (emergency, other), the presence or absence of surgery, the presence or absence of secondary diagnoses and discharge status. This classification (not containing specific diagnoses) explains 27 per cent of the variability. This simple example illustrates two points: diagnostic information is not highly predictive of charges and that existing classification systems do not explain a high percentage of variability. A variety of discharge variables have been used in analyses and in most cases their explanatory power is significant but not over 50 per cent. It should be noted, however, that there are groups of admissions, e.g., elective procedure in surgery, that have minimal variability and represent reasonably homogeneous groups with respect to length of stay and charges. One could ask: What is missing from the variable set that would add to predictive power? Other research suggests that factors related to severity at time of admission and prognosis would add considerably.(6) Clearly, if medicine like surgery could readily classify the diagnostic-therapeutic approach to patient management, this might explain the majority of the variability. However, this would remove clinical decision making from sources of variability, with the residual being differences in patient response to therapy and quality.

TABLE 3

PREDICTIVE OF TOTAL CHARGES IN DEPARTMENT OF MEDICINE, THE JOHNS HOPKINS HOSPITAL

	Number of Categories	Per cent of Variance Explained (N=6709)
Yale DRG's	383	23%
Patient/Episode Characteristics (Age, sex, Type of Admission, Surgery, 2+ Diagnoses, Alive/Dead	192	27%

Examining Change in Patterns of Care and Charges: Even though discharge data are only moderately explanatory of charges (with the exception of length of stay), one would expect the data to be useful in measuring change and in isolating relevant factors. In Table 4, charges over a three year period in the four Department of Medicine teaching units are shown. Average length of stay decreased by over 20 per cent and admissions increased by approximately the same per cent, resulting in roughly constant occupancy. These discharge data do provide a basis for assessing the extent of changes in case mix, changes in charges per case and charges per day within DRG groupings. The total charges for many of these types of cases decreased over time as length of stay decreased. However, charges per day climbed. This reflects the effects of inflation and probably, the reduction in length of stay coming from less expensive days. Not shown are the increases in numbers of admissions for each category over time. Between 1977 and 1979, respiratory cancer admissions increased 51 per cent, diabetes 7 per cent, acute MI 37 per cent, ischemic heart disease 72 per cent, CVA's by -1 per cent and respiratory signs and symptoms by 96 per cent. The uneven increases raise interesting questions: where are these patients coming from? Has the threshhold for admission changed? Have the levels of severity or stage of disease changed within these categories? The changes in length of stay also raise questions about changes in the diagnostic and therapeutic approach and changes in quality. The discharge data set can provide some insight into these questions. Where patients are coming from can be analyzed on a geographic basis. To the extent procedures, surgical or major diagnostic, are being done differently on these patients, this could also be explored. The mix and frequency of secondary diagnoses can be analyzed. However, in the final assessment, these data can help focus attention on the appropriate medical care questions; they can provide a sampling framework for studying these questions; but cannot answer how these changes occurred and what their consequences may be.

SUMMARY AND CONCLUSIONS

The hospital discharge abstract has been, and can be expected to continue to be, an important source of information on the use of hospital resources. This paper has examined some of the issues relative to the application of discharge data in hospital cost studies. It has been suggested that the use of charge data as a surrogate for costs in previous studies, (7,8,9) can be improved upon by using available Medicare Cost Report (MCR) data. Although MCR are legally available to the public, they are not easily accessible. It would be desirable if data on average cost per case, cost per day and ratios of cost to charges were published regularly on all Medicare participating hospitals. This would facilitate cost comparisons and the application of discharge data in cost analyses.

Patient classifications to define homogenous groups with respect to hospital resource use rely principally on diagnostic groupings of patients. As illustrated here, diagnosis has generally not been highly predictive of hospital

TABLE 4: EXAMINING CHANGE-FIRM UNIT OF THE DEPARTMENT OF MEDICINE, THE JOHNS HOPKINS HOSPITAL

DRG Category	Length of Stay			Charges Per Case			Charges Per Day Per Case		
	77	78	79	77	78	79	77	78	79
Total	12.8	11.5	9.8	$3,692	$3,430	$3,226	$ 288	$ 297	$ 329
Respiratory Cancer	18.1	18.3	14.2	5,380	5,105	4,843	297	279	341
Diabetes	12.0	11.7	8.9	2,997	3,115	2,741	250	266	308
Acute MI	16.3	15.6	13.6	5,530	5,509	5,473	339	353	402
Ischemic H.D., Excluding MI	9.8	9.0	7.8	2,913	2,680	2,734	297	298	351
Cerebrovascular Disease	18.1	16.6	13.2	4,691	4,457	3,901	259	268	296
Symptoms-Signs of Respiratory, Circulatory and Nervous Systems	8.5	8.2	7.9	2,501	2,467	2,444	294	301	349

charges. In part, this may reflect differences in severity and stage of the disease not indicated by the diagnosis. It would be desirable to add such measures to the discharge abstract, but further work is needed to develop more generally applicable measures of severity that might be routinely captured. In discussing the utility of diagnosis in analyzing costs, coding reliability issues also must be considered. Lack of reliability currently limits the usefulness of specific diagnoses and suggest the value of aggregating diagnoses to improve reliability.(10)

There are other enrichments of discharge data that would likely enhance its application in hospital cost comparisons. These include a breakdown of total charges into major categories (e.g., routine, ancillary) and the addition of professional fee information to permit total cost comparisons. Even so, one would still be limited by basic inconsistencies in how charges are established among hospitals and by differences between charges and the expected level of reimbursement, i.e., few insurers pay full charges to either physicians or hospitals. Some states with hospital rate setting authority have implemented hospital budgeting, cost reporting, and reimbursement systems that minimize these problems, e.g., Maryland and New Jersey. Their experiences may serve a useful prototype.

The applications of discharge data in hospital cost comparisons can be expected to increase as efforts to contain costs intensify. Steps should be taken to enhance the potential of discharge data for expanding our knowledge of cost and utilization issues. This may be achieved through improvements in reliability and comprehensiveness of data, as well as through testing the utility of new data items linked to the existing discharge data set.

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SUCCESSES AND FAILURES IN THE ANALYSIS OF FAMILY MEDICINE DATA BASES

S. James Kilpatrick, Jr., Medical College of Virginia

This talk is concerned with research using encounter records. By encounter records, I mean routine records of face-to-face doctor/patient contacts. I use two examples to illustrate my thoughts, the denominator problem in family practice and secondly, the natural history of diabetes.

Some appropriate uses of encounter records are: content of practice, workload studies, sentinel practices, the ascertainment of patients for clinical trials and, perhaps, the natural history of chronic disease. Dr. Wood and his colleagues have published the Virginia study (1) which, for the first time documented the content of family practice in this country. There have been workload studies (2), (3) using encounter records. Gene Farley is currently organizing a number of family physicians in the United States to monitor the health of the population in a cluster of sentinel practices. Encounter records can also be used for ascertaining patients with given conditions for clinical trials and for studying the natural history of chronic diseases.

I want to examine our current use of encounter records to study adult onset diabetes. One of the objectives of this study is to establish a register of patients at risk of developing diabetes; i.e., to examine the precursors for diabetes as seen in an encounter system.

Another objective is to test whether blood pressure falls as weight is controlled in diabetics; i.e., to examine if one of the common side effects of diabetes is modified by treatment.

Again, an objective is to study the concurrent familiality of diabetes and obesity; i.e., to examine the joint effect of life style and heredity on these two common problems.

Next, I describe our early attempts to use encounter records to begin this study. First, we used the computer to help us detect the diabetics in our system. Two thousand nine hundred and thirty-four (2934) "presumed diabetics" (i.e., patient identifications with any mention of diabetes in any of its forms) were detected in the computer files of five teaching practices for 1970-75. These identifications were checked against the 1977 age/sex registers in the practices and 1821 (62%) of those were found. Of these 1821, 1629 (90%) had made a visit in the past two years and, therefore, were considered "active". Of this 1629, 1463 (90%) satisfied the criterion of diabetes as established by the Diabetic Task Force.

Having ascertained 1463 such "active diabetics" by this screening mechanism, how representative are they? Well, at least, they appear to be representative in terms of the age distribution. Table 1 compares the age distribution of these 1463 "active diabetics" with that of the National Center for Health Statistics/Health Interview Survey showing remarkable agreement.

Can we follow these diabetics prospectively from year to year? To find the proportion of active diabetics who return next year we matched the identifications of patients visiting in 1978 with the list of diabetics who had visited in 1976 or 1977. Two out of three active diabetics (980 of the 1463) returned in 1978. Those who did not return may be inactive, may have moved, or died. To see if we can identify any of those who have died using only computer files, we searched death records listing diabetes as a cause of death anywhere on the death certificate for the state of Virginia. Of the 1463, ten deaths have been found registered in the period March 1, 1978 to June 30, 1978.

This example has illustrated some of the problems working with encounter records. Some of these problems are threshold, self referral, mobility and noncompliance. By threshold, I mean the patient's decision to visit the practice. By self-referral, I mean the patient's decision to visit other doctors, including diabetologists. With regard to mobility, diabetics may be mobile as other Americans. Finally, in a chronic disease like diabetes we have the problem of compliance with prescribed treatment regimens and recommended modifications to life style.

Turning now to another subject, how close can we get to population surveillance studies such as the Framingham study, using encounter records in primary care? Kerr White states

TABLE 1

AGE DISTRIBUTION OF DIABETICS (PERCENT)

Age	0-15	16-44	45-64	65+	Total
Five Virginia Practice Teaching Centers	0.9	16.5	43.4	39.2	100
Virginia (4)	1.2	16.6	45.3	37.0	100

FIGURE 1

DISTRIBUTION OF EPISODES OF ILLNESS
REPORTED BY 315,000 PERSONS

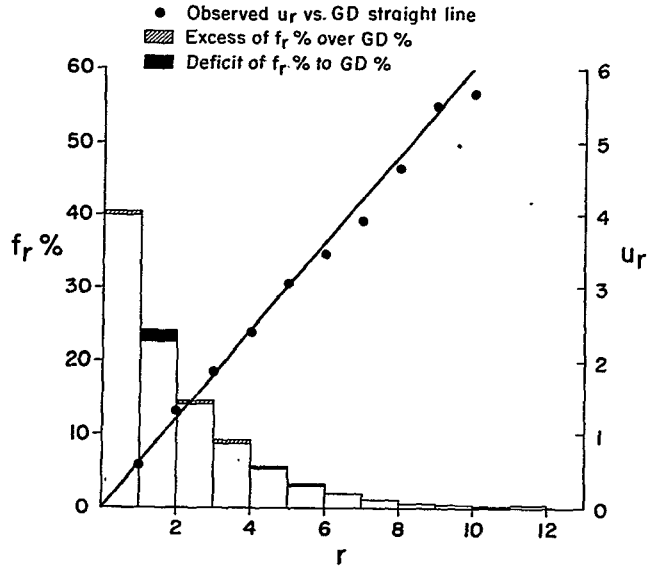
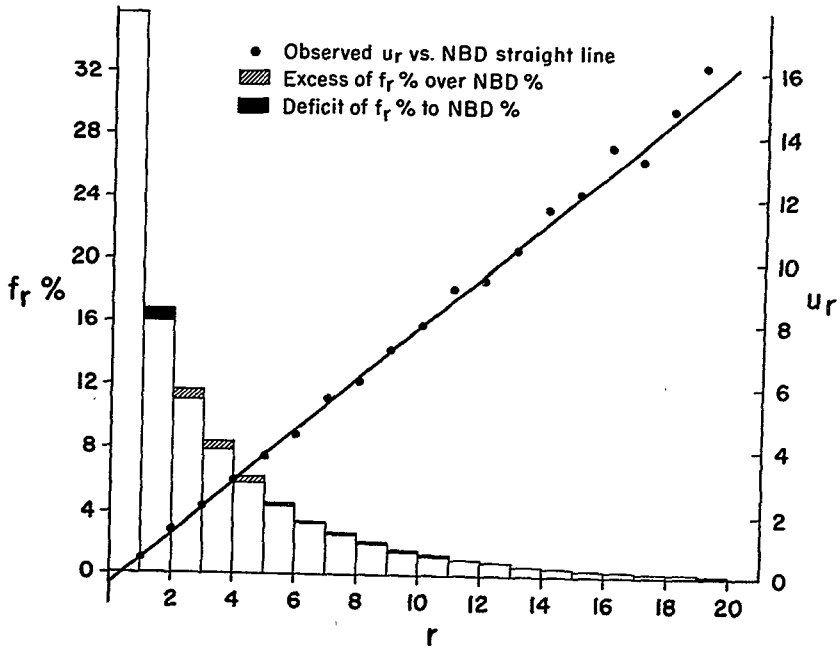


FIGURE 2

DISTRIBUTION OF CONSULTATIONS OF 270,000 PERSONS
REGISTERED FOR THE DURATION OF THE SURVEY YEAR



that "comparisons among practices are best made by rates per 1000 of the population served" (5). From this point of view, there are two types of health care system in primary care; those with registered patients and unregistered patients. I have analyzed encounter records from both types (Registered: Britain, Denmark and Ontario; Unregistered; Pennsylvania, Rochester, New York and Virginia). There is no problem with the denominator if the primary health care system registers its patients but what denominator to use in countries like the U.S. where patients are not registered?

One suggestion is to use the number of patients attending as a denominator for rates. The claim here is that this would in effect give the same results as using registered patients for the denominator (6). This is true only if the percentage of nonattending patients is constant. However, the percentage of nonattending patients from practice to practice in Britain and Denmark, ranges from 20% to 50%. This variation in nonattending practices can produce abnormalities such as given in Table 2 where we see examples of reversals in the rates among Danish practices. Now age and sex differences in the practice populations compared may explain some of these reversals but this is as yet unexplored.

Another approach is to fit the negative binomial to encounter distributions in order to estimate the practice population. During a sabbatical year in England, I discovered that the negative binomial appeared to fit the distribution of episodes and consultations aggregated from the National Morbidity Survey, as shown in Figures 1 and 2. These show the histograms of the observed and fitted distributions together with a superimposed straight line. The straight line is the Ord plot, a linear transformation of the histogram representing the fitted distributions, and the points are the observed observations suitably transformed.

In the United States we do not know the number of nonattending patients. My suggestion was to fit the negative binomial to encounter distributions and to estimate the number nonattending by extrapolation. We first checked this with a pseudo registered patient population in North America; namely, the encounter records for all general practitioners in London, Ontario. However, there was very little correspondence between the estimated number of nonattending patients and the number of nonattending patients known from the Ontario Health Insurance Plan.

We turn now to Rochester, New York and Virginia where the number of nonattending patients is unknown. Table 3, for Rochester, gives consistent estimates of the unknown number of nonattending patients both over time and from one variate to another. However, in Virginia (Table 4) there are considerable differences between the estimates derived from "all problems" and "new problems". More recently, I have tested the goodness of fit to three practices in Pennsylvania over five different years (Table 5). Note that in the Quarryville practice, we get good fit except for 1976, where $P = 0.02$ and that in Lancaster we get a poor fit before 1976 but a good fit thereafter!

These failures and other considerations lead me to believe that, in the United States, a practice population is a nebulous concept; it is undefinable and cannot consistently be estimated.

Hence, I conclude that under the present health care system, we cannot use encounter records to do population based research. This does not mean that we cannot use encounter records for research in primary care. Encounter records provide easy access to disease cohorts. However, we must remember that our patients are not captive but make decisions as to when and to whom to visit. We, therefore, need to be particularly careful in the design and analysis of research studies in family medicine and in generalizing from a practice's encounter records to the morbidity of the community it serves. Thank you.

TABLE 2

EXAMPLES OF REVERSALS IN RATES AMONG DANISH PRACTICES

Practice Number	% Not Visiting	Rate per Registered Patient (Rank)	Rate per Visiting Patient (Rank)
178	.37	2.03 (72)	3.23 (102)
232	.28	2.20 (104)	3.07 (78)
209	.25	2.15 (93)	2.85 (46)
204	.38	1.91 (51)	3.08 (82)

TABLE 3

ESTIMATES OF f_0 IN ROCHESTER DATA

Sex	Year	Without Repeats	With Repeats
Females	73-75	1223	1683
Males	73-75	1721	1989
Total	73-75	2874	3802

TABLE 4

ESTIMATES OF f_0 IN VIRGINIA TEACHING PRACTICES FOR FISCAL YEAR 1975

Practice	Contacts for New Problems	All Problems
1	19162	73673
2	19214	65387
3	17384	34260
Combined	57997	250095

TABLE 5

FIT OF NEGATIVE BINOMIAL TO PENNSYLVANIA PRACTICES AS JUDGED BY CHI-SQUARED GOODNESS OF FIT TEST (P VALUE)

	New Problems		
	Lancaster	Hershey	Quarryville
1974-75	.03	.06	.84
1975-76	.05	.04	.66
1976-77	.56	.00	.02
1977-78	.59	.00	.64
1978-79	.52	.08	.70

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USE OF ASSESSMENT DATA FOR LONG-TERM CARE PLANNING, PROGRAM DECISIONS, AND STATISTICAL ACCOUNTING

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Information about persons in need of long-term care is used for evaluative and decision-making purposes. Such information is required for management of service programs, for policy and planning, and for decisions about patient care.[1]

Within the long-term care system, information and evaluation are prerequisites for sound program management. This management has critical leadership functions that should extend to an entire community and take into consideration broad needs of the individual and the community. It should optimize resources in order to achieve equitable distribution of the best possible care at reasonable cost to all.

The management has such objectives as: a) to improve provider coverage, b) to facilitate access and discriminating consumer entry by decreasing barriers, c) to improve the alignment between consumer expectations (demand) and need, d) to increase consumer and provider satisfaction, e) to increase the acceptance and delivery of preventive and restorative services, f) to improve comprehensiveness and continuity, and g) to increase sharing so that all responsible parties cooperate. Among the necessary ingredients for rational cooperation and management, a sound information and evaluation system is needed to improve continuous, comprehensive facts that are consulted at times of decision.

Information and evaluation serve to strengthen and implement policy and planning. Developing policy that is useful and can be implemented, requires an appraisal of the implications of existing knowledge about long-term care for such goals as improved access, quality maintenance, and cost containment. Detailed questions about health, illness, and the quality of life are posed. The types and magnitudes of problems, their origins and determinants, and the predictable course of events, interventions, services and resources, as well as their effects on whom and at what cost are identified and described. In the light of available knowledge, alternate views about long-term care are presented and consensus evolves about policy that is consistent with current knowledge, yet is readily modified where gaps in knowledge pose uncertainties. Gaps in information help the investigator identify directions for research.

For patient care, the need for information and evaluation is visible throughout the process of care. For example, providers who have special knowledge and skills assess problems of the patient and environment. After setting goals, they put a service plan into effect. In long-term care, this often requires coordinated provision of services through shared information, where we define coordination as integrated decisions and actions in relation to particular professional goals. The service process, in addition, is not an inflexible set of actions that follows a single set of goals. Service is a dynamic process of changing goals and decisions, where the changes are based on feedback of information about improvement or its lack.

In considering the types of information that we must collect, we should like to, first, describe the unique aspects of chronic conditions and long-term care and, second, describe the framework in which long-term care decisions can be made.[1] People who receive long-term care have chronic conditions. Such conditions are recurrent or persistent deviations from normal health and may be experienced at any age as symptoms, illnesses, handicaps, disabilities, or impairments. For those who are afflicted, there is an increased prospect of such outcomes as decreased function and shorter life spans. The associated outcome of dependence has serious consequences for the person, family, and community.

The sociodemographic characteristics of clients or patients with chronic conditions differ from those with acute conditions. Their illnesses and problems are different. For example, they are more likely to have multiple problems which draw concurrently on multiple services. The mix of providers is different from acute care, and the structure and goals of services are different. The continuing cost of care increases the impact of decreasing socioeconomic productivity. Home-making, medical, and income services are more likely to be needed over long periods of time. As a result, long-term care uniquely requires a system of services that integrates basic living supports and multidisciplinary elements of service. It is notable that long-term care is not only a treatment situation, but a living arrangement as well. It encompasses both institutional care and organized services that enable persons to remain at home with informal supportive aid with relatives or friends. It encompasses health care, supportive social services, and environments in which those with chronic conditions and disabilities live. As Dorothy Rice has said, "In the continuum of social welfare, a program for long-term care is viewed as being in the middle ground between health care and income maintenance."[2] We note, also, that the population that avails itself of long-term care experiences a) repeated hospitalizations; b) short lengths of home health service; and c) many transfers from one level of care to another. Planning for the amounts and kinds of resources needed in a community and national policy to guide resource allocation for long-term care require an accounting of this movement of the population, as well as some measure of the ongoing appropriateness of the services being provided. The information that we collect must recognize these many unique aspects of chronic conditions and long-term care.

Informational Needs

A framework for making long-term care service decisions can be described as follows.[1] The needs and demands of those who have chronic conditions can be expressed in physical, psychological, social, and environmental terms. Long-term activities bear upon such needs and demands to obtain achievable outcomes at certain costs.

Within this framework, service decisions aim to improve our effectiveness in health maintenance, illness intervention, and the quality of life. In the absence of cure, outcome goals are formulated in such terms as restoration of function to the best possible level of independence and dignity, and its maintenance at that level. This framework establishes certain requirements for the types of information that we should include in our assessments. The information should be multidimensional, including physical, psychological, social, and economic descriptors. It should be objective, reliable, amenable to systematic collection, and of demonstrated utility. For example, it should have use in predicting resource needs or in describing improvement and deterioration of patients over time.[3,4,5]

Although different types of users require a similar core of information, we recognize that various users require different amounts of detail. State and national planners and policy-makers generally need less detailed information, aggregated across populations and service systems. They need information about the amounts of problems and demands, about the services that are needed, about the impact of such services, and about their costs. Providers and directors of individual local service programs need more detailed information about their clients. Use of a widely-applied, common language enhances the utility of information which is essential from most points of view.

There appears to be increasing consensus about the kinds of information that should be included in descriptions of people in long-term care, as illustrated in the Patient Classification Manual and the Long-Term Care Minimum Data Set.[6,7] Several comprehensive reviews of assessment literature have been conducted, and the general level of knowledge about the adequacy of various components has increased.[8,9] We recognize that some components of assessment are well-developed, while others are less well-developed. For example, items of activities of daily living have a solid methodologic background and have been widely applied, while measures of psychosocial outcome are less well-developed. We observe also that long-term care classification systems increasingly characterize clients according to function, namely, physical, psychological, social, and economic function. Within this framework, a comprehensive picture of health status which reflects dependence or need is produced. Changes in function reflect the response to care and changes in need. As such, they can also serve to define outcome standards for quality assurance. Measures of function are indicators of the existence, stage, and impact of chronic conditions; thus, they become useful indicators of severity. Measures of function also offer a conceptual basis for defining homogeneous groupings in large populations. Importantly, function can be expressed in terms of a common language that has relevance to clients, as well as many types of provider disciplines, policy-makers, and planners.

Obtaining comparable information across programs is not an easy task because provider of service collect and report information in diverse ways for similar decisions. Each provider (i.e., nursing homes, home health agencies, hospital discharge planners, and community social service agencies) uses some information mechanism to decide whether an individual needs the services available and meets the financial requirements for the particular program. Health departments, Medicare agencies, and Medicaid agencies require different types of reporting for similar decisions. Referral or admission decisions depend heavily on an ability to collect and record information in terms which are understood and accepted by regulatory and fiscal agencies. The amount of information transferred from one service provider to another is frequently minimal and inaccurate because it is based on perceptions of service need in a setting different from the one to which an individual is being referred. Our point is that a great deal of effort is expended in obtaining information about persons who may be in need of long-term care, but the information often is not useful because it is not systematically collected, is not comparable, and is oriented to the facility rather than the person in need. The importance of using a common language to describe persons and their long-term care service needs becomes evident. Use of the same information by different kinds of service providers, regulatory agencies, and fiscal intermediaries for their respective purposes would decrease discrepancies in decisions about level of care and about financial and program eligibility, and would promote continuity of care.

At the local provider level, a full range of comprehensive information describing the current status of an individual is needed. Referral decisions and care plans depend on detailed information to avoid biases toward any one type of service and to account for all the services an individual may need. At various times during the course of service, reassessment of the individual is needed to evaluate progress and to develop a new goal and care plan. The comprehensive information needed to make initial referral decisions and care plans is the same kind of information necessary to evaluate progress and to develop subsequent care plans. Since the informational needs of many types of provider of direct care are similar, their use of the same objective, comprehensive information base would provide comparable data needed to make internal program decisions and to provide a vehicle for transferring accurate easily understood information to other providers and to regulatory and fiscal agencies. Similar information would not have to be recollected and rerecorded. Decisions by regulatory agencies about service eligibility and level of care, and by fiscal intermediaries about financial eligibility, would be served by a subset of the data base developed by those who provide care directly. Comparable data would be obtained across programs at the state level, and would provide information for communication between regulatory agencies and fiscal intermediaries to effect cooperative decision-making.

Health planning agencies and policy-makers do not have adequate access to the information currently being used by providers of direct care. Too often, the decisions of such planners and policy-makers rely fully on population projec-

tions, statistics of previous utilization, and political pressures. Comparable information about the characteristics and service needs of individuals who seek and who receive long-term care would provide indicators of the appropriateness of current utilization and the adequacy of current resource allocation. Information for such use requires common language assessment.

The recommended approach of collecting and recording common language, assessment information at the direct care level and, then, reporting the same information or portions of it to other providers and public decision-makers does not seem unrealistic to us. A review of current referral, assessment, and reporting forms required by state agencies revealed that most forms require a similar core of information, covering sociodemographic, medical, and functioning status. Unfortunately, few of the forms have specific definitions for any of the items of information requested; and the items are presented in different ways. Medicare, Medicaid, and Administration on Aging regulations require assessment, evaluation, or care planning in some form. Consequently, those who provide care directly search for useful assessment tools, expand considerable time and energy in developing their own, express dissatisfaction and are often penalized inappropriately by regulatory agencies. Providers, governmental agencies, health planners, and policy-makers acknowledge that they need certain kinds of information in common. Those who provide services directly also appear ready to adopt a common language for use in the assessment of sociodemographic, functioning, and medical status of individuals in long-term care.

Long-Term Care Information System (LTCIS)

The W. K. Kellogg-sponsored project entitled Long-Term Care Information System is training providers in Michigan to use a "common language instrument" in their on-going service programs. The assessment process includes use of a comprehensive assessment instrument and use of a translation method to define whether and which of any of eleven different services are needed. The assessment information is defined specifically (as objectively as currently possible) and includes descriptors of sociodemographic and identifying, medical, and functioning status from the Patient Classification for Long-Term Care, plus additional information about services received, social support, and the availability of non-institutional living arrangements. The translation method systematically uses the assessment of twenty items of information to project needs in the areas of nursing, physical therapy, speech therapy, emotional and social assessment or treatment, housekeeping, shopping, meal preparation, non-institutional living space, audiology, opthalmology/optometry, and dental service. An abstract form, designed as a convenient checklist organizes all of the information in one place. Figure I presents information about the algorithm used to translate assessment categories into needs for services.

The assessment process of the LTCIS is viewed as a management tool by service providers who currently use the system. Discharge planners in hospitals for acute care use the abstract form to record information as it is obtained through evaluation interviews and record reviews. The information is used as a screening mechanism to decide whether continued planning for discharge is needed and, if so, what remaining portions of the form must be completed. A decision is made about the type of long-term program to which the individual will be referred. When an available program of long-term service is located, the completed abstract form is transferred with the individual, as the referral form and as an objective record of the individual's status at the time of discharge. The provider who receives this information has a comprehensive base of information to begin to plan immediately for the next phase of care. Continuity of care is facilitated. The hospital retains a copy of the completed forms for use in its own internal program planning. An additional copy sent to appropriately authorized regulatory agencies and fiscal intermediaries (for eligibility determinations) would eliminate the need to fill out multiple forms and would avoid the discrepant information bases currently used for decisions about level of care. Aggregating the information would allow its use for program planning and policy-making.

Nursing homes, home health agencies, and adult day care programs currently use the assessment process of the LTCIS to decide whether individuals are eligible to receive their services. They also use it in planning for care and to evaluate progress over time. At the time of inquiry concerning eligibility, the abstract form is used as a worksheet. Based on abstracted information, a decision is made about whether to proceed with the admission process. At admission, or shortly thereafter, remaining assessment information is obtained. In a team conference, assessment information is presented, and problems and service needs are identified. Discussion is focused on developing goals and a plan for care. The care plan is developed in writing at the conference, and its directions are, then, followed.

At a subsequent time, specified in the care plan, the individual is reassessed according to the assessment process. A conference is held, and progress is reviewed as reflected in the reassessment. Continuing or new goals and plans are developed. Where applicable, a discharge or referral plan is developed, using the same discharge planning procedures as in acute care hospitals. When an individual is referred, a copy of the completed assessment is transferred to the relevant provider for the next phase of care. In one facility, aggregate assessment information is being incorporated into a management effort to determine staffing patterns and the need for specialized services.

The assessment process of the LTCIS is also used by long-term care providers in programs of outreach, information and referral, home-making service, home-delivered meals, and sheltered housing. The same general procedures previously described for determining eligibility and for referral and care planning are followed, adjusted to accommodate each program's needs. We have learned that the same common language, assessment instrument has been useful in each type of

Figure I

Translation into Needs for Service
(Long-Term Care Information System)

Assessment Categories		Service Needs
HEARING - Impairment without compensation		AUDIOLOGY
DENTITION - Some or no opposing teeth without compensation		DENTAL SERVICE
BEHAVIOR	ORIENTATION	EMOTIONAL AND SOCIAL SERVICES
Appropriate	Disoriented some spheres	Supervision
Wandering/Passive weekly or more often	Oriented	Supervision
Appropriate	Disoriented all spheres	Professional Assessment and Appropriate Services
Wandering/Passive weekly or more often	Disoriented	Professional Assessment and Appropriate Services
Abusive/Aggressive/Disruptive less than weekly	Oriented or Disoriented	Professional Assessment and Appropriate Services
Abusive/Aggressive/Disruptive weekly or more	Oriented or Disoriented	Treatment
ACTIVITIES OF DAILY LIVING (ADL)		
Bathing, Dressing, Toileting, Transferring, Bowel Function, Bladder Function, Eating/Feeding		
Dependent in 2 to 3 ADL		HOUSEKEEPING
Dependent in 4 ADL		HOUSEKEEPING AND NURSING BY AIDE OR LAY PERSON
Dependent in 5 to 7 ADL		HOUSEKEEPING, MEAL PREPARATION, AND NURSING BY PRACTICAL OR PROFESSIONAL NURSE
Eating/Feeding by IV or Clysis		HOUSEKEEPING, MEAL PREPARATION, AND NURSING BY PROFESSIONAL NURSE
Limited Joint Motion		
NON-INSTITUTIONAL LIVING SPACE - Not Available		HOME-FINDING SERVICES
SIGHT - Impairment without compensation		OPTHAMOLOGY/OPTOMETRY SERVICE
JOINT MOTION - Immobility or instability, uncorrected		PHYSICAL THERAPY
HIP FRACTURE - One year or less. Rehabilitation program not completed.		PHYSICAL THERAPY
PARALYSIS/PARESIS - One year or less. Rehabiliation program not completed.		PHYSICAL THERAPY
MISSING LIMBS - Rehabilitation program not completed.		PHYSICAL THERAPY
MOBILITY LEVEL - Goes outside with help or does not go outside.		SHOPPING
SPEECH - Impairment six months ago or less		SPEECH THERAPY

program. Its use had led to the development of systematic procedures for decision-making. Its use has facilitated participation by all care givers, including nursing aides, all of whom contribute assessment information and inputs into the treatment plan. Since the assessment information is defined in specific and easily understood terms, persons representing a wide range of education and work experience have learned to use it. Health and social services professionals, program managers, nursing aides, and outreach workers obtain assessment information that is reproducible. If the assessment process were adopted by the long-term care health and social system, communication linkages between and among programs would be faciliated: and a means for gathering comparable information about the populations in long-term care would be available.

Collection, Transmission, and Translation

It would be a sterile exercise to limit this discussion to the description of applicable data sets and their methodologic backgrounds. Data, by themselves, even when based on good developmental methods, may not be useful. In order to make data useful, we must be concerned with how the data are collected, how they are translated, and how they are transmitted.[10] Too often data are expected to answer questions without due regard for such issues.

In addition to detailed knowledge about assessment terminology, those responsible for program decisions and planning must know something about the reliability and validity of the data collection measures, where reliability is expressed in terms of the conditions needed to obtain reproducible information and validity is expressed in terms of the understandings and uses that have been achieved. Knowledge of "how to assess" is also important, that is, knowledge of sound assessment procedures (e.g., putting the client at ease and checking the information).

Adequacy of the technical aspects of measures and the measurement process does not, in itself, generally lead to acceptance and appropriate use of data in decision-making. Health planners and policy-makers, for example, without specific experience concerning the benefits and risks of service, cannot answer questions about manpower needs solely on the basis of information obtained through patient-oriented, assessment schedules. To answer such questions, additional information is needed about the effectiveness of various types of manpower and mixes of manpower, as well as about many factors such as legal constraints, economic constraints, and social and cultural factors. Judgements and values also enter into decision-making. If the planner or policy-maker does not recognize that patient-oriented information does not make decisions but provides a valid contribution to decision-making, he or she may expect too much from the information and wrongly discard it as inadequate. It is, unfortunately, our perception that this lack of understanding is quite prevalent among many who make decisions that affect the aging and chronically ill.

For those of us who seek to transmit and translate the utility of patient-oriented assessment information, this problem has certain implications. We have a responsibility to interpret accurately what the data both can and cannot do. We have the responsibility to develop an understanding of the viewpoints of the provider, the planner and the policy-maker, and help to formulate specific questions that require answers and that have a chance to be answered. We can identify, for such users, the contribution of patient-oriented assessment to the questions; and we can help identify the other informational requirements that are needed. In advance, we can illustrate the informational displays and interpretations that can be derived from patient-oriented assessment, thereby minimizing the risks of vague or unreal expectations. We can translate disciplinary and organizational jargon (often a barrier to acceptance) into common language. In this regard, we have found that a common language of patient status, expressed in basic functional terms, has been very helpful. Consumers use language of basic function regularly. Legislators understand the terms of basic functions. Sophisticated clinicians incorporate functional assessment into their problem-solving processes as, for example, in the Lansbury Index used by the rheumatologist and the New York Heart Association Classification of Cardiac Function used by the cardiologist.[11,12] Basic functions are also essential components of the languages of the many disciplines that serve the chronically ill and aged. This common language facilitates cooperative interrelationships and promotes cross-disciplinary credibility.

Summary

Information about persons in need of long-term care is required for decisions about program management, policy-making, planning, and patient care. Many of the informational requirements at these levels are similar except that more detail is needed to manage service programs and to deliver care. Although a common language across the system would enhance the utility of the information, obtaining comparable assessment information has not been achieved because of diversity in recording and collecting. Reflecting the fact that there is increasing consensus about patient assessment, the W. K. Kellogg-sponsored project, Long-Term Care Information System, is training providers in Michigan to use a "common language instrument" to derive their service needs. From such objective detailed information, it is possible to formulate less detailed, aggregate statistics for use in decisions related to policy, planning, and program management. To be emphasized is the importance of training both those who collect the information and those who use it. Training those who assess improves reliability and validity, while training those who use the information is essential if they are to draw correct inferences before making decisions.

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Uses of Manpower and Facilities Statistics

Concurrent Session C

THE KEY COMPONENTS OF HEALTH PLANNING: THE RHODE ISLAND MANPOWER EXPERIENCE

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Introduction

Health Planning can be segmented into various conceptual parts. For example, there are four fundamental steps in planning: 1) system investigation, 2) ends establishment, 3) means selection, and 4) intervention evaluation.[1] From the perspective of substantive content, planning consists of: 1) what we know, 2) what we know how to do, and 3) what we value.[2] Rhode Island's recent manpower planning experience will be presented from this latter perspective.

Rhode Island's State Health Planning and Development Agency (SHPDA) is designated under Section 1536 of Public Law 93-641 to perform both SHPDA and Health System Agency (HSA) functions. The SHPDA is an administrative unit of the Rhode Island Department of Health. The Rhode Island SHPDA has approached its health system planning responsibilities with two related but separable missions in mind: 1) the improvement of the population's health status and 2) the improvement of the health service delivery system in the state.

In planning for health services, the Rhode Island SHPDA views facilities, manpower, equipment and finances as means to service ends, not ends in themselves. The goal is to deliver the required level of health services as efficiently and effectively as possible.

Health manpower planning is often neglected but nevertheless it is a critical part of the overall health system planning process. The existing complement of health manpower in a geographic area will have a profound impact on health status needs identified, the demand for health services, and the demand for facilities and equipment. The manpower complement also has a profound impact on the access, quality and cost of health care. In fact, the extent of these impacts makes health manpower planning more important from a developmental perspective than health facilities planning.

Three key health manpower categories were included in Rhode Island's first State Health Plan: physicians, registered nurses and dentists. The case of physician manpower planning will illustrate the interplay between what we know, what we know how to do, and what we value.

What We Know

This component of planning represents the extent to which we understand the history, present status and likely future condition of the health system. This has long been the province of health data specialists. In fact, health information specialists and health planners are still struggling to bring their respective areas of expertise together in a mutually beneficial way.

In the physician manpower planning area, the State of Rhode Island has been licensing the physician manpower supply for almost 100 years. The passage of the Medical Practice Act in 1895 was a public health milestone. The Board of Health licensed 480 physicians in that first year.[3] Annual renewal of physician licenses began in 1954 in Rhode Island. However, physician licensure information was not used for health manpower planning purposes until very recently. At the present time, physicians practicing in Rhode Island are required to renew their licenses every year but the supplemental information which is required for planning purposes is collected every three years.

Rhode Island participates in three Cooperative Health Statistics System (CHSS) components: vital statistics, manpower and facilities. The Rhode Island SHPDA subcontracts with Rhode Island Health Services Research, Inc. (SEARCH) to collect, process and distribute CHSS health data.[4] The SHPDA has used two primary sources of information regarding the current supply of physicians in the state: 1) the CHSS supplement to the physician relicensure survey has been utilized since 1975 and 2) the SHPDA also uses American Medical Association (AMA) Masterfile information which is reported by the AMA and the Health Resources Administration (DHHS).

Recently, "second location of practice" was added to CHSS relicensure supplement. Location, principal specialty practiced and hours of patient care at the second location of practice are now collected. This addition will improve analysis of physician manpower availability around the state.

In 1975, there were 1,433 nonfederal physicians providing patient care in Rhode Island or 154 such physicians per 100,000 population according to the CHSS relicensure survey (includes D.O.s).[5] The AMA Masterfile produced a higher estimate of the number of physicians for the same year: 1,487 physicians or 160 physicians per 100,000 population.[6] (See Table 1). Rhode Island has the sixth highest physician ratio in the nation.

Table 1

Rhode Island Physician Manpower Supply 1975 and 1977*

Source	Number	Rate Per 100,000 Population
CHSS Relicensure Survey		
1975	1,433	154
1977	1,403	151
AMA Masterfile		
1975	1,487	160
1977	1,577	170

*Nonfederal Physicians Providing Patient Care

In 1975, the CHSS relicensure survey produced an estimate of 647 primary care physicians or 70 primary care physicians per 100,000 population. Primary care physicians are defined to include the specialties of general and family practice, general internal medicine, pediatrics, and obstetrics and gynecology. Primary care physicians equaled 45 percent of the 1975 physician supply. (See Table 2).

Table 2
Rhode Island Primary Care Physician Supply
1975 and 1977 Estimates*

	Primary Care Physicians	
	1975	1977
Number	647	603
Rate Per 100,000 Population	70	65
Per Cent of Total Physician Supply	45%	42%

*Nonfederal Physicians Providing Patient Care

Two alternative methodologies have been utilized to project Rhode Island's future physician supplies.[7] In the first method, AMA masterfile data by specialty were used as the bases for a least squares estimation of the likely future supplies of physicians by specialty. In the second method which was used to project total physician supply only, Rhode Island and U.S. AMA masterfile data by specialty type were used as the bases for a least squares estimation of Rhode Island's likely percentage of future national physician supplies. This projected percentage allocation was then coupled with the Graduate Medical Education National Advisory Committee's (GMENAC) projections of national physician supplies to project the State's future supplies of physicians.[8]

Projection method one indicates that in 1990 Rhode Island will have a total physician to population ratio of 220 per 100,000. Projection method two indicates that in 1990 Rhode Island will have a total physician to population ratio of 306 per 100,000. Further, according to method one which is admittedly a crude method, Rhode Island's primary care to total physician percentage could continue at 42 percent through 1990 even though the absolute number of primary care physicians is projected to increase from 647 in 1975 to 880 in 1990. (See Table 3).

Table 3
Projected Physician Supply
In Rhode Island 1990*

Projection	Number	Rate Per 100,000 Population	Per Cent
Method One			
Total Physicians	2076	220	100%
Primary Care	880	93	42%
Method Two	2883	306	100%

*Nonfederal Physicians Providing Patient Care

Unfortunately, the numbers of physicians completing the CHSS supplement to the physician relicensure survey appears to be declining. This declining response rate may be related to the SHPDA's physician manpower planning activities. If this is the case, the accuracy and reliability or viability of physician manpower planning may become a serious issue in the near future. The State of Massachusetts has already been confronted with this issue.[9]

Another grave issue which faces health manpower planning is the proposed cutoff of the CHSS manpower component funding. Existing local funds and national manpower data are not adequate for health manpower planning.

What We Know How To Do

It is one thing to be able to describe the existing health system or to predict the future condition of the system; it is entirely another thing to decide if the system is good, bad or indifferent. Such judgements depend to a large extent on our ability to develop appropriate standards. Health manpower planning standards should be grounded in the technologies of health planning and epidemiology. Health manpower planning standards are usually based on either professional judgements about need and/or demand for health manpower, or the empirical deployment rates of operating health care delivery systems.

In the past, health manpower planning has not been well integrated with health system planning. Health system planning has focused mainly on facility considerations. Leadership in health manpower planning has frequently been provided by the educational sector.

As stated previously, the Rhode Island SHPDA placed a high priority on health manpower planning. The SHPDA identified physician manpower standards which had been organized for the Bureau of Health Manpower (DHHS).[10] In addition, the SHPDA produced two Technical Reports (#13 and #20) in an effort to determine appropriate standards for physician supply in Rhode Island.[11,12] These Technical Reports and other physician manpower analyses indicate that Rhode Island shares the three major physician manpower problems of the nation: 1) an impending surplus, 2) specialty maldistribution, and 3) geographic maldistribution. In the second Technical Report (#20), physician supply standards were utilized to estimate Rhode Island's physician requirements simultaneously by specialty and geography. A physician panel was utilized to define primary, secondary and tertiary level physicians. Four different types of standards were employed: 1) U.S. professional judgement standards, 2) Kaiser-Permanente (HMO) empirical deployment standards, 3) British National Health Service empirical deployment standards, and 4) Canadian professional judgement standards.[13,14,15,16] (For example, see Table 4). The four sets of standards were compared with Rhode Island's existing (1977) physician supplies. Primary (22), secondary (4) and tertiary care (1) geographic areas were utilized in these comparisons.[17]

Table 4
Physician Manpower Requirements

Standards	Total Rate Per 100,000 Population	Primary Care Proportion
U.S. Professional Judgement	159.4	50%
HMO Empirical Deployment	90.0	54%
British Empirical Deployment	115.2	40%
Canadian Professional Judgement	150.4	54%

The following statements can be drawn from comparisons of existing physician supplies with the standards: that Rhode Island's total supply of physicians is probably excessive, and that Rhode Island's proportion of primary care physicians is probably deficient (See Table 5). These findings take on added significance when they are coupled with projections of an increasing total physician supply in the state and a continuing primary care physician proportion which is inadequate. If projections of increasing physician supply in Rhode Island are accurate, Rhode Island will have a clear surplus of physicians according to all four standards and the proportion of primary care physicians will be less than most standards. If just the numbers of general and family practitioners are considered, the primary care situation becomes more serious.

Table 5
Rhode Island's Physician Supply (1977)
In Relation To Four Standards[1,2,3]

Standard	Primary Physicians	Total Physicians
U.S. Professional Judgement	-28%	-11%
HMO Empirical Deployment	+35%	+66%
British Empirical Deployment	-62%	+22%
Canadian Professional Judgement	-28%	- 5%

[1]Per Cent Above Or Below The Standard
[2]Adjusted Standards
[3]Full-Time Equivalents

In addition to geographic deficiencies which were noted in Technical Report #20, a geographic maldistribution of primary care physicians can be identified in Rhode Island by the fact that seven Primary Health Manpower Shortage Areas have been designated in Rhode Island by the U.S. Secretary of Health and Human Services. Four of these areas are located in densely populated inner-city sections and three of the areas are located in the rural sections of the state.

The technology for establishing physician manpower standards is still relatively crude and untested. However, the last four years have produced a burst of interest and activity in the area. In the near future, we can anticipate the emergence of physician manpower standards which will enjoy wide agreement and use. The maturation of this technology will attract the average health planning agency into physician manpower planning.

What We Value

Comparing the existing situation to standards will help to define problems and/or goals. In physician manpower planning, shortages or excesses may be identified in total numbers and/or specialty distributions and/or geographic distributions and/or institutional distributions. Once potential problems and/or goals are identified, there is a number of intervention options which exist:

* do nothing,
* promote voluntary action,
* institute financial incentives,
* stimulate market forces, and
* regulate supply.

The choice of the most appropriate intervention is ultimately a value decision.

In the face of a projected physician surplus and associated costs, the staff of the Rhode Island SHPDA recommended a certificate-of-need program for physicians in the state.[18] As envisioned by the staff, this program would represent an extension of the current physician licensure process. In the future, physicians seeking licensure in the state would be required to meet "need" tests as well as competence tests. The program would not coerce physicians in any way, it would simply limit their choices of practice settings. Physicians would not be told where they must practice, rather they would face bounded choices with respect to where they could voluntarily choose to practice. The staff viewed the certificate-of-need proposal as the most effective way of avoiding a physician surplus and of producing a more ideal distribution of physicians by specialty and geography.

However, under the structure of Public Law 93-641, the final value decisions in planning rest with the Statewide Health Coordinating Council (SHCC). The SHCC is a consumer majority body which also contains representation from a variety of health professionals. The Rhode Island SHCC rejected the concept of certificate-of-need for physician manpower. They did this after receiving negative reactions to the concept from physicians and others at special Council meetings and public hearings. In fact, the idea of certificate-of-need for physician manpower did not generate support from any segment of the Rhode Island community.

Nevertheless, the Rhode Island SHCC was sufficiently concerned with potential physician supply problems to make the following recommendations:

"IT IS ESTIMATED THAT THE NUMBER OF NON-FEDERAL PHYSICIANS (MD AND DO) PROVIDING ACTIVE PATIENT CARE IN 1980 IS APPROXIMATELY 1780 OR APPROXIMATELY 190/100,000 POPULATION AND THAT THESE REPRESENT APPROXIMATELY THE PROPER NUMBER OF PHYSICIANS TO FULFILL THE HEALTH CARE NEEDS

OF RHODE ISLAND CITIZENS. ACCORDINGLY, IT IS RECOMMENDED THAT THE RHODE ISLAND MEDICAL SOCIETY WORK COLLABORATIVELY WITH THE RHODE ISLAND DEPARTMENT OF HEALTH, THE HOSPITAL ASSOCIATION OF RHODE ISLAND, THE STATEWIDE HEALTH COORDINATING COUNCIL, AND WITH THE REGIONAL HEALTH PLANNING COMMITTEES TO MONITOR THE TOTAL NUMBER OF PHYSICIANS ACTIVE IN PATIENT CARE IN THE STATE AND IN EACH REGION. WHENEVER THAT NUMBER EXCEEDS APPROXIMATELY 1800 OR APPROXIMATELY 195/100,000 POPULATION (WHICHEVER IS THE SMALLER NUMBER) ON A STATEWIDE OR REGIONAL BASIS, EACH HEALTH CARE INSTITUTION AND REGIONAL HEALTH PLANNING COMMITTEE WITHIN EACH REGION SHOULD ENCOURAGE ONLY NEEDED PHYSICIANS OR NEEDED PHYSICIAN SUBCATEGORIES TO ENTER PRACTICE IN THAT REGION."[19]

"IN 1985 THE PERCENTAGE OF THE TOTAL NUMBER OF NON-FEDERAL, ACTIVE PATIENT CARE PHYSICIANS WHO SPECIALIZE IN PRIMARY CARE IN RHODE ISLAND SHOULD EQUAL APPROXIMATELY 50 PERCENT OF THE NON-FEDERAL ACTIVE PATIENT CARE PHYSICIANS. THIS RATIO SHOULD BE MONITORED ON A REGIONAL BASIS. UNTIL THIS RATIO IS REACHED, EACH HEALTH CARE INSTITUTION WITHIN EACH REGION SHOULD ENCOURAGE ADDITIONAL PRIMARY CARE PHYSICIANS TO ENTER PRACTICE IN THAT REGION."[19]

While there are many problems associated with a voluntary approach to managing physician supply, the Hunterdon, New Jersey interlude of success in this area indicates that it is not impossible.[20]

Conclusion

The key ingredients in planning are: 1) what we know, 2) what we know how to do, and 3) what we value. The physician manpower policy which was recently adopted by the Rhode Island Statewide Health Coordinating Council includes elements of all three of these key ingredients. Of course, "what we know," "what we know how to do," and "what we value" in physician manpower planning will change over time. As a consequence, policy recommendations may shift in the future.

Acknowledgements

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APPLICATIONS FOR HEALTH MANPOWER DECISIONS AT THE STATE LEVEL

Lewis Dars, New Jersey Department of Higher Education

I would like to thank the National Center for Health Statistics for their invitation to speak to you on the use of manpower data to make state level health manpower policy decisions. I think I can best address this issue by discussing what the Department of Higher Education's responsibility is with respect to manpower planning and the process and research that we use to address manpower questions.

The New Jersey Department of Higher Education and its Board of Higher Education were established by the Higher Education Act of 1966. Under the provisions of the Act, the Board was given exclusive jurisdiction over higher education in the State with two specific responsibilities that initiated our current activities. The Board was required to first develop and maintain a long range master plan addressing the higher education needs of the citizens of the State and, second, to review and approve all publicly supported educational programs at the public, and most of the private institutions.

Specifically, the Office of Health Professions Education, within the Department of Higher Education, undertook the development of a master plan in the health area. In 1973, the Board approved the first Health Professions Education Master Plan (HPEMP). That plan is based upon the following five objectives:

1. To set guidelines for a network of educational programs to meet the changing needs for health care in the State.

2. To end the fragmented, unsystematic approach to creating programs often as a response to crisis situations or the enrollment demands of a particular institution of higher education or the unexamined demands of professional groups.

3. To create a research instrument which will assess current supply, utilization rates and the projected demand for health professionals by 1985.

4. To open institutional and public discussion on major health issues and recommend their possible solutions and develop appropriate policy as they impinge upon the responsibilities of institutions of higher education.

5. To establish a framework within which an effective statewide advisory agency can assist the Department and Board of Higher Education in planning and developing collegiate level health professions education programs.

While the HPEMP addresses a wide variety of issues such as the team concept; accreditation, licensure and certification; continuing education; and regionalization and institutional cooperation in the use of education resources, it also is primarily concerned with the quantitative manpower and specific qualitative programmatic needs for a variety of health occupations. A major section of the Plan is devoted to establishing estimates of the types of health manpower which would be required in New Jersey to staff an effective health care delivery system. It is obvious that, from a planning point of view, it is important to assess whether or not additional manpower is needed prior to the approval of costly health professions education programs.

Wherever possible, the question of manpower needs was addressed quantitatively. This required the development of an initial data base and a projection methodology. Of the 25 occupations that are addressed in the Plan, baseline data was available for only 19 professions. Much of the data were drawn from the various associations and the census. While important questions were raised about the data's completeness, it was the best available information. Accordingly, we proceeded to incorporate these data into our forecasting equations.

The methodology and data presented in the HPEMP has been used by the Department, the various institutions of higher education, and other planning groups to address a wide variety of issues, such as:

1. What health professions will be needed in the future? How many educational programs will satisfy this need and in what parts of the State?

2. Should facilities be expanded and/or new facilities be built to train health professionals?

3. Should current enrollments be allowed to expand in certain programs?

4. To what extent will a new health facility (i.e., hospital, nursing home, etc.) once it is completed, have the necessary manpower to operate efficiently?

5. What will the future employment opportunities for graduates of health professions education programs be?

More recently the following questions were addressed:

1. Is there a need for a new medical school in the southern part of the State?

2. What is the appropriate educational policy with respect to nursing enrollments and programs?

3. Can one address the geographic and specialty maldistribution problem that

exist in the area of medical and dental services?

In order to improve our ability to quantitatively address these issues the Department undertook the task of implementing a data base similar in scope to the CHISS. Each licensed health professions is now surveyed on a regular basis. Information is collected on a variety of socio-economic and demographic variables. The data are computerized and put in an interactive format for retrieval.

These data form our baseline upon which projections of supply and demand are developed. Supply projections are developed by applying data relating to workforce separation rates due to death, retirement, and job mobility. The finished product of these calculations is a point estimate of future manpower supply (5 or 10 years hence) which is then compared to our projections of demand.

The projections of demand are developed by comparing the distribution of manpower to such factors as population size, age, income, and health status. Further adjustments to the demand projections are made to reflect the future impact of a national health insurance program. The comparison of these projections indicate whether or not we can reasonably expect a surplus or shortage situation in the future for a given occupation. These projections are carried out on a continuing basis and form one of the reference points upon which decisions are made respecting new program approvals.

Examples of such projections are presented in figures 1 and 2. They represent the estimates of the need for physicians and nurses. Figure 3 presents a different use of our data base to examine the employment pattern of nurses by levels of nursing education and age. As indicated in Figure 4, attrition of nurses from hospitals varies inversly with the level of education.

Based upon the projection of need for physicians, the Department sought legislation to implement a Graduate Medical Education Program in order to provide direct state support to physicians residency programs to attract more physicians to the State and a Physicians - Dentist Loan Redemption Program to place physicians and dentists in unlicensed areas of the State. In return for such services, the State will reddem up to 85% of their indebtness for three years practice.

With respect to the projections on nursing, a number of recommendations were developed designed to address the current shortages within acute care facilities. These recommendations, which were adopted by our Board of Higher Education in July of this year, deal with educational, practice setting and economic issues.

I want to thank you for this opportunity to share our experiences with you. Before I end, however, I would like to emphasize that the development of data systems similar to CHISS has provided, at least in one state, an opportunity for state planners to have a meaningful impact on public policy.

Figure 1

Supply, Demand and Need for Full-Time Equivalent Physicians

Under Immigration Restrictions of P.L. 94-484

1975-1985

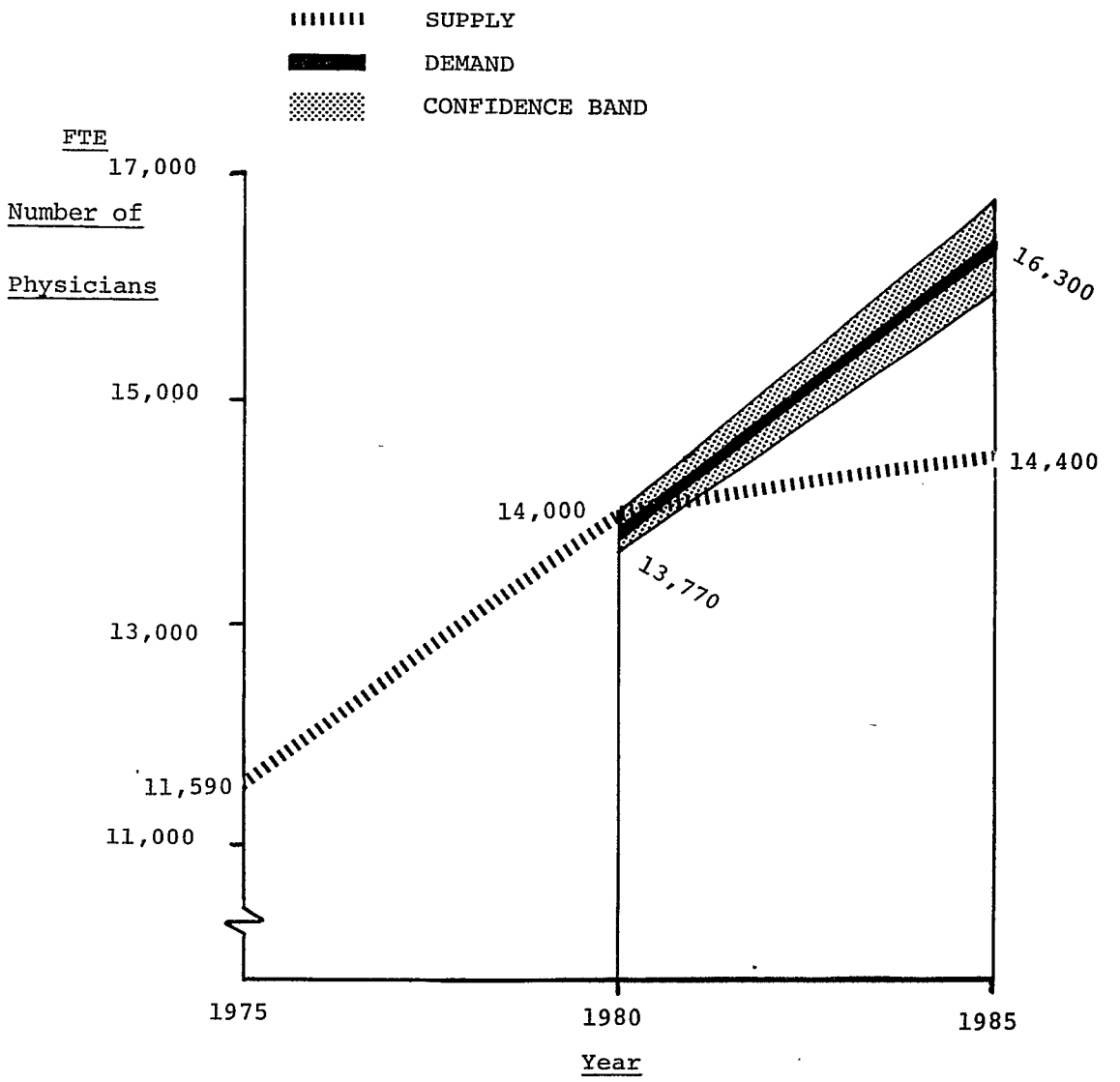


Figure 2

REGISTERED NURSE DEMAND AND SUPPLY PROJECTIONS
NEW JERSEY
(FTE)

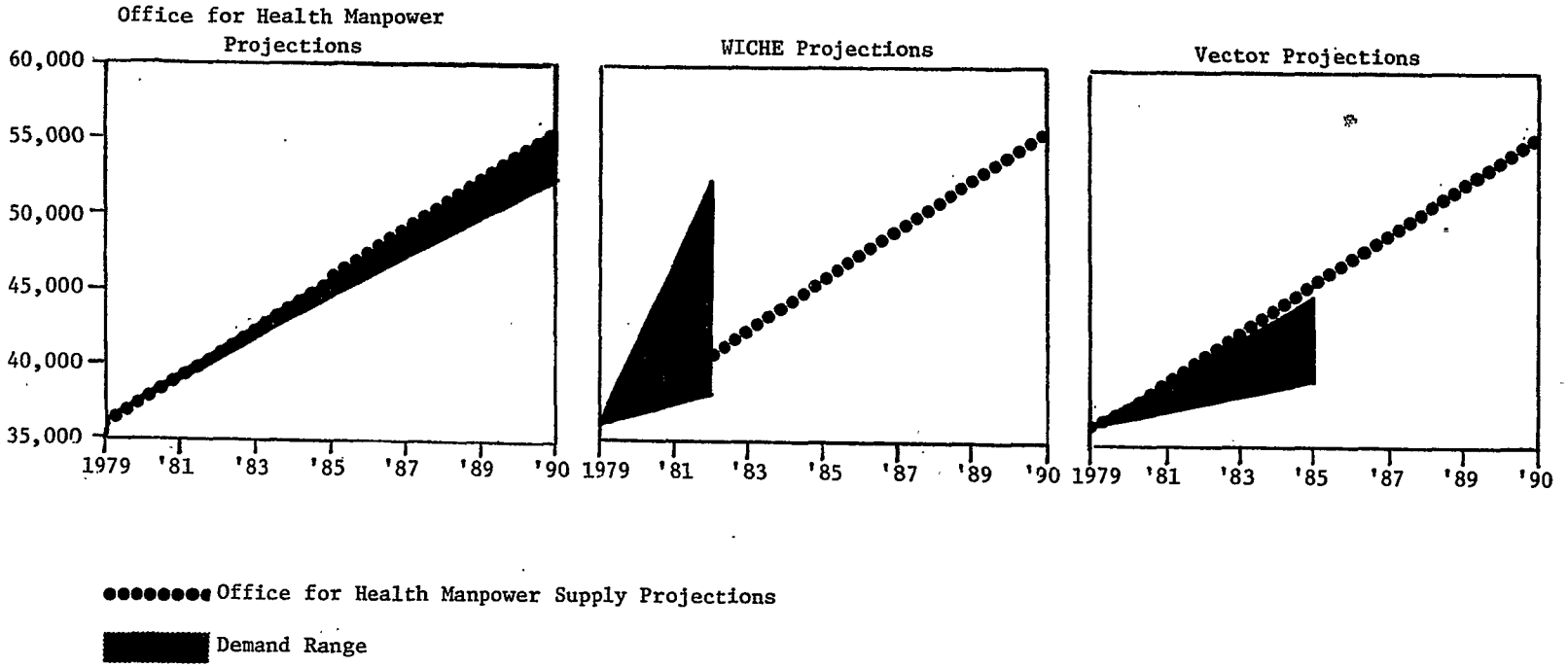
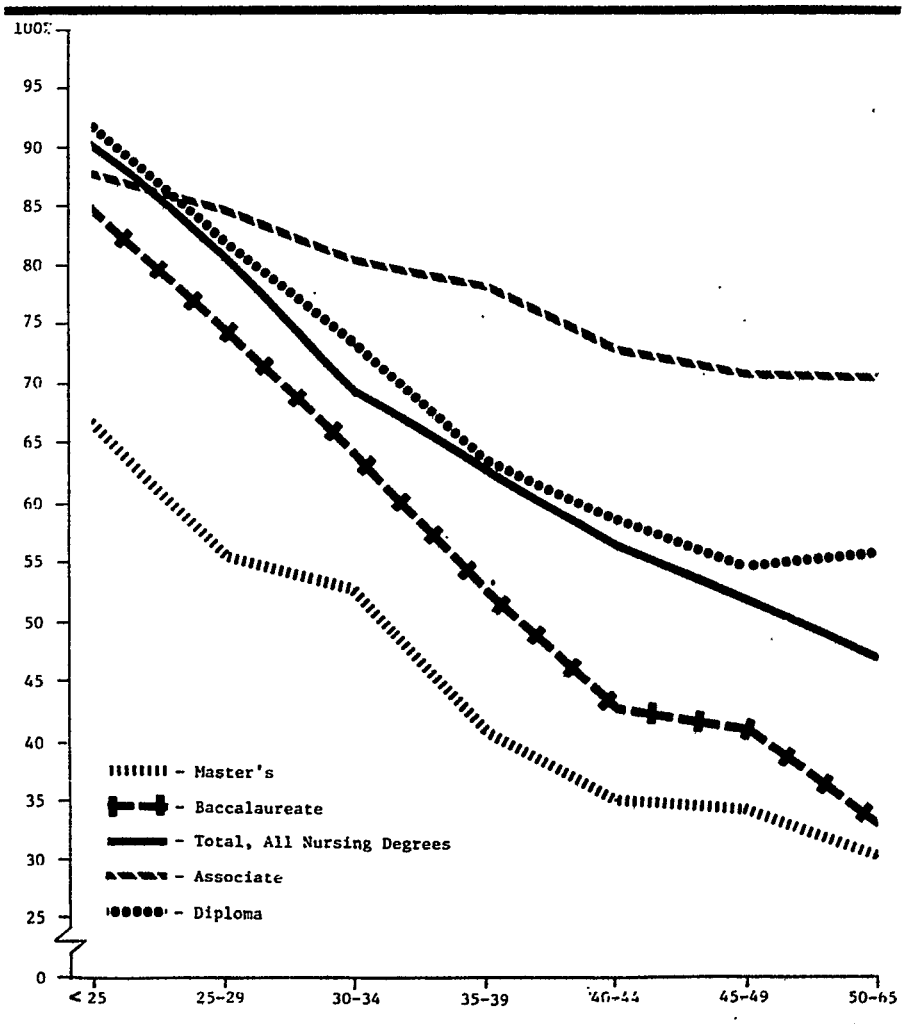


Figure 3

PERCENTAGE OF NURSES IN HOSPITALS
BY DEGREE AND AGE

Age	Total, All Nursing Degrees	Diploma	Associate	Baccalaureate	Master's
<25	90.3%	91.7%	87.8%	84.5%	66.7%
25-29	80.7	82.1	84.7	74.9	55.4
30-34	69.6	73.2	80.5	64.0	52.8
35-39	63.2	63.7	78.0	52.7	40.7
40-44	56.3	58.6	72.9	42.6	35.0
45-49	51.9	54.7	70.9	40.9	34.1
50-65	47.0	55.6	70.5	33.0	30.0



Medicare Data for Health Planning and Epidemiological Studies

Concurrent Session D

DEVELOPMENT AND USES OF MEDICARE DATA FOR HEALTH PLANNING

James D. Lubitz, Health Care Financing Administration

Introduction

For the past three years, the Health Care Financing Administration (HCFA) has been developing data from the Medicare Statistical System (MSS) for health planners. HCFA's efforts were motivated initially by the desire of the Bureau of Health Planning that Health Systems Agencies (HSAs) receive the same Medicare data reports that were already being distributed to the PSROs and by HCFA's wish to expand the applications of Medicare data into new fields. This paper describes the work done at HCFA to produce planning data from the MSS, possible applications of the information, problems encountered, and plans for future work. It also points out some lessons learned about what is involved in producing planning data for local agencies from a large national data system.

The Medicare Statistical System

A discussion of the development of data for health planning from the MSS must begin with a description of the system itself. The nature of the system defines the range and types of data that can be derived from the Medicare program. By and large, the MSS is a by-product of the administrative record-keeping system of the Medicare program. This system must keep track of the eligibility of enrollees and of the benefits they use. It must keep track of the certification status of institutional providers. And, it also must keep track of payments made for covered services. The system is huge. In 1977, records were maintained on 26 million active enrollees, 17,300 participating institutional providers, and 123 million bills for services were processed.

The basic data files of the MSS parallel the major files of Medicare's administrative system. As figure 1 at the end of the text shows, there is an enrollment file containing demographic data including age, sex, race, state, county and zip code of residence, and eligibility information for all enrollees. The single most important item is perhaps the unique Medicare identification number. As will be seen, this allows use of service by individuals to be followed across types of services and through time. The file also contains information on date of death so that an important health outcome measure can be linked to records on use of services.

There is an institutional provider file with information on hospitals, skilled nursing facilities, home health agencies and independent laboratories certified for Medicare participation. The information in this file includes the institutions' size, location, and type of control. Just as each enrollee has a unique ID number, each institutional provider also has a unique identification number.

The third major type of file contains records of services used under Part A of Medicare -- hospital, skilled nursing facility or home health agency services. The construction of a hospital stay record file illustrates how these files operate. The claim submitted by a hospital for services to a Medicare enrollee contains information about the hospital stay including admission and discharge dates, charges and reimbursement, and, for a 20-percent sample of discharges, principal diagnosis and surgical procedure. The claim also has the Medicare identification number of the enrollee and the hospital. Using these two numbers, information in the hospital claim is linked to information on the enrollment and institutional provider files to create a new file where each record contains information about a hospital stay (figure 1). It is important to emphasize that this system does not rely on the bill for any information beyond that about the stay itself. Items such as residence or age of the patient are from the central enrollment files not from the bill.

The last major type of file (not illustrated in figure 1) in the MSS provides information on the use of Medicare Part B services, the most important of which are physician services. These files are based on information submitted by the Medicare carriers for payments they make for Part B services and include data on the physicians submitted charge, the amount Medicare allowed, Medicare reimbursements, and the number and type of services received. As with hospital bills, the bills for Part B services are linked to the information in the enrollment file through the enrollee's Medicare number. At this time, no system is operating nationally to identify the physician supplying the service. Thus, physician service data cannot be aggregated on physician characteristics as hospital data can be on hospital characteristics. This explains why patient origin data for Medicare physician services cannot yet be developed at the national level.

Advantages and Limitations of the Medicare Statistical System for Health Planning Data

The nature of the Medicare Statistical System gives it both inherent advantages and limitations as a source of data for health planning. These are summarized in Table 1. One obvious advantage is that because Medicare is a national program with uniform eligibility requirements and benefits, the MSS provides a complete national picture of program experience using uniform definitions. Hospital data can be aggregated by residence of the beneficiary or by location of the hospital for areas as small as zip code areas or counties up to larger areas like health service areas, states, or regions, and comparisons among different areas can be made. This follows because the system is based on unit records rather than aggregate reports. This means that there is great flexibility in producing data by any combination of variables desired. Another advantage is that data are produced as a by-product of administrative processes without the cost of special surveys. The MSS has been in operation since Medicare's beginning in 1966, and can provide a longitudinal perspective on program use.

TABLE 1

Some Advantages and Limitations of the Medicare Statistical System for Planning Data

ADVANTAGES

1. National program
2. Various levels of geographic aggregations
3. Unit records
4. Low cost vs. special surveys
5. Continuous since 1966
6. Data on population at risk
7. Unique person ID

LIMITATIONS

1. Restricted to persons 65 and over
2. No data on non-covered services

The system contains data on the entire population-at-risk, all Medicare enrollees, whether or not they ever use any benefits. This facilitates the computation of rates of use of services and means that studies can be done on non-use, as well as use, of program benefits. In addition most enrollees join the program at age 65 and remain covered until they die. Thus, the problem of persons dropping their coverage is not a significant one for longitudinal cohort studies.

The unique enrollee identifier expands the range of the system for analysis. Records for the same person can be linked through time and across different types of benefits to carry out studies not possible with cross-sectional data systems. For example, studies have been performed on multiple hospital admissions for the same person. It was found that from 1974 to 1976, 49 percent of all enrollees were admitted to the hospital at least once, and 26 percent were admitted more than once. Studies now underway using this record linking capability include a study of the total program cost of selected surgical procedures, a study of the utilization and cost of services in the last years of life, and a study of mortality after common surgical procedures.

The uses of Medicare data for planning are limited by the groups of people and benefits covered by the program. Medicare coverage, of course, is limited to the aged and certain disabled persons. The data give a good picture of program use by the aged in specific health service areas since an estimated 95 to 98 percent of the entire population aged 65 and over are enrolled in Medicare. The aged account for a substantial portion of total health care use. According to the National Center for Health Statistics, persons aged 65 and over accounted for one-fourth of all hospital discharges and one-third of all days of care in the United States. To some extent patterns of Medicare hospital use may parallel hospital use by the entire population. This was suggested by a study in three New England States that compared Medicare patient origin data with patient origin data for the entire population and showed that, in general, the same conclusions were reached regardless of which source was used. (Wennberg and Gittlesohn, 1980).

The scope of Medicare data is also limited by the benefit structure of the program. Hospital services are well covered, as are physician services after a $60 deductible, so the MSS will have a nearly complete record of use of these services. However, for nursing home services, coverage is limited to stays in certified facilities at the skilled level of care, and only following an inpatient hospital stay. Medicare expenditures comprise only 5 percent of total nursing home expenditures from public funds. Additionally, the MSS cannot, of course, provide data on services not covered at all by Medicare such as out-patient drugs or dental.

Data for Health Planning

In addition to the regular reports on enrollment and program use, and special research reports which are often of interest to planners, several reports have been developed specially for health planning. They include reports on enrollment, MEDPAR reports giving profiles of hospital use, a report on rates of hospital use in health service areas, and hospital patient origin and destination reports.

Enrollment tables beginning with 1974 data at the health service area have been distributed to all HSAs, and county level data will be sent out very soon. We feel a major use of these data is to provide estimates of the total aged population at the county level in the years between censuses. County level census estimates are often not available for the aged. Even where such estimates are available they are not likely to provide the detailed age, sex and race breakdowns available from Medicare.

The MEDPAR report, a set of 21 tables for each health service area, present hospital, health service area, regional and national profiles of various aspects of hospital use, including distribution of cases by age, sex, and race, and average length of stay by day of the week of admission and discharge. These tables have been sent to HSAs beginning with 1974 data. We feel planners might use the tables to identify areas for further study. For example, one MEDPAR table focuses on long staying patients. Data from this table for HSA 2, Hudson County, in New Jersey, are shown in table 2. The table focuses on patients with stays of over 4 weeks. In this HSA, 12.3 percent of the patients had long stays, a higher percent than the HHS region II average of 10.6 percent or the U.S. average of 5.6 percent. As the table shows, hospitals D and G are especially high in the percent of long stay patients. Planners at the local agency might be able to evaluate these data together with knowledge about their hospitals to decide whether further study of subjects like the availability of post-hospital placement facilities is in order.

TABLE 2

Medicare Enrollees Aged 65 and Over: Long stay cases (29 days and over) as a percentage of all cases, Hudson County, N.J. HSA3, 1977

AREA	PERCENTAGE
United States	5.6
HHS Region 02	10.6
HSA 3	12.3
Hospital A	11.3
B	14.6
C	7.4
D	16.9
E	7.0
F	13.9
G	18.4
H	11.0
I	11.0

NOTE: Data are based on a 20-percent sample of Medicare discharges.

A report on rates of Medicare discharge, days of care, and average length of stay will be sent to HSAs in a few months. The data should be useful to health planners in identifying cross-sectional variations and trends in hospital use for their areas compared to other areas.

As noted earlier, the records of hospital stays in the MSS contain information on the residence of the patient and location of the hospital. Using these two data items, patient flow tables have been generated, taking advantage of the MSS's ability to record out of area use by the residents of an area, due to the system's national coverage. While the 3 reports just described were extensions of data already being produced, the patient flow reports represent an information package developed specially for HSAs.

Patient origin and destination tables at the health service area level, and patient origin tables at the hospital and county level have been prepared. In addition, patient origin tables at the hospital and zip code level have been developed for a few areas. The data could be used to help in the definition of service areas for hospitals and to examine the flow of monies on behalf of residents in one area to providers in another area. Table 3 gives an example of patient origin data at the hospital and county level. The table is part of the set for HSA 7 in Santa Clara County, California. The table illustrates the different patient origin patterns at Stanford University Hospital where only 41 percent of Medicare patients come from Santa Clara County in contrast to that of Good Samaritan Hospital, where 85 percent of the patients are from Santa Clara County.

TABLE 3

Medicare Enrollees Aged 65 and Over: Patient Origin Data, Santa Clara, CA HSA 7, 1977

County of Residence	Number of Discharges	Percent of Discharges
GOOD SAMARITAN HOSPITAL OF SANTA CLARA		
Total	2202	100
Santa Clara	1880	85
Monterey	39	2
Santa Cruz	25	1
•		•
•		•
•		•
STANFORD UNIVERSITY HOSPITAL		
Total	5102	100
Santa Clara	2099	41
San Mateo	1447	28
Alameda	265	5
•		•
•		•
•		•

NOTE: Data reflect hospital bills received and processed in the Medicare Statistical System as of September, 1980.

Lessons and Plans for the Future

In the three years Medicare data have been distributed to planners, a number of issues have arisen. One concerns the amount of effort HCFA should devote to developing data for planning. In a survey of 6 HSAs conducted last summer, we found that HSAs would like additional HCFA efforts in four areas. (Garfinkle and Lubitz, 1979).

First, we found that HSAs want as much geographic detail as possible in the data packages. For instance, HSAs want enrollment and patient origin and destination data at least the county and preferably the zip level. Along with this, areas with substantial non-white populations wanted race breakdowns not shown in the tables.

Second, HSAs expressed an interest in receiving new types of data, principally reimbursement data for Medicare services to their residents. They observed that expenditure information is the hardest kind of information to obtain. They also expressed interest in long term care and physician service data. Data on these subjects, as opposed to hospitals, are not generally well-developed and HSAs felt that HCFA would be a possible source.

The third major area of interest to the HSAs surveyed was special requests. A set of tables designed for all HSAs obviously cannot be tailored to address every topic of special interest for an individual agency. HSAs wanted to be able to contact someone in HCFA for data for special studies or to obtain tapes to do their own analyses.

The fourth area involved comments from the HSAs surveyed that we should increase our efforts to publicize Medicare data and explain their nature and uses. Apparently, HSAs were more familiar with National Center for Health Statistics and Census data than Medicare data. This is understandable since these agencies are older and exist primarily to produce and disseminate data, while our data

is a by-product of administering the Medicare program. HSAs felt that if they understood more about the MSS, they would find more uses for the data. They suggested a "users guide" to Medicare data for planning, explaining the Medicare program, the nature of Medicare data and their applications.

The desires of HSAs for additional HCFA activities in the field of data for planners raise the question of the amount of effort this program should receive. HCFA is not required to produce data for planners; the work is a by-product of our main work of studying Medicare's impact on beneficiaries and providers. An idea of the effectiveness of our data for planning would be helpful in allocating resources, yet we must depend on unsolicited comments or on special surveys to learn how our data are used since we have no regular contact with HSAs. We have found we get enthusiastic praise from about 10 HSAs and silence from the others. In the absence of a clear idea of what our data are worth to planners, it is difficult to decide how much to devote to this sort of work.

A related problem we face is deciding what kinds of information reports to produce. Again, because there is no administrative relationship between HCFA and the HSAs, we have relied up to now on our own judgement and advice from the Bureau of Health Planning for ideas. While we have the best knowledge of what the MSS can produce, we are not sure we have the best idea of what information is most useful.

The issue of data accuracy has also arisen in regard to both present and proposed activities to develop planning data. This issue arises because as data are shown at finer levels of detail and as new types of data reports are developed, the chances for inaccuracies increase. Data that are adequate at the national, regional or state levels may be inaccurate at the county or zip levels. For example, based on comparisons with Census data, there is reason to suspect that there may be problems in coding county of residence in the Medicare enrollment file in areas like Virginia that have independent cities. Mis-allocating enrollee counts between an independent city and an adjacent county would not affect a national or even state total, but would result in misleading county level information. An enormous amount of effort is required to assure data accuracy and to warn users of data problems. But if the effort is not made, and planners discover an inaccuracy, they could lose confidence in the data.

Another issue concerns the usefulness of our MEDPAR hospital data for HSAs in states with a hospital discharge data system providing data on the entire population. Even in these areas we feel MEDPAR tables might be employed to validate other data, for making comparisons with other HSAs and with regional and national averages, and to obtain ideas for new hospital utilization profiles.

In the next year or two, we plan to undertake three projects in the area of planning data. The first is to attempt to develop data packages giving service-specific, data on Medicare reimbursements at the county and health service area levels. The data fields are already in the MSS, but the project will require a good deal of manipulation of large data files. The information should prove to be useful not only to planners, but for internal studies as well.

The second area of work will be to further examine the extent to which Medicare utilization and expenditure patterns parallel patterns for the entire population. We are planning a small study to compare patient origin data on Medicare enrollees and on all age groups in five sites.

The third area is to try to increase our efforts to obtain suggestions and advice from planners on our program to produce planning data. One of the tasks in a grant from HCFA to the American Health Planning Association will be to assess this program and guide us in making our efforts more useful to planners.

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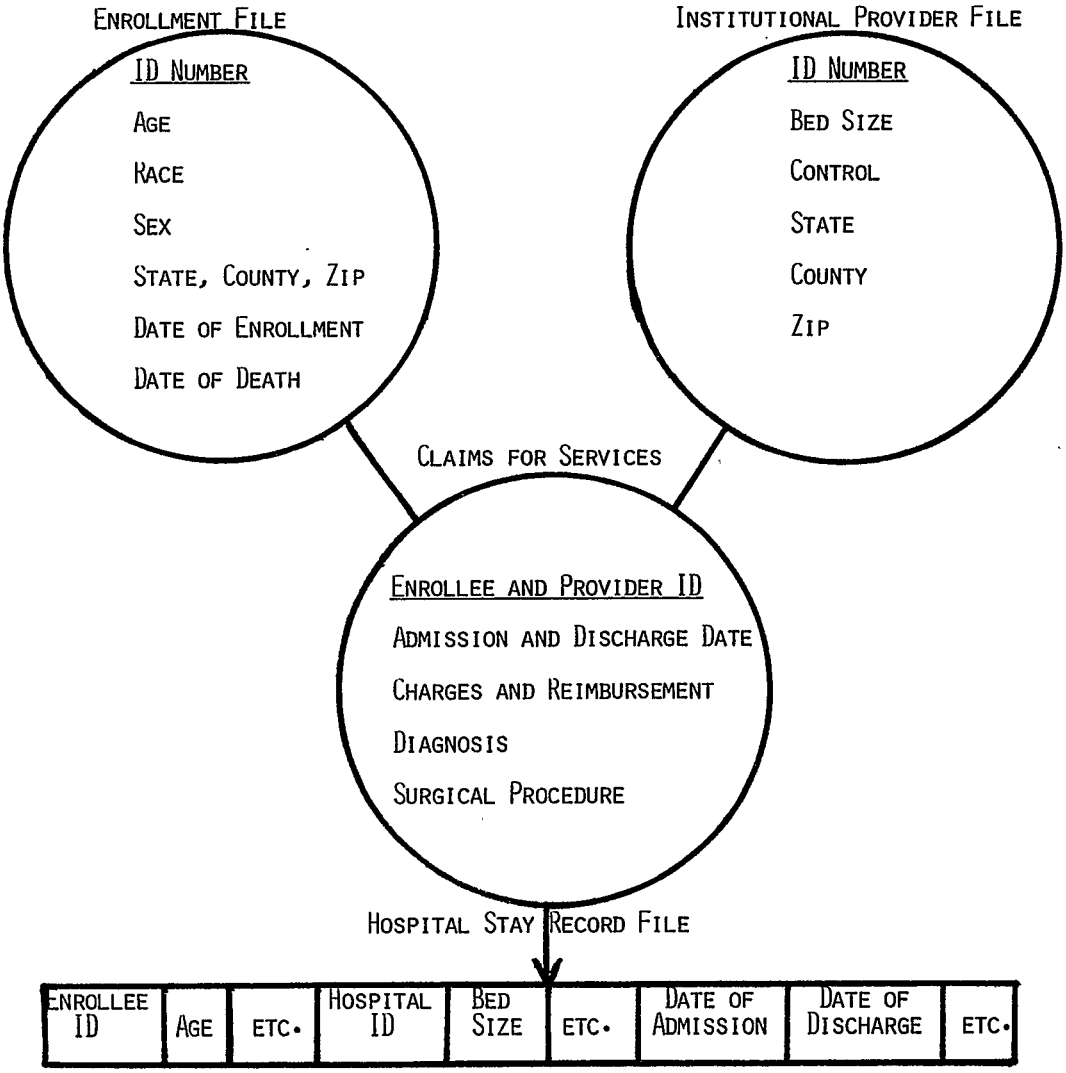
FIGURE 1

THE MEDICARE STATISTICAL SYSTEM



POTENTIAL USES OF MEDICARE DATA FOR EPIDEMIOLOGICAL AND EVALUATION STUDIES

Paul W. Eggers, Health Care Financing Administration

Introduction

The Medicare statistical system has a number of special characteristics which make it particularly useful in various types of health research. Briefly, they are as follows:

First, there is comprehensive coverage. Almost all persons age 65 and over in the United States are enrolled for Medicare. The major exceptions are those persons who do not have sufficient quarters of coverage under the Social Security program. As a national program Medicare has uniform definitions and benefits across the nation, thereby making regional comparisons possible.

Second, the statistical system consists of unit records. Bills are submitted in unit record form thus enabling separate breakouts of use and expenditure by service such as inpatient, outpatient, home health, skilled nursing facility and physician services.

Third, there is a unique person identifier, based upon the social security number. This identifier is present on all bills, thus enabling one to link use to specific individuals.

Fourth, there is a unique identifier for each institution. With these identifiers utilization can be related to a specific institution.

Fifth, Medicare data have been collected since July 1, 1966 (when the program began), thereby providing the basis for longitudinal studies of Medicare use. Not all of the research data files, however, go back to 1966 but each year, each file adds another year of experience.

Sixth, there is a definable and known population-at-risk -- the Medicare beneficiaries. Therefore, it is possible to calculate rates of use of services and reimbursements, something not possible for Medicaid beneficiaries for instance. Individuals and providers can be identified according to geographic location down to zip code area and county, thus, providing the opportunity to aggregate data to almost any definable geographic, political or health related area (e.g., county, states, SMSA's, PSROs, or HSAs).

Finally, data are collected as part of the Medicare billing system. Unlike survey data, non-response is, essentially, not a problem with a claims data system. This method is unobtrusive and thus, does not depend on the cooperation of the individual nor is it subject to recall errors or bias of response. As a by-product of the Medicare administrative system, it is a low cost system.

Epidemiological Studies

One potential use of Medicare data in the area of epidemiology is to study the relationship between use of services and antecedent work history. The potential for this kind of study is currently being investigated by the Office of Research and Statistics in the Social Security Administration. It involves linking a Social Security data file, the Continuous Work History Sample with a Health Care Financing Administration (HCFA) file, the Continuous Medicare History File. This is feasible because of one of the strengths of the data system just described, i.e., the unique enrollee identifier which is based upon the social security number. This number serves as the basis for both the Continuous Work History Sample and the Continuous Medicare History Sample. The Medicare History Sample is a 5 percent sample of all Medicare beneficiaries selected on the basis of the last two digits of the social security number. The Work History is a 1 percent sample of social security beneficiaries, also selected on the basis of the last two digits of the social security numbers. The two samples are "nested" samples. That is, the 1 percent sample used in the Work History Sample is a subset (with some exceptions) of the 5 percent sample used in the Medicare History

Table 1 at the end of the text shows the approximate sample sizes for these two data files. Overall, there are 22 million social security beneficiaries in the United States. The 5 percent Medicare History Sample thus contains, as of 1974, information on approximately 1.1 million persons. A 1 percent Medicare History Sample would, thus, contain about 225,000 persons.

Thus, it would seem that there are 225,000 persons for whom work history and Medicare history data could be linked. Unfortunately, this is not exactly the case. Medicare claim numbers for dependents and survivors are not their unique social security numbers but rather those of the primary beneficiary, that is, the primary wage earner who in most cases is the husband. Many married women have had Medicare eligibility determined on the basis of their husband's earnings record. There are approximately 270,000 survivors and dependents in the 5 percent Medicare History Sample whose Medicare numbers are not the same as their social security numbers. Virtually none of these persons' Medicare History data can be matched with Work History data. However, for approximately one percent of these survivors and dependents, their social security number will put them into the work history sample. This small sample (2,000 to 3,000 persons) may enable one to make estimates relevant to workers who were not the primary earners in their families.

The final merged data set will have a wealth of information on both work history and subsequent Medicare utilization and reimbursement experience. Table 2 lists the general categories of information to be available in the merged files.

TABLE 2
DATA ITEMS TO BE AVAILABLE IN MERGED CONTINUOUS WORK HISTORY AND CONTINUOUS MEDICARE HISTORY DATA FILE

-AGE
-SEX
-RACE
-CURRENT RESIDENCE
-EARNINGS
-INDUSTRY EMPLOYMENT HISTORY
-INDUSTRY LOCATION
-DATE OF ENTITLEMENT TO MEDICARE
-DATE OF DEATH
-HOSPITAL ADMISSIONS (DIAGNOSIS, SURGICAL PROCEDURES, CHARGES, REIMBURSEMENTS)
-OUTPATIENT UTILIZATION (CHARGES, REIMBURSEMENTS)
-SKILLED NURSING FACILITY STAYS (CHARGES, REIMBURSEMENTS)
-HOME HEALTH AGENCY (CHARGES, REIMBURSEMENTS)
-PHYSICIAN SERVICES (CHARGES, REIMBURSEMENTS)

Among the data elements to be available for each individual on the file are certain demographic factors such as age, sex, race and current residence. Work history data will include information on yearly earnings as well as total career earnings. The employment history by type of industry will be available enabling one to determine the length of time an individual worked in a given industry. Industry geographic location will also be available.

From the Continuous Medicare History File, data will include Medicare entitlement dates for both Parts A and B, and date of death, if deceased. Short-stay hospital data will include numbers of discharges, days of care, reimbursements and charges. In addition the primary diagnosis and surgical procedure codes will be available. Less detail are carried for other types of services. For outpatient services and physician services it will not be possible to determine the number of encounters or visits. However, charges and reimbursements will be available. For skilled nursing facility use, numbers of stays and total days will be available as well as the charges and reimbursement data. Finally, home health agency visits and accompanying charges and reimbursements will be on the file.

Such a merged data file will provide excellent opportunities for relating work history with health care utilization experience. Three potential types of studies which can be done with such a file are described below.

First, the relationship between lifetime earnings/income and subsequent Medicare utilization and reimbursement experience can be studied. We could see for example if wealthier persons as indicated by earnings use more or less services than poorer persons. Earnings in this case, would serve as a proxy measure for quality of life.

Second, Medicare utilization experience of workers in specific industries could be studied. Do specific high risk industries such as coal mining, chemical industry or farming have a utilization and reimbursement experience and/or mortality experience greater than the average Medicare population?

Third, industry location can be related to Medicare utilization experience. Do certain industrial areas present more serious long term health hazards than other areas? For instance, it could be that persons who worked many years in the steel and oil refining areas of the midwest have a greater risk of illness and consequently a higher level of Medicare reimbursements.

There are doubtless many other studies which could be performed as well. It should be mentioned at this point that the file is in the process of being created and has as yet not been used. As is the case with most data files, both the strengths and weaknesses of a file will become more evident as researchers acquire experience in its use.

Program Evaluation

A second potential area in which Medicare data can be used is in the area of program evaluations. As discussed at the beginning of this paper, one of the strengths of the Medicare system is the geographic code associated with each beneficiary and provider. This enables one to aggregate individual record data to almost any definable geographical area. In the past Medicare reports were concerned mostly with producing basic program statistics such as enrollment, days of care and reimbursement by state or by census region. In the past few years it has become apparent that the same geographic data can be used to draw conclusions about the effects of health care programs.

Three such area designations are Professional Standard Review Organizations (PSROs), Health Systems Agencies (HSAs), and End Stage Renal Disease Network areas. Each of these organizational entities was created to perform a certain function within a given area. PSROs exist to monitor the appropriateness and quality of health care; Health Systems Agencies exist to help control the construction of new facilities, and ESRD networks exist to coordinate the provision of dialysis and transplant services to persons affected with End Stage Renal Disease.

Another presentation at this conference, "Development and Uses of Medicare Data for Health Planning" has already addressed the issue of Medicare data uses in health planning so this paper will not cover the HSA area.

Most of the work in program evaluation that has been recently done with Medicare data is in the area of PSRO evaluation. For three years and soon to be a fourth, studies have been conducted to evaluate the impact of PSRO review on Medicare hospital utilization. The basic design is a cross-sectional time series study. Comparisons are made of the change in utilization (e.g., days of care per 1,000 beneficiaries) from a pre-PSRO implementation period to a post-PSRO implementation period. Typically, 1974 is used as the pre-implementation period because no PSROs were active in that year and the latest possible year is used as the post-implementation period. The 1980 report will examine calendar year 1979 data. Up through the latest evaluation there was a

more or less even split between active and inactive PSRO areas so that changes in utilization could be compared between areas with review and areas without review. Basically, the difference between the two changes in utilization, after adjusting for covariates, is attributed to and interpreted as, the PSRO impact.

Additional studies of PSRO impact have been conducted looking at diagnostic and surgical procedure discharge rates and average lengths of stay. These studies replicate the methodology used in the overall utilization rate studies.

Aggregation of Medicare unit record data to the PSRO level for population rate estimates has the advantage that Census data, American Medical Association data, American Hosptial Association data, National Center for Health Statistics data and other national data bases can be merged with the file and used as covariates in the analyses.

Examples of the types of variables that are used in the PSRO evaluation to explain Medicare utilization variance are shown in table 3.

TABLE 3

VARIABLES USED IN PSRO EVALUATIONS

-DEPENDENT VARIABLES:
- TOTAL INPATIENT UTILIZATION (e.g., days of care/1,000 beneficiaries)
- SURGERY SPECIFIC RATES (e.g., cataract surgery discharges/1,000 beneficiaries)
- DIAGNOSTIC SPECIFIC RATES (e.g., average length of stay for acute myocardial infarction discharges)

-COVARIATES:
- AGE DISTRIBUTION
- SHORT-STAY BED SUPPLY
- PHYSICIAN SUPPLY
- POPULATION DENSITY
- LONG-TERM CARE BED SUPPLY
- OCCUPANCY RATE
- INCOME LEVEL
- SUPPLY OF BEDS IN TEACHING HOSPITALS
- *HMO CONCENTRATION
- *MEDICARE PREVAILING CHARGES

* Not yet used in PSRO program evaluations.

The dependent variables are simply Medicare utilization rates. Predictors or covariates of Medicare utilization rates include age distribution, bed supply (both short-stay and long-term care), physician supply, population density, occupancy rate, income level and supply of beds in teaching hospitals. In future analyses certain of these variables will be refined. For instance, opthalmologists would be used instead of total physicians when examining cataract surgery rates. In addition, new variables will be added when appropriate. Health Maintenance Organization (HMO) concentration, for instance, could serve as a proxy measure for competition in the health sector. Medicare prevailing charges could serve to help adjust for price differentials in different parts of the country.

Another program amenable to evaluation is the End Stage Renal Disease program. This program covers the medical costs for dialysis, transplant and most other medical services for persons who suffer from irreversable kidney failure. Such individuals comprise only one-fourth of one percent of the Medicare eligible population, yet due to their extremely great health care needs, consume about 5 percent of total program reimbursements. So, there is great concern among administrators and legislators about ways to control costs and make the program operate more efficiently.

Using the unique person identifiers and the eligibility code which indicates whether or not a person has End Stage Renal Disease a data base has been created which contains the unit bill records for all ESRD persons ever covered by the Medicare program. This file serves as an excellent source file for studies of the ESRD program.

This file has been used to do survival studies of ESRD patients. By linking the date of onset of renal failure with the date of death it is possible to estimate survival probabilities by age, sex, race, geographic area, primary diagnosis or type of treatment.

Figure 1 at the end of the text shows the results of a survival study broken down by age at onset of disease. The graph clearly shows a rapidly decreasing probability of survival as age increases. In the two youngest age groups (0-14 years and 15-24 years) over three-quarters of ESRD patients can be expected to survive at least 5 years. In the two oldest age groups (65-74 years and 75 years and over) less than 30 percent can be expected to survive at least 5 years.

A central issue in the ESRD program is cost. There is a general consensus that home dialysis is a less expensive treatment modality than facility dialysis. Overall, since the inception of the program, the percent of persons dialyzing at home has decreased from about 40 percent to 13 percent. However, certain ESRD network areas have encouraged home dialysis to a much greater extent than other network areas.

A potential evaluation study could examine the overall per capita costs (which would include all non-dialysis expenditures as well) across network areas to assess the total dollar impact of different treatment modalities.

Another use of the Medicare Statistical System is to investigate utilization and reimbursement patterns of any selected group of individuals. An example are Medicare beneficiaries who enroll in HMO's. By examining pre-HMO enrollment utilization one can estimate the extent to which the enrollment mechanism in the HMO is acquiring persons who are representative of the Medicare population in general.

In a recent study of a risk sharing agreement between Medicare and an HMO approximately 900 Medicare beneficiaries who enrolled in an HMO between October 1976 and July 1, 1979 were identified by the HMO according to their social security number. These numbers were used to search the bill files to capture Medicare use in the time period preceeding enrollment. Due to a limitation in the system the analysis had to be limited to inpatient records.

The results of this analysis are briefly summarized in table 4 at the end of the text. As can be seen the pre-enrollment use and reimbursement experience of this group of persons was considerably below that of the population in general in the same geographical area. The data have been adjusted for age and sex as well as the fact that the comparison group contains persons who die during a year whereas the enrollment group consists solely of survivors. In 1975 the HMO enrollees had a discharge rate of 140 discharges/1000. This is 37 percent below the rate for all Medicare beneficiaries. Their days of care rate of 849 days/1000 was 52 percent below the rate for all other beneficiaries. In terms of Part A reimbursements this group was 53 percent below the comparison group with a per capita reimbursement rate of $101.35. The same relationship existed in 1976 when the discharge rate was 52 percent lower, the days of care rate was 62 percent lower and the per capita reimbursement rate was 53 percent lower than the average for all Medicare beneficiaries in the area.

This analysis is an example of how a specific sub-population of the Medicare beneficiary population can be singled out for special analysis. Currently, HCFA is funding 3 demonstration grants for HMO's to enroll Medicare beneficiaries under a risk sharing contract. We plan to replicate the previously discussed study in these 3 demonstration HMO's to determine if the selection outcome observed in the first HMO was a unique occurance or is a problem likely to show up in other enrollment situations.

Lest I leave you with the impression that the use of the Medicare Statistical System for epidemiological and evaluative studies is simple, clean and tidy, I should restate some of the problems inherent in using such a system.

First, it remains basically an administrative claims system designed for the purpose of paying bills and determining eligibility. Research is not its primary function. Consequently, one often has to tailor questions to fit the data. For instance, we tend to concentrate on reimbursements and charges as opposed to costs. Another example is physician services where we are unable to count individual visits but must rely on charges and reimbursements. Also those data items which are important for research are not necessarily items which make a difference in billing. Bills can be paid whether or not the diagnostic code is correct. Thus, as a researcher, one has to take an active role in working with the claims maintenance and operations people to maintain quality and edit checks on specific data items. A study by the Institute of Medicine has delineated some of the reliability in coding problems that exist in the Medicare data system. It is of some comfort to note, however, that similar problems exist in other large scale health data systems.

Second, information is received only on covered services. Therefore, ambulatory drug utilization and out-of-pocket costs for drugs for the Medicare population cannot be studied through these data. Dental services are not covered as well thereby eliminating dental use and expenditures as areas for research.

Finally, it should be remembered that this system does not enable one to develop true disease incidence or prevalence rates. The rates that are developed must be linked to utilization. Diseases which may not result in a medical contact, and hence a bill, will be missed by the system. An example would be upper respiratory illnesses. Many, perhaps most, instances of colds and influenza will not be detected by this system.

Still, despite certain unavoidable limitations in the use of claims data, the system has sufficient flexibility, size and detail, that a researcher can, with perseverance, care and originality conduct some intriguing studies in the areas of epidemiological and evaluative research.

TABLE 1

APPROXIMATE SAMPLE SIZE AVAILABLE FOR MATCHING THE HCFA CONTINUOUS MEDICARE HISTORY SAMPLE WITH THE SSA CONTINUOUS WORK HISTORY SAMPLE*

ITEM	TOTAL	RETIRED OR DISABLED (PRIMARY)	DEPENDENTS & SURVIVORS (SECONDARY)
		POPULATION	
MEDICARE BENEFICIARIES	22,258,000	16,565,000	5,415,000
		SAMPLE DATA	
5 % SAMPLE (1%)	1,112,900	828,250	270,750 (2,750)
1 % SAMPLE	222,580	165,650	54,150

* Table taken from presentation by Harold Grossman, SSA, October 1979 (1974 data).

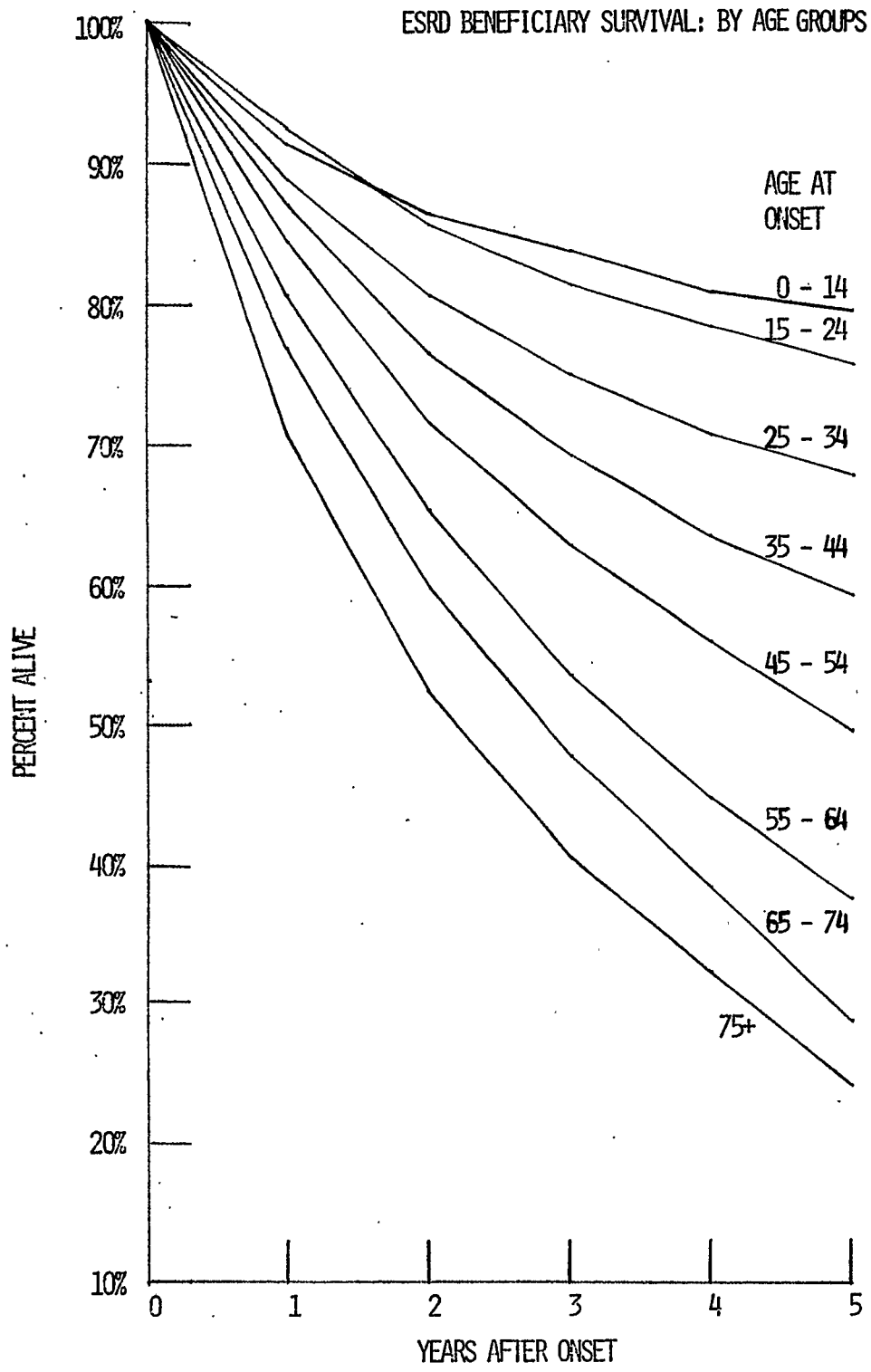
TABLE 4

ADJUSTED DISCHARGE, DAYS OF CARE AND REIMBURSEMENT RATES FOR HMO OPEN-ENROLLMENT AGED MEDICARE BENEFICIARIES AND ALL OTHER AGED MEDICARE BENEFICIARIES*

GROUP	DISCHARGES/1000	DAYS OF CARE/1000	REIMBURSEMENT/PERSON
		1975	
HMO OPEN ENROLLMENT BENEFICIARIES	140	849	$101.35
ALL OTHER MEDICARE BENEFICIARIES	223	1,761	$213.43
		1976	
HMO OPEN ENROLLMENT BENEFICIARIES	115	731	$128.35
ALL OTHER MEDICARE BENEFICIARIES	242	1,929	$240.99

* Data were adjusted for age, sex and differential mortality.

FIGURE 1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70%
60%
50%
40%
30%
20%
10%
PERCENT ALIVE
AGE AT ONSET
0 - 14
15 - 24
25 - 34
35 - 44
45 - 54
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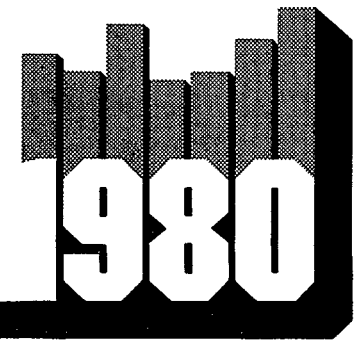
YEARS AFTER ONSET

Meeting New Challenges With Vital Records Data

Concurrent Session E



EVALUATION OF QUALITY OF DATA FROM VITAL RECORDS

Patricia W. Potrzebowski, Pennsylvania Department of Health

Statistical and medical information from birth and death certificates is a major source of data used by public health program managers and health planners for identification of high risk or target populations, for need assessments, and for evaluating program impact and effectiveness.

In part, vital statistics data are widely used because, first, they are complete, that is registration is generally estimated to be 99% or higher; second, they are comparable, because most states utilize the recommended U.S. standard certificates or a slightly modified version; third, it is generally assumed that the data are of a uniformly high quality, which is due largely to the effects of standard quality control procedures implemented under the Cooperative Health Statistics System; and finally and probably the most important reason, the data are available. They are already being collected and processed at the state level and do not require a separate and costly independent data collection effort by the users.

As I stated previously, there is a general assumption that vital records data are of acceptable quality. However, all too often this assumption is based on little or no hard data.

Because of the expanding scope and use of vital statistics, the need for evaluating the quality of these data on a regular basis is becoming increasingly apparent. Nevertheless, the need for either ongoing or periodic evaluations of data quality from vital records at the state level does not receive adequate emphasis. Especially with today's climate of limited resources in both federal and state budgets, this is one area where it is easy to rest on past experience, to reassign staff to other duties, and just assume that the quality of the data being collected will continue to be acceptable to our data users.

Improving data quality is one of the goals of the Cooperative Health Statistics System. The National Center for Health Statistics has traditionally worked closely with state vital statistics offices in promoting improvements in the completeness, accuracy, and timeliness of vital records. In fact, one of the requirements included in each Cooperative Health Statistics System contract for vital statistics, is that the state develop an active field and query program working with data sources to improve data quality. While there is considerable variation in these activities in the various states, at present there are no federal guidelines available for use by the states in developing uniform methods and procedures to assure an acceptable level of data quality. This is an area that I understand NCHS will be addressing in the near future, and it is long overdue.

What I'd like to discuss briefly today are several techniques for evaluating data quality in the area of vital records.

These evaluation techniques fall into five major groups. The five groups are:

1. linkage studies using other data sources
2. followback to the original data source
3. internal monitoring and computer edits
4. production measurements
5. verification techniques for coded items

These different evaluation techniques each measure differing aspects of data quality, such as item completeness, consisting of reliability, timeliness, and underreporting. Based on evaluation results, a number of programs can be implemented to improve vital records data, and John Wilson, our next speaker, will discuss in more detail methods for improving vital records data.

The first evaluation technique I mentioned was the use of linkage studies with other data sources. Generally this is accomplished by comparing information reported on birth and death certificates with hospital records to measure reliability, that is reproducibility of recording, abstracting, and coding. This type of evaluation can also be used to estimate underreporting of certain items, such as congenital malformations on birth certificates. While hospital records or hospital discharge abstracts are generally used for these studies, there is the potential to use other records, such as private physicians, third party payors, and various public health program records as the linkage source. Two notable examples of linkage studies are the New York State Department of Health's monograph No. 15 entitled "Reliability of Statistical and Medical Information Reported on Birth and Death Certificates", prepared by Peter M. Carucci, and a study by Alan Gittelsohn and John Senning, based on computer linkage of records which compared cause of death with hospital record diagnosis, and was published in the American Journal of Public Health Volume 69, in July 1979.

The second evaluation technique I mentioned was that of followback studies to the original data source. This technique is often confused with linkage studies, but the distinction, while minor, is that of comparing information between two or three different data sources, with going back and reconfirming information from the original data source. In the New York study which I just mentioned, for some items on the birth certificate where the hospital record was the original data source, the evaluation technique used was a followback study and not a linkage study. In other words, one study can incorporate both followback and linkage techniques. Another example of a followback study was recently published in the Vital and Health Statistics (rainbow) series, Series 2, Number 83. This study compared reporting between the birth certificate and the National Natality Survey. The National Natality Survey is a

periodic followback to mothers, hospitals, and physicians, and is used primarily to obtain additional information to augment vital records data. However, this type of followback is also extremely useful in evaluating the quality of data from the original source, in terms of comparability.

Another followback technique which is used by the Bureau of the Census and could be adapted to assess accuracy of vital records data is the use of "reinterviews" on a sample basis.

The third evaluation technique I'll describe is internal monitoring and the use of computer edits. This evaluation technique is probably the most widely used, and should be ongoing. While the previous techniques involve undertaking special studies, this technique can be built into our standard processing procedures. The extent of use of this type of monitoring is almost limitless. For instance, it can be used to measure some types of coding error by identifying certain "impossible" codes, according to given criteria. This technique can also measure consistency which is defined as the extent to which certain sets of data items bear a logical relationship to each other. Another form of internal monitoring is that of matching of birth and death certificates for low birth weight infants. Completeness of registration was evaluated and specific problems in underregistration were identified in a study in Georgia using this technique. In this study, the authors pointed out the urgent need to evaluate the quality of infant mortality data, which is widely used by health planners and program managers.

Several internal monitoring techniques to evaluate data quality were also proposed several years ago by Moshman Associates in their development of an evaluation questionnaire for vital records and vital statistics programs. The effectiveness and impact over time of query programs can be measured using this technique and the Moshman questionnaire included questions on item completeness both before and after query, and other quality control procedures, such as manual edits, key verification, and range checks.

While this may seem both simplistic and obvious, we should also not neglect to mention the need for careful internal analysis of vital statistics data before their release or publication. Any unusual results, especially in comparison with previous month's or year's data, could identify problem areas in underreporting, coding errors, etc. While this evaluation technique is relatively inexpensive to implement, it is, unfortunately, too often overlooked.

The fourth type of evaluation technique is production measurement. Generally this technique is used for measuring timeliness. It is important to monitor the processing of vital records data at each step and according to a previously established schedule to prevent backlogs from building up and in order to produce useful aggregate vital statistics data in a timely fashion. Our data users need our data as soon as possible, not only for health planning, but especially for epidemiological studies based on using vital records as sentinel events to identify potential occupational, health, and environmental problems.

The last evaluation technique I'll discuss today is the use of verification techniques for coded items. While any coded item from vital records can be evaluated by verification techniques, this method has been used most extensively to evaluate medical coding of cause of death on death certificates, and a number of different verification techniques are being used by NCHS and the states. A recently published methodological study by NCHS measured the accuracy of error rates produced by 3-way independent verification, and compared them with error rates produced by 2 other commonly used methods of verification: 2-way dependent verification and 2-way independent coding with adjudication of differences. This study is reported in the Vital and Health Statistics series 2, No. 81, if you would like more information on these three coding verification methods.

While I have briefly described 5 different evaluation techniques, it is clear that studies undertaken to evaluate vital records data quality can and should incorporate several of these 5 techniques.

To close, I want to reemphasize the importance of ongoing evaluations of data quality from vital records. Based on evaluation results, we can implement vital records improvement programs, and with improved data quality, expand the usefulness and applicability of vital statistics.

In addition, I would strongly recommend the uniform adoption in all states of the Moshman Evaluation questionnaire for vital statistics programs. And, finally, I think both the states and the NCHS should promote the further development of innovative methods for measuring data quality.

IMPROVEMENT OF VITAL RECORDS DATA

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Persons engaged in public health statistics soon realize how important quality is in vital statistics data. We know that no amount of sophisticated statistical maneuvering can produce reliable statistics from erroneous or incomplete data.

An important benefit of the Cooperative Health Statistics System is that it has given states resources to improve the quality of the data they collect. I will discuss some of the programs which have been used by states for the improvement of vital records data. The listing is not complete, and you can undoubtedly think of others.

Field Representatives

A number of states have, in recent years, been able to add one or more field representatives, more appropriately called quality control field consultants, to their staffs. These persons are primarily responsible for the improvement of vital records data.

Education is the key to the goals of the quality control field consultant. Any improvement in accuracy and timeliness of records is dependent on how careful and knowledgeable the preparers of the records are. Preparers with whom field representatives work include hospital personnel, physicians, morticians, local registrars, medical examiners, midwives, and others who are responsible for the preparation of birth, death, and fetal death certificates. Some of these people must also prepare other records associated with the certificates, such as burial-transit permits, notifications and reports of death, and lists of births occurring in hospitals.

If the state collects information on marriage and divorce, the quality control field consultant must also work with clerks of court, priests, ministers, rabbis, and others authorized to solemnize marriages, and with lawyers and judges, in the collection of information on divorce and annulment.

Some states have programs for the reporting of legally induced abortions. Here again, the quality control field consultant must work with physicians, hospital staffs, and with personnel from clinics which have as their primary purpose the provision of this service.

It is obvious that providing training in records preparation for a large and varied group of people is no easy task for the field representative. He must, therefore, use all available educational resources, including other members of the state vital statistics staff and outside consultants. Educational materials such as pamphlets and film strips are also important. These materials have been produced both at the state level and by the National Center for Health Statistics.

Training is most commonly provided in a group setting, and may be either a single state-wide meeting, or may be held as a series of meetings throughout the state. A special benefit of these meetings, not directly categorized as training, is the personal contact between state-level vital statistics staff and local-level persons involved in registration. It's always a little easier to do business if you know the other party personally.

Some states with sufficiently large populations employ a number of quality control field consultants and may give a consultant responsibliity for a specific geographic area of the state. They may also involve them in the process of filing current registrations.

A substantial portion of a field consultant's time is often spent in hospitals training new people involved in the birth registration process. Hospitals experience a significant turnover in these jobs, and unless the field consultant is able to train new staff promptly, the quality of birth registration may decline. In many states, the field consultant will ask the local registrar to accompany him in training the new hospital personnel. In so doing, the field representative ensures the continued cooperation between the local registrar and the hospital, and reinforces for the local registrar his understanding of the registration process.

Query Programs

A second approach to improving vital records data is the use of query programs, whether manual or computerized. Computerized edit programs for vital records can detect missing, inconsistent or invalid entries and call these to the attention of vital statistics staff members. Staff can then query the local sources of the data either by correspondence or by telephone. Most querying is done by mail, but telephone queries may be necessary, especially when essential information such as the date of the event is missing. In some instances, telephone querying may be used when there is no response to the written query.

A log should be kept of records queried, and a notation made when a satisfactory response is received. A review of the number and type of queries may be the first indication of a developing problem. The quality control field consultant is not normally involved in directly generating queries, but should be in close communication with those who do. There are always cases that may demand special attention and may require a visit by the field representative in order to obtain a satisfactory query response.

With the advent of computer technology, there is no reason, conceptually, that queries can not be generated and mailed automatically. A few states already have automated query programs in operation. The implementation of an automated program must be done carefully to avoid offending sources of data with inappropriate queries.

Timeliness

One of the maxims of vital registration is that records should be filed promptly following occurrence of an event. A number of states conduct timeliness studies. These may measure the interval from the date of the event to the date signed by the physician, from the date of the event to the date filed with the local registrar, and from

the date of the event to the time received in the state office. Timeliness studies may be done routinely on all certificates, may be done continuously on a sample basis, or may be done for selected sample months. The information may be provided back to the local registrar in a report that shows his timeliness compared with that of the state, or in a list which shows this information for all local registrars. This latter list seems a more effective incentive to local registrars to continue filing records in a timely manner, or to improve.

Cross-checks

A method to improve completeness of filing of vital records is using cross-checking procedures. This means obtaining data on events independently of certificates filed, and using these data to check on the completeness of registration. As a specific example, casket sales or notification of death reports provide a means of check-off to see that all death or fetal death certificates have been filed. Similarly, lists of births provided by hospitals enable the local registrar or state office to identify certificates which, for some reason, are missing. In some states, the notification of death supplied by the funeral director to the local registrar provides the local registrar with a means of checking on completeness of death registration.

Late Certificate Reports

Another method of encouraging more prompt reporting is to select certificates which are filed well beyond the legally required limits. In these instances, a letter can be sent, say to the mortician involved, asking for an explanation of the circumstances which occasioned the late filing. Our experience is that in half the cases, the mortician will provide an explanation. Often the excuse is that the attending physician failed to sign the medical certification of cause of death. After collecting a sufficient amount of this kind of data, one can use it to approach the medical association to demonstrate the need to encourage doctors to sign certificates promptly. In the other 50 percent of the cases, no response will be received from the mortician. This triggers a telephone call by state staff for a discussion of the case. In either event, the mortician is reminded that registration officials are concerned with prompt filing of the certificates. Quality control field consultants report that it is necessary to work closely with the ladies in a doctor's office as they are the persons who most often remind the physician that he has certificates that need to be signed.

Follow-back Studies

Before a vital records quality control improvement program can be designed, information needs to be collected regarding the deficiencies of the current program. In some instances, the quality control field consultant selects a sample of records for a hospital, and then visits that hospital to compare the entries on the hospital charts with those on the birth certificate. A difference, of course, does not necessarily mean that the birth certificate is incorrect, but simply that there is disagreement. In a study of this sort conducted in Montana, we found almost perfect agreement on those items found on the legal portion of the birth certificate. Of those items in the lower portion of the certificate titled "Confidential Information for Medical and Health Use Only", the two most frequently incorrect items for our major hospitals were 'Complications of Labor' and 'Operation for Delivery'.

It is difficult to make comparison of the items 'Month of Pregnancy Prenatal Care Began' and ' Prenatal Visits' because this information is frequently in the physician's office record and would necessitate an inspection of his office files, an operation for which we have neither the temerity nor legal authority to pursue.

Birth Notification Program

This is a program which was encouraged by the national vital statistics authority a number of years ago. It included a franking privilege for mailing birth notifications. With the withdrawal of federal support for this program, and with the increasing cost of postage, many states have given up on this means of improving vital record quality. In some states, a substitute has been provided through the use of multi-part certificates which include a parents' informational copy, provided to a parent after the record has been completed. It is interesting that at least one state is considering reinstitution of a birth notification program in connection with their immunization effort.

Newsletters

There has been a resurgence in the publication of newsletters in recent years. They would seem to serve much the same purpose as any house organ in improving communication. They may be published monthly, quarterly, or on some other interval and may provide a summary of vital statistics for the latest period as well as instructional material and notification of changing or new procedures. When Montana had a newsletter, it was mailed toward the end of the month as a reminder to local registrars and clerks of district court to send in their monthly reports. The newsletter was discontinued when some of the humorous material, for which it became well known, offended some of the readers, including the state health officer.

Work Sheets

In sparsely populated states, there are usually a number of hospitals with less than 25 beds. These institutions do not have the range of resources available to them that exists in larger hospitals. The small hospitals, and even some of their larger counterparts, appreciate the state office's supplying work sheets for the collection of the information needed to complete the birth certificate. Several types of work sheets may be made available so that the hospital can choose whichever seems most appropriate for its kind of operation. Space can be left at the top of the form so that the hospital can use a rubber stamp to make the form its own.

APGAR Score

We have been discussing some of the methods for improvement of vital records data. One is the selection of items on records that provide the most

useful data. Apgar Score as an item or information on the latest U. S. Standard Certificate of Birth is there because analysis of data from the 1972 National Natality Survey showed that it was a good indicator of infant health status and is related to social, demographic, and health items on the certificate. Our follow-back studies in Montana show close agreement between the Apgar Scores reported on the birth certificate and those in the hospital records. This item provides the basis for analysis of the relationships of a variety of social and demographic, maternal health, and infant health factors. It may well be that the 1980 National Natality Survey will suggest additional worthwhile items which can be considered in the next revision of the Standard Certificate of Birth to improve data on natality.

Closing

Many of the programs and methods considered here have been assisted by the financial resources available through the Cooperative Health Statistics System.

Most states and certainly those in the CHSS have their data processing operations computerized and should be able to produce special tabulations as well as routine ones with a minimum of delay and expense. The challenge now is to improve the quality of the data that go into the System.

EXPANSION OF SCOPE AND USEFULNESS OF VITAL STATISTICS

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General Introductory Comments

I have been asked to comment on the future of vital statistics -- the expansion of its scope and usefulness. I would like to expand this topic to include the future of health statisticians and in some small way the state health agencies that employ them. I am not sure my qualifications insure that my crystal ball is any clearer than yours. When talking about the future, it is always easy to stray toward the side of platitudes. Hopefully what I have to say this afternoon will have the type of content that you will mull over, struggle with and cause you to reflect as you go back to face the inevitable administrative problems awaiting your return.

Background

The history of vital statistics is long, replete with success and unfortunately missed opportunities. Many of my preliminary remarks may seem caustic; however, they are meant to focus our attention to the future...not just reflect on the past. Make no mistake, I am a strong proponent of vital statistics; however, I have no use for them being collected because there is some historical urge to replicate past publications, forgettable tabulations or because it is the inherent duty of state health agencies to support vital statistics. How VITAL are our statistics? A better question might be --- How VITAL are we?

In the past, vital statistics provided the only measure of the health status of our citizens. We published where these events took place and to whom --- lightly salted with descriptive information. We did this by providing counts, rates and ratios. We spent considerable time in strengthening vital registration and the quality of our data. Because vital statistics has been the strongest continual health data collection system, could be defended the easiest and reasonably controlled, state health departments have considered these data as their official health information system. Most annual reports of state health agencies were based on vital statistics. Many times vital statistics were the only real content of the report. Citizens anticipated the latest published results. Unfortunately the reason for that anticipation was similar to waiting for the next year's Almanac. Basically, vital statistics became bureaucratically justifiable but lost its cutting edge...its real reason for being.

In the 1970's strides were made in two areas:

- the availability of computerized files for use by outside researchers and planners; and
- the provision of more detailed analysis in identifying trends in vital statistics.

Concurrent with these efforts was the development of the Cooperative Health Statistics System and the concept of components, i.e., vital statistics, manpower, facilities, hospital discharge.... As these components developed, publications, analyses and data files were created but in a compartmental approach.

Where does this leave us? I feel we find ourselves at a crossroads.

- Yes --- we publish more data concerning vital statistics
- Yes --- our data is more current
- Yes --- we provide stronger quality control measures and thus have a better product
- Yes --- we take great pride in our vital registration system and in the term vital statistics

However the term vital statistics has played a part in some serious problems.

- We seem satisfied when we have published our annual vital statistics reports...forgetting that vital statistics cannot tell the whole story.
- We continue to strive for another way to depict vital statistics...yet without regard to other health data.
- We feel comfortable or possibly smug with the quality of vital statistics and use this as an excuse not to conduct studies involving health statistics of less known quality.
- We have allowed ourselves to become compartmentalized. At the moment University researchers and health planners are doing the most comprehensive job in using vital statistics in concert with other health and social statistics to depict health trends. I feel that determining the health status of our citizens in our communities is a responsibility of public health and should not be left solely to the current interests of university researchers or quixotic attempts by health planners. We must broaden our base. We must relate vital statistics to the dynamics of health and health care delivery that takes place between the milestones of birth and death.

State health statistics agencies should take the lead in using vital statistics as a springboard in the analysis of the major health issues that confront us. I'd like to discuss with you some of these possibilities.

Surveillance

The challenge that faces us is to put vital statistics in a current or more forward-looking frame or reference. The Center for Disease Control (CDC) has been quite successful in securing support for the relevance of its data gathering efforts by building on the concept of surveillance. Granted, the types of events they monitor are usually highly visible, sometimes of specific duration, can be confined to identifiable geographical locations or institutions and invite successful intervention. However these attributes do not preclude the use of vital statistics; for, CDC is applying these same surveillance techniques in such areas as

nutrition and the incidence of congenital malformations.

Public health and public health statisticians cannot continue in confining themselves to maternal and child health issues and cataloguing the past. More and more we see increased attention on the impact of the environment on the public's health. Pesticides, radiological and chemical wastes, harmful exposures in the workplace, pressures on the job, shifts in the sexual distribution of the workforce and contaminants in our air, water and food supplies all have long range consequences for medical care in the future. Coupled with environmental concerns that impact or accelerate the chronic disease process is the increase of the population at risk due to the aging of our population. Public health and vital statistics roots were in the area of environmental health (sanitation) and epidemiology. We should stress anew the area of environmental health and develop programs in chronic disease epidemiology surveillance.

Occupational Health

Although the incidence and prevelance of occupational injury and illness are unknown, it has been estimated that over 31% of all medical conditions are occupationally induced and that 20% of future cancers will be related to the work place. Most states have on the death certificate information concerning the usual occupation and industry. Except for a few states, little work has been done at the national and state level to develop meaningful classification schemes for this information, much less try to use the information in concert with Workmen's Compensation, Cancer Registry and other occupation-related data to develop hypotheses of the associations between occupation and morbidity. Age-adjusted mortality and morbidity rates for race-sex groups could be calculated for geo-political areas along with a years-of-life-lost index, average days lost from work by industry, work injuries by industry, work injuries and illnesses per 100 fulltime workers, nature of injury or illness, age of injured or diseased employee, etc. Mapping and pattern recognition techniques can be employed inexpensively to develop hypotheses of associations. Later case-control or follow-back studies can be initiated. NIOSH is currently planning to initiate an occupational health surveillance system for states. Public health agencies and particularly vital statisticians should get involved with this project.

The National Center for Health Statistics is considering work in developing meaningful classification of occupation information on death certificates. States should support this effort by providing their experience in this area as well as collecting the data once a classification scheme materializes and using this information as a baseline for long-range surveillance of occupational related health problems.

Water Supply Studies

The Environmental Protection Agency (EPA) has sponsored the development of a water supply monitoring system (MSIS) which is being provided to states that have received "Primacy." Although there have been many complaints relative to the tractability of the software that was provided by EPA, there should be a very definite health surveillance spin-off. For the first time states will have detailed and current water quality data concerning their public water supplies. Such information as pH value, turbidity, alkalinity, acidity, calcium, magnesium, iron, potassium, fluoride content of our water supplies can be studied for small geographic areas over time relative to causes of death, congential malformations, cancer registry data, etc...to draw possible associations between health status and water content.

Hazardous Waste

In a similar vein EPA is pushing states to accept the responsibility of "Primacy" for the monitoring of the flow of hazardous waste. Central to the endeavor will be the creation of a hazardous waste manifest system which will monitor industries that create hazardous by-products, when those waste products are moved and where they are finally disposed. Such a control system can never preclude accidental spills, but it certainly gives us a much better means to know when and where such an accident occurred as well as the exact toxic agents that were involved. At that point it will be necessary to have some form of surveillance system available to measure possible relationships between the spill and morbidity and mortality. Such surveillance needs to be in place over many years and not be precipitated by any specific accident. Existing systems must be used to accomplish this; vital statistics should be a primary data source.

General Environmental Health Applications

Many of the potentially dangerous environmental factors to which we are exposed are either unknown, not considered dangerous or are at such low levels of concentration that it is difficult to detect any immediate relationship to disease, disability or untimely death. However surveillance is still necessary to indicate possible effects of such exposures over extended periods of time. For each Love Canal, known PCP chemical spill and Three Mile Island incident, we have the potential for so many smaller incidents to go undetected. Unfortunately when this happens our only method of detection is after such exposure has manifested itself into diagnosable diseases. Of even more concern is that we really don't have such a surveillance mechanism in place.

In a 1976 article of the New England Journal of Medicine, the concept of sentinel health events was put forward to indicate cases of unnecessary disease, disability and deaths as a measure of the quality of medical care. Basically quality of care indexes were constructed around conditions or sentinel events in which, if every thing had gone well, the condition would have been prevented or managed. These sentinel events equated to the incidence of unnecessary disease, disability and death.

This type of reasoning could be applied to the surveillance of unrecognized environmental

exposures. For example sentinel health events or indices could be based on the incidence of certain forms of cancer as a means of detecting possible exposure to carcinogenic agents. These sentinel events could be refined to be specific for certain age/race/sex/occupation/industry groupings as well as being indentifiable for small geographic areas. In order to accomplish this, vital statistics would have to be used and strengthened along with cancer registry data, hospital discharge data, etc.

Extending Vital Statistics

Often we hear the question --- Why can't we expand the birth certificate -- the death certificate -- the fetal death certificate? The data relating to these events can be expanded without adding to the certificates. This, of course, is accomplished through follow-back surveys. As we know the National Natality and National Fetal Mortality Surveys are being undertaken this year by NCHS. In these follow-back surveys questionnaires are sent back to a sample of mothers and associated physicians and hospitals. States should also consider such follow-back studies either for general purposes such as the NCHS surveys or for more confined studies. Such follow-back studies could be a next step in the surveillance system mentioned previously or could be a quick response to an unusual highly visible event such as the heat-related deaths in the midwest and southwest that are now taking place.

Another area of expansion is the use of medical examiner data. More states are moving toward a statewide medical examiner system. The data derived from medical examiner reports such as autopsy and toxicology results can provide improved and expanded diagnostic information to the death certificate.

Evaluation of Public Health Programs

Previously I mentioned that we must not confine ourselves to issues within the framework of maternal and child health. Of course there are many issues in this area that vital statistics could be quite helpful and yet have not been used. For example, one of the newest and largest programs within state health agencies is the food supplement program --- WIC --- supported by the Department of Agriculture. In our state it comprises 22% of our state health budget. What impact is WIC having on the birth weight or prematurity of our children? Can WIC be expectd to decrease perinatal or postneonatal deaths? The evaluation of the impact of this massive input of funds into improving the nutrition of mothers and children must, in part, be measured by vital statistics.

Another major health initiative is the provision of public family planning services. To measure the impact of this program in such areas as unwanted teenage pregnancies and prematurity, vital statistics including data on abortions must be used. Vital statistics cannot only be used to measure impact but also to redirect family planning services.

Funding

State health statistics agencies as well as state health departments are facing a critical financial future. Unfortunately this is sometimes caused by continuing to depend on the same source of funds. Many of the areas I have talked about do not relate to the Public Health Service, i.e., EPA and the Department of Agriculture. NIOSH, although part of CDC, is an agency not normally on the agenda of state health departments. We must be inventive not only in our applications for vital statistics but in our search for funds.

Summary

Vital statistics are too necessary to stand alone. It is too easy to get trapped in our everyday work schedule, to take pride when we have closed out another year of data and reported the results. We must disenthrall ourselves with vital statistics as the only statistics. We must consider these statistics as a vital part of a wide range of health statistics. We must constantly strive to examine means of using other data with vital records data.

I believe that the types of surveillance systems that I have talked about will take place. What remains to be answered is whether vital statisticians and public health agencies will be central to this effort.

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Innovative Uses of Health Care Data

Concurrent Session F

CASE MIX MEASURES: INTENSITY OF SERVICES AND SEVERITY OF ILLNESS

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The increase in the regulatory programs aimed at controlling the cost of hospital care has resulted in the need to identify and understand the factors affecting the cost of providing hospital services. Historically, hospital characteristics such as teaching status and bed size have been used to attempt to explain the substantial cost differences which exist across institutions. However, such characteristics fail to account adequately for the cost impact of a hospital's case mix. Individual hospitals have often attempted to justify higher cost by claiming that they treat a more "complex" mix of patients; the usual claim being that "my patients are sicker." Although there appears to be a consensus in the hospital industry that a more complex case mix will result in higher costs, the concept of complexity lacks a precise definition. Before hospital case mix complexity can become a useful factor in understanding hospital costs, a clear definition of the concept of complexity must be established and an operational means of measuring case mix developed.

Case Mix Complexity

In the past, clinicians, administrators and regulators have often attached different meanings to the concept of complexity depending on their backgrounds and purposes. The term complexity has been used to refer to an interrelated but distinct set of patient attributes which include severity of illness, prognosis, treatment difficulty, need for intervention and resource intensity. Each of these concepts has a distinct meaning.

Severity of Illness refers to the relative level of loss of function and mortality normally caused by a particular illness.

Prognosis refers to the probable outcome of an illness including the likelihood of improvement or deterioration in the severity of the illness, the likelihood for recurrence and the probable life span.

Treatment Difficulty refers to the patient management problems which a particular illness presents to the health care provider. Such man - agement problems are associated with illnesses without a clear pattern of symptoms, illnesses requiring sophisticated and technically difficult procedures and illnesses requiring close monitoring and supervision.

Need for Intervention relates to the consequences in terms of severity of illness that lack of immediate or continuing care would produce.

Resource Intensity refers to the relative volume and types of diagnostic, therapeutic and bed services used in the management of a particular illness.

When clinicians use the notion of complexity they mean that the patients treated have a greater intensity of illness, present greater treatment difficulty, have poorer prognoses and have a greater need for intervention. Thus, from a clinical perspective complexity refers to the condition of the patients treated and the treatment difficulty associated with providing care. On the other hand, administrators and regulators usually use the concept of complexity to indicate that the patients treated are more resource intensive. Thus, from an administrative or regulatory perspective complexity refers to the demands that patients place on an institution. While the two interpretations of complexity are often strongly related in a causal sense, the distinction must be maintained in order to avoid confusion in interpreting case mix measures. Since the motivation for examining the case mix complexity of hospitals is to understand the variations in the cost of providing hospital services, the resource intensity interpretation of case mix complexity is appropriate for this purpose. Therefore, a hospital having a more complex case mix means that they treat patients who require more hospital resources but not necessarily that they treat patients having a greater severity of illness, a greater treatment difficulty, poorer prognosis or a greater need for intervention.

Patient Classification

In order to construct an operational means of measuring case mix complexity, it is necessary to develop a manageable method of determining the types of patients treated and relating each patient type to the resources they consume. While each patient is unique, they do have certain demographic, diagnostic and therapeutic attributes in common with other patients that determine their level of resource intensity. If clinically similar groups of patients with similar resource intensity can be identified then patients can be aggregated into meaningful patient classes. Moreover, if these patient classes cover the entire range of patients seen in an inpatient setting, then collectively they constitute a patient classification scheme that provides a means of establishing and measuring hospital case mix complexity.

The patient classification scheme can serve not only to measure case mix complexity, but also as an important management tool for the hospital industry. In the hospital setting it is not management but individual physicians who are responsible for allocating the majority of resources. If the cost behavior of hospitals is to be understood and controlled then effective communications between the financial systems of the hospital and its physicians must be established. Thus, an essential feature of the patient classification scheme must be that it can provide the framework for a meaningful dialogue with the medical staff.

Characteristics of a Patient Classification Scheme

In order for a patient classification scheme to be practical and meaningful it should have the following characteristics:

1. The patient characteristics used in the definition of the patient classes should be limited to information routinely collected on hospital abstract systems.

2. There should be a manageable number of patient classes which encompass all patients seen on an inpatient basis.

3. Each patient class should contain pa-

tients with a similar pattern of resource intensity.

4. Each patient class should contain patients who are similar from a clinical perspective (i. e., each class should be medically meaningful).

Restricting the patient characteristics to those readily available insures that the patient classification scheme can be extensively applied. Currently, the patient information routinely collected includes age, primary and secondary diagnosis and primary and secondary surgical procedures. Creating a patient classification scheme based on information that is only collected in few settings or on information which is difficult to collect or measure would result in a patient classification scheme which can not be applied to the problems facing today's health care industry. That is not to say that information beyond that currently collected might not be useful for defining a patient classification scheme. As additional information becomes routinely available it must be evaluated to determine if it might result in improvements in the ability to classify patients.

Limiting the number of patient classes to manageable numbers (i.e., hundreds of patient classes not thousands) insures that for most of the patient classes, a typical hospital will have enough experience to allow meaningful comparative analysis to be performed. If there were only a few patients in each class, then it would be difficult to detect patterns in case mix complexity and cost performance and to communicate results to the physician community.

The resource intensity of the patients in each patient class must be similar in order to establish a relationship between the case mix of a hospital and the resources it consumes. Similar resource intensity means that the resources used are relatively consistent across the patients in the class. However, differences in the case severity of the patients in the same patient class will result in some variation in resource intensity. In other words, the definition of the patient class will not be so specific that every patient is identical, but the level of variation is known and predictable. Thus, while the precise resource intensity of a particular patient can not be predicted by knowing to which patient class he belongs, the average pattern of resource intensity of a group of patients in a class can be accurately predicted.

Since one of the major applications of a patient classification is as a means of communicating with the physician community, the patients in each patient class must be similar from a clinical perspective. In other words, the definition of each patient class must be medically meaningful. The concept of medical meaningfulness requires that the patient characteristics included in the definition of each patient class relate to a common organ system or etiology and that a specific medical specialty should typically provide care to the patients in the class. For example, patients who are admitted for a D&C or a Tonsillectomy are similar in terms of most measures of resource intensity such as length of stay, preoperative stay, operating room time and use of ancillary services. However, different organ systems and different medical specialties are involved. Thus, the requirement that the patient classes be medically meaningful precludes the possibility of these types of patients being in the same class.

A common organ system or etiology and a common clinical specialty is a necessary but not sufficient requirement for a patient class to be medically meaningful. In addition, all available patient characteristics which medically would be expected to consistently affect resource intensity should be included in the definition of the patient classes. Furthermore, a patient class should not be based on patient characteristics which medically would not be expected to consistently affect resource intensity. For example, patients with appendicitis may or may not have peritonitis. Although these patients are the same from an organ system, etiology and medical specialist perspective, the classification scheme must form separate patient classes, since the presence of peritonitis would be expected to consistently increase the resource intensity of the appendicitis patients. On the other hand, sets of unrelated secondary diagnosis can not be used to define the patient classes since there would not be a medical rationale to substantiate that the resource intensity would be expected to be different.

The definition of medically meaningful is dependent on the purpose for the formation of the patient classification scheme. Thus, the definition relates to the medical rationale for differences in resource intensity. If, for example, the purpose of the classification scheme related to mortality then the patient characteristics which were medically meaningful and, therefore, included in the classification scheme might be different. Finally, it should be noted that the requirement that the patient classes be medically meaningful will cause more patient classes to be formed than would be necessary for only explaining resource intensity.

Previous Patient Classification Schemes

Historically, there have been two alternative methods for classifying patients. The first method is to define a patient class solely based on primary diagnosis. However, primary diagnosis is not sufficient for classifying patients with respect to resource intensity since other variables such as surgical procedure performed and age of the patient are important determinants of resource intensity. For example, patients with a primary diagnosis relating to gastric and peptic ulcers with no surgery or complicating factors would typically be hospitalized for six days while those with a minor surgical procedure such as an endoscopy would stay twelve days and those with a major surgical procedure such as a gastric resection and multiple diagnoses would stay twenty-one days. Thus, this simple example

using length of stay as a measure of resource intensity illustrates that information in addition to primary diagnosis must be incorporated into the patient classification scheme.

The second method for classifying patients has been developed by the Commission on Professional and Hospital Activities (CPHA). The CPHA classification divides all possible primary diagnoses into 349 mutually exclusive major diagnostic categories. Each of these major diagnostic categories is then divided based on the presence or absence of a secondary diagnosis, presence or absence of any surgery and five age categories. This results in 20 subcategories for each of the 349 major diagnostic categories for a total of nearly 7000 patient classes. The large number of patient classes presents operational problems since for a typical hospital most of the classes will be empty or have just a few patients. Further, because of its uniform structure throughout all 349 diagnostic categories, the CPHA classification tends to over specify in some diagnostic categories (e.g., age is not particularly relevant with respect to resource intensity for senile cataract patients) and under specify in other areas (e.g., the precise type of surgery is important for ulcer patients). Thus, neither of the existing patient classification schemes could adequately define hospital case mix and its relationship to resource intensity.

Alternative Approaches to Patient Classification

Since existing classification schemes were not satisfactory, it was necessary to develop a new patient classification scheme. During the process of developing the classification scheme, a number of alternative approaches to constructing the patient classes were investigated. Initially, a normative approach was used which involved having clinicians define patient classes using the patient characteristics which they felt were important for determining resource intensity. There was a tendency for their definitions to include an extensive set of specifications, requiring information which might not always be collected through a hospital's medical information system. If the entire range of patients were classified in this manner, it would ultimately lead to thousands of case types, most of which described patients seen infrequently at an institution. It, therefore, became evident that the process of patient class definition would be facilitated if data from acute care hospitals could be examined to determine the general characteristics and relative frequency of different patient types. Also, statistical algorithms applied to this data would be useful to suggest ways of forming patient classes that were similar in terms of resource intensity. However, it was also discovered that statistical algorithms applied to historical data in the absence of clinical input would not yield a satisfactory set of patient classes. The patients classes resulting from such a statistical approach, while similar in terms of resource intensity, would often contain patients with a diverse set of characteristics which could not be interpreted from a clinical perspective. (i.e. the classes were not medically meaningful). Thus, it became apparent that the development of a patient classification scheme required that physician judgement, statistical analysis and verification with historical data be merged into a single process. It was necessary to be able to examine large amounts of historical data with statistical algorithms available for suggesting alternative ways of forming patient classes but to do so in such a way that physicians could review the results at each step to insure that the patient classes were medically meaningful. Since there was no computer system available which could support these diverse requirements, it was necessary to construct the AUTOGRP computer system before the process of patient class definition could begin. Once AUTOGRP was constructed and sufficient patient data available, the process of forming the patient classification scheme could begin.

Formation of the Diagnosis Related Groups (DRGs)

The process of forming the patient classification scheme was begun by dividing all possible primary diagnoses into 83 mutually exclusive primary diagnosis areas referred to as Major Diagnostic Categories (MDCs). The MDCs were formed by physicians as the first step toward insuring that the patient classes would be medically meaningful. The diagnoses in each MDC correspond to a single organ system or etiology and in general are associated with a particular medical specialty. Thus, in order to maintain the requirement of medical meaningfulness, no final patient class could contain patients in different MDCs. Examples of MDCs are Infectious Diseases, Malignant Neoplasms of the Digestive System, Diabetes and Fractures.

Each MDC was analyzed independently and one or more patient classes were formed from each MDC. The final patient classes formed are referred to as Diagnosis Related Groups (DRGs). Length of stay was used as the measure of resource intensity. Length of stay was chosen since it was readily available, well standardized and reliable. Further, within a range of similar diagnoses, length of stay is highly correlated with other measures of resource intensity such as patient charges. The database used in the formation of the DRGs contained approximately 700,000 abstracts primarily from New Jersey and Connecticut hospitals and one southern PSRO. All diagnostic and surgical information was coded in either HICDA-2 or ICDA-8.

The process of forming the DRGs for an MDC began by making all patient abstracts within that MDC available for AUTOGRP analysis. Patient abstracts for deaths, with obvious coding errors and with extremely long length of stays

were excluded from the analysis. The variance reduction algorithm in AUTOGRP was used to suggest the patient characteristics that affected length of stay.

The recommendation of AUTOGRP would be evaluated from both a statistical and medical perspective. The process of forming the DRGs was recursive in nature. As each patient's characteristic was included in the DRG definitions, the process would then be repeated with the remaining patients' characteristics until there were no longer any patient characteristics which from both a medical and statistical perspective affected length of stay. The result for each MDC was a tree-like structure of patient characteristics which defined the DRGS.

At any point during the definition of the DRGs there would often be several patient characteristics which appeared important for understanding length of stay. (e.g. for a particular MDC age and type of secondary diagnosis may have had a strong impact on length of stay). The selection of the patient characteristics to be used and the order in which they would be used was a complex task with many factors examined and weighed simultaneously. Statistically, the amount of variance reduction in length of stay was only one factor considered. For any patient characteristic the creation of many subgroups, especially as the initial characteristic, was difficult to manage and of questionable significance. Furthermore, it is an artifact of the variance reduction algorithms that many subgroups can be created when there are a large number of different values of the patient characteristic. For example, secondary diagnoses often had many different values and thus often produced significant variance reduction by forming many subgroups. However, such groups were not medically meaningful and were therefore not used in the DRG definitions. The recommendations from AUTOGRP were often modified by clinical judgement. Thus, while the type of surgery performed might be important from both a medical and a statistical perspective, the surgical grouping suggested by AUTOGRP would often be altered by the physicians in order to obtain surgical groupings which were more medically homogeneous.

As an example, consider MDC 55, Urinary Calculus which was partitioned into four DRGs. Initially the Urinary Calculus MDC was partitioned based on the presence or absence of surgery. The non-surgical group was then divided based on the presence or absence of a secondary diagnosis. The surgical group was divided into a group with minor surgery such as a cystoscopy or passage of a catheter to kidney and a group with a major surgery such as a nephrotomy, cystotomy or ureterotomy. In summary, the classification process resulted in the formation of 4 terminal groups, or DRGs 239-242, from the Major Diagnostic Category of Urinary Calculus:

239 Urinary calculus without surgery, and without a secondary diagnosis

240 Urinary calculus without surgery and with a secondary diagnosis

241 Urinary calculus with cystoscopy, passage of catheter to kidney, other operations

242 Urinary calculus with nephrotomy, cystotomy, ureterotomy, other major operations

Each MDC was partitioned into DRGs and the result was the formation of 383 DRGs. The variables used to define the DRGs differed across the MDCs. For example, age was used in the definition of the DRGs for Hernia patients and the precise type of secondary diagnosis was used for Arrhythmia and slowed conduction patients. Some MDCs such as hemorrhoids were not further partitioned while others such as Fractures were partitioned into many DRGs (e.g., 13 DRGs for Fractures).

As they are now defined, the DRGs form a manageable, medically interpretable set of case types that allows one to control for differences in complexity attributable to patient characteristics as described by age, primary diagnosis, secondary diagnosis, primary surgical procedure and secondary surgical procedure. On the basis of values for these variables, practitioners can gain some understanding of the patient being identified and specify within reasonable limits expected services to be delivered, criteria to be applied in treatment, and expected outcomes.

The classification of patient records into DRGs is a constantly evolving process. In fact, the current DRGs represent the third version of the DRGs. As coding schemes change and data are collected that are more current and representative of acute-care institutions in the United States, these groups will be re-examined and revised accordingly.

Currently the DRGs are being applied in a number of different practical and research settings in the health care field. The various applications of the DRGs illustrate the central role which case mix can play in the understanding of the behavior of hospitals.

Utilization Review

In comparing hospital performance on the basis of patient-care-related measures such as length of stay, cost, and death rate, it is important to determine the extent to which observed differences can be attributed to case mix and to what extent they are related to differing treatment practices. An individual institution has limited control over the former, and one expects utilization and quality-of-care measures to vary across the different types of cases it treats. For example, while a 15 per cent mortality rate is not unusual for acute myocardial infarction patients in most inpatient acute-care facilities, it would be alarming for women with normal deliveries. Likewise, a 2-day stay for tonsillectomies is typical, but it is unusually short for appendectomies. Thus, a hopsital with a higher proportion of relatively complex cases could be expected to have, on the average, longer lengths of stay, increased costs, and higher death rates. Any comparision, then, of this institution with another on the basis of such measures must take into account its more complex case mix.

Based on the DRGs case mix-adjusted measures may

be computed to control for case mix differences and used in comparing acute-care inpatient facilities or groups of facilities. In addition, observed differences in some variable between 2 hospitals or a hospital and a set of hospitals may be partitioned into 1) the amount of difference attributed to hospital treatment practices; and 2) the amount of the difference attributed to hospital case mix. This information allows one to make comparisons of hospital utilization and quality of care taking into account case composition. Further, the DRGs provide a framework to identify the types of patients for which an institution has a particularly deviant utilization pattern. These patients may then be closely monitored and the pattern of practice evaluated over time.

Hospital Budgeting and Cost Control

An important objective of hospital costing and budgetary systems is the understanding and control of hospital costs. In traditional organizational settings, cost control is most successful in those situations where well-defined products or services are provided with a predictable set of associated costs. The provision of different combinations of products or services results in different levels of total resource consumption and cost requirements. Cost control in such settings basically entails the monitoring of resources consumed and costs incurred during the production process to insure consistency with expected levels. Thus, for such a system to be operational with a hospital, there must be a precise definition of the services provided by the institution. In a general sense, hospitals provide "patient care," but more specifically, they provide patient care of various kinds and intensities over various durations based on the needs of the patients treated.

Since the DRGs form a classification of the patient population into classes with similar expected resource intensity, they can provide a definition of the services provided by a hospital. As such, they allow the resources consumed and costs incurred to be related directly to the types of patients or case mix that the hospital treats. This is important in a hospital setting, where it is not management (i.e., administrators) but rather individual physicians who are responsible for allocating resources through various services and departments in order to provide effective patient care. To a large extent, physicians act independently of each other and are not generally aware of the overall financial implications of their individual decisions. If hospital cost control is to be attained, effective communication between the financial systems of the hospital and its physicians must be achieved. By formulating the hospital budget in terms of patient classes with similar patterns of care, a direct linkage between the practices of individual physicians and the financial consequences for the hospital can be realized.

DRGs can be used to provide a complete financial picture of the costs of treating specific types of patients, whose care is the basic service of a hospital. Under the traditional organizational structure of a hospital, there is no department whose responsibility is to insure that individual patients are financially well managed. Typically, the hospital's two accounting systems (financial and managerial), deal with patients in the aggregate and not on an individual basis. The financial system provides the basic financial description of the hospital in terms of the balance sheet, income statement and funds flow, while the managerial accounting system provides the financial information oriented at the department level (e.g. nursing, laboratory, medical records) for internal management purposes. Thus, hospital accounting systems have not provided the integrated picture of the financial consequences of the care delivered to individual patients.

The cost of treating patients in each DRG can be determined. In order to establish the following year's budget, it is only necessary to project the hospital's case mix and apply the appropriate inflation factors. Deviations from the budget due to case mix can be immediately detected and the diagnostic and service areas experiencing significant deviations from established unit costs can be isolated.

Hospital Reimbursement

In 1980 the state of New Jersey established prospective DRG rates for 26 hospitals. Preliminary rate design has set a rate per DRG for each hospital, composed of proportions of the hospital mean case cost per DRG and the state standard (the mean case cost per DRG across the sample 26 hospitals). The hospital and state proportion would always sum to unity. Thus, for example, the rate for a particular DRG might consist of 75 per cent hospital cost and 25 per cent state standard. The early emphasis on the hospital actual cost will provide a reasonable opportunity for institutions themselves to make use of management information by DRG. Detailed management information by DRG will be provided to each hospital and will be organized to help the hospitals effectively focus on areas of concern in order to deal with problem areas.

Hospitals have both the opportunity and responsibility for reacting to the management information by implementing steps to remedy inefficiency, expanding efficiency, and opening an effective dialogue with their physicians. The motivation for discharging this burden is supplied by prospective, incentive-based reimbursement. Thus, in any given year, a hospital would retain the savings achieved by bringing in its cost per case under the prospective rate. Since the form of payment is per case rather than per diem, the unit of reimbursement no longer poses an incentive to increased lengths of stay. Recalculating the next year's prospective rate based on the previous year's actual achievement serves the public interest by embedding the results in an improved standard.

The system allows health care issues to be placed in their DRG-specific and medical context, rather than the current collection of financially oriented appeals, thus permitting an examination of efficiency, quality and appropriateness

Regional Planning

Regional planning refers to the activity of organizing health care resources in a defined geographic region to achieve a desired state of affairs in terms of the availability of health care of acceptable quality and cost. The primary thrust of the hospital planning activity has traditionally focused on hospital facilities, primarily beds. Through legislation such as the

Hill-Burton Act, much of the planning activity prior to the 1970s emphasized the adequacy and distribution of hospital beds to meet the needs of of the population. However, the rapid increase in sophisticated medical technology has resulted in a need to plan a regional basis not only for hospital beds but also for specific hospital services and equipment. Thus, the planning for the quantitity and distribution of major new equipment such as computed tomography scanners or specific hospital services such as open heart surgery has become an intergral part of the planning activity. Since certain types of services and equipment are necessary to treat specific patient types, planning decisions will affect the case mix a hospital can treat.

The modification by the planning process of the case mix that an individual hospital can treat will inevitably affect the case mix of the other hospitals in the region. For example, if a new service is added in one hospital, then that hospital will begin to treat additional types of patients. This will likely result in a decrease in the number of those types of patients treated at the other hospitals in the region. Further, the new service may cause the other capacities of the hospital (e.g., beds or operating room time) to be exceeded, requiring that the hospital cease to treat patients to whom it previously provided care. The excess patients will have to be treated in the other hospitals in the region. Thus, the implications of a planning decision can be complex and difficult to predict. A case mix approach to regional planning would have as its central focus the patients being treated and the demands they place on hospital resources. The role of each hospital in the region would be defined in terms of the case mix it treats. The goal of the planning activity becomes to match the resource of a region with the patients requiring care.

Summary

The DRGs provide a practical framework for analyzing the impact of hospital case mix. The various actual and potential applications of the DRGs in the areas of utilization review, hospital budgeting and cost control, prospective reimbursement and regional planning emphasize the central role of the patient. By focusing the types of patients being treated, programs responsible for these activities will share a common conceptual basis even though they are concerned with different aspects of the health care system. While the applications to date have been implemented to meet the immediate needs of the individual programs, future work will be directed toward exploring the potential of the DRGs in achieving better integration and coordination of the different program goals and activities.

Case Mix Definition in Ambulatory Care

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Ambulatory care accounts for a substantial portion of health care resources in the United States. Annually, there are about 600 million visits to office based physicians. Three out of every four Americans visit a doctor at least once a year [1].

The management of ambulatory care systems, however, is not as well understood as the management of hospitals. In recent years, great attention has been focused on understanding and controlling the pattern of resource use in hospitals. Diagnosis Related Groups (DRGs) have emerged as an important tool in this regard. The purpose of this paper is to describe a system of patient classification for ambulatory care settings analagous to DRGs for inpatient settings -- that differentiates the type and amount of resources required to provide ambulatory care.

The ambulatory care system can be thought of as an economic entity. Its inputs are labor, material, and equipment used in the provision of these services. Its outputs are specific services rendered in terms of physician and nurse care, laboratory tests, counseling, and other services. Its product is the specific bundle of services that each patient receives. Because each patient requires different services, the system must produce different products.

A patient classification system useful for management should differentiate patients into groups based on their clinical condition in such a way that the patients in each group require similar bundles of services. Each group, therefore, represents a product of the ambulatory care system.

The database we used to develop such an ambulatory patient classification system was from the National Ambulatory Medical Care Survey (NAMCS) of 1975 and 1976. It included data on 112,516 ambulatory patient visits to a nationwide probability sample of office-based physicians. For each visit, data collected included demographic information, characteristics of the visit such as whether this was a first visit or a revisit, characteristics of the patient such as presenting problem and diagnosis, characteristics of the therapy, disposition, and duration of the visit. (See Figure 1).

The starting point for the formation of our classification system was to divide the entire range of ICDA-8 diagnositc codes into fourteen mutually exclusive and exhaustive categories which we called Major Ambulatory Categories (MACs) For the most part, we found MACs that reflect the predominant organ system affected by the disease. Each ICDA-8 code was assigned to one MAC by considering the organ system affected or the medical specialist most likely to treat the disease. Table 1 lists the fourteen MACs that we developed along with the ICDA-8 codes that are classified in each one.

Each MAC was then subdivided utilizing the significant attribute method. We sequentially partitioned the patients in each MAC based on a series of variables that reflect their clinical attributes. The choice of which variable to use at each point in the partitioning process and the choice of the values of the variable at which to make the partition was based on an interactive process between physician and AUTOGRP, a computer system for the analysis of health data bases. This process has been described elsewhere [2]. Each variable representing a patient or visit characteristic was examined for its ability to explain resource consumption in a statistical sense as well as in a medical sense. Resource consumption, for the purpose of the initial analysis, was represented by a variable "duration of visit." Subsequently, the groups formed were analyzed in relation to other measures of resource consumption such as laboratory, x-ray, EKG, use, etc.

The patient and visit characteristics that we found to be important in explaining resource consumption are listed in Table 2.

The general guidelines adhered to wherever possible in the partitioning process were:

1) When partitioning new patients the use of the variable presenting problem was favored over the use of diagnosis because a primary diagnosis is usually not established until the end of a visit.
2) Non-clinical variables such as type of visit or referral were used whenever possible before using clinical variables such as diagnosis or presenting problem.
3) Within a MAC attempts were made to be consistent in the way groups were formed. For example, if age is used as a partitioning variable in more than one place in the definition of the ambulatory patient groups (APGs)for a particular MAC then the same age categories should be used (e.g., use under and over 65 for all age splits).

The end result of this process was the formation of 154 ambulatory patient groups (APGs). The interactive partitioning process used in forming the APGs can be best illustrated in the context of an example - the Classification of Major Ambulatory Patient Group 5: Disorders of the Circulatory System. This category contains patients with primary diagnoses of:

ICDA-8 Codes	English Descriptor
0930-0930	Cardiovascular Syphilis
390-402	Rheumatic Fever; Chronic Rheumatic Heart Disease; Hypertensive Disease except Renal; Ischemic and Other Heart Disease
4400-4459	Diseases of the Arteries except Polyartertis Nodosa and Allied Conditions
4510-4549 4561-4569 4580-4589	Diseases of the Veins and Other Diseases of the Circulatory System except Pulmonary Embolism and Hemmorhoids
7820-7826,7829	Cardiovascular Symptoms
795	Sudden Death
Y100	Adjustment of Pace-Setter or Other Cardiac Device

The process used in the formation of the APGs is summarized in the tree diagram presented in Figure 2. Initially, this category is partitioned into three branches based on the variable visit status (VSTAT). The first branch contains all

patients seen by the physician for the first time New Patient - V1). The second branch contains all revisits experiencing a problem that the physician has treated in the past (Revisit/Old Problem-V2). The third branch contains all revisits experiencing a problem that the physician has not treated in the past (Revisit/New Problem-V3). For purposes of this example, the Revisit/Old Problem-V2 branch will be described in detail. (See Figure 3)

Step I: V2 was partitioned into two groups based upon whether the patient received a periodic examination. Periodic examinations require particularly long physician times.

1) Terminal Group 52 - revisit/old problem who received a periodic examination.
2) Intermediate group - revisit/old problem who did not receive a periodic examination.

Step II: The intermediate group described in Step I was further subdivided based upon whether the patient was referred. Patients who were referred tended to require more physician time. This step resulted in the formation of:

1) Terminal Group 51 - revisit/old problem, who did not receive a periodic examination and who was referred.
2) Intermediate group - revisit old problem, who did not receive a periodic examination, and who was not referred.

Step III: The intermediate group described in Step II was further divided based upon the presence or absence of the presenting problem chest pain. Chest pain is a particularly worrisome manifestation of cardiovascular disease and therefore tends to require additional physician time. This step resulted in the formation of:

1) Intermediate group, revisit/old problem, who did not receive a periodic examination, who was not referred and who had a presenting problem of chest pain.
2) Intermediate group, revisit/old problem, who did not receive a periodic examination, who was not referred and did not have a presenting problem of chest pain.

Step IV: The intermediate group one described in Step III was further divided based upon the presence or absence of a secondary diagnosis. This resulted in the formation of:

1) Terminal Group 50 - revisit/old problem, who did not receive a periodic examination, who was not referred, who had a presenting problem of chest pain, and who had a secondary diagnosis.
2) Terminal Group 49 - revisit/old problem, who did not receive a periodic examination, who was not referred, who had a presenting problem of chest pain, and who did not have a secondary diagnosis.

Step V: The intermediate group two described in Step III was further divided based upon the presence or absence of the diagnosis of hypertension. Revisits for hypertension were frequent and brief in duration. This step resulted in the formation of:

1) Terminal Group 48 - revisit/old problem, who did not receive a periodic examination, who was not referred, who did not have a presenting problem of chest pain, and who had a diagnosis of hypertension.
2) Intermediate group - revisit/old problem, who did not receive a period examination, who was not referred, who did not have a presenting problem of chest pain, and who did not have a diagnosis of hypertension.

Step VI: the intermediate group described in Step V was further divided based upon the presence or absence of a secondary diagnosis. This step resulted in the formation of:

1) Terminal Group 47 - revisit/old problem, who did not receive a period examination, who was not referred, who did not have a presenting problem of chest pain, who did not have a diagnosis of hypertension, and who had a secondary diagnosis.
2) Terminal Group 46 - revisit/old problem, who did not receive a periodic examination, who was not referred, who did not have a presenting problem of chest pain, who did not have a diagnosis of hypertension, and who did not have a secondary diagnosis.

In summary, the classification process resulted in the formation of seven ambulatory patient groups or APG's 46-52, listed below.

46	O5V2NHBPND2	CIRC,OPT,OPR,N EXAM,N REF,WO CHSTPN, WO HBP, WO DX2
47	O5V2NHBPYD2	CIRC,OPT,OPR,N EXAM,N REF,WO CHSTPN, WO HBP,W DX2
48	O5V2HBP	CIRC,OPT,OPR,N EXAM,N REF,WO CHSTPN, W HBP
49	O5V2CPNND2	CIRC,OPT,OPR,N EXAM,N REF,W CHSTPN, WO DX2
50	O5V2CPNYD2	CIRC,OPT,OPR,N EXAM,N REF,W CHSTPN, W DX2
51	O5V2REF	CIRC,OPT,OPR,N EXAM,REF
52	O5V2PRDEX	CIRC,OPT,OPR,EXAM

Results

From the initial sample of 112,516 patients, 559 records were eliminated because they represented "outliers", i.e., patients with excessive resource consumption. The average time spent with the physician for the remaining 11,957 patients was 16.8 minutes (S.D. 12.46). X-rays were performed in 7.6%, laboratory work 22.3% and EKG in 3.5%. Disposition was to the hospital in 2.5%.

Table 3 illustrates the relationship between APG and physician time. Patients in APG 8 require an average of 46.2 minutes of physician time. These are pateints with psychiatric disorders who were referred for their first visit. At the other end of the spectrum, patients in APG 65 require an average of 4.8 minutes of physician time. These are patients with respiratory disorders on a revisit for medication.

The abiltiy of APG's to separate patients into groups requiring different ancillary services is illustarated in Table 4. The rate of EKG use in the seven APG's defined for circulatory disorders representing revisits for old problems ranges from 6% in patients who have hypertension, to 43% in patients with chest pain and secondary diagnosis.

Conclusion

We have developed a patient classification system for ambulatory care patients that relates patient attributes to the consumption of health care resources. Patients can be classified into one of 154 ambulatory patient groups (APG's) on the basis of their diagnosis, presenting problem, age, reason for visit and type of visit.

Each APG can be thought of as representing a product of the ambulatory care system. The mix of products, or case mix, of an ambulatory care facility can be characterized by use of this classification

system. It is expected that using APGs ambulatory facilities can be described, compared, and managed, in the same way that using DRGs hospitals can be described, compared and managed.

List of Major Ambulatory Categories

Initial Group #	Initial Group Name	ICDA8 Code	Terminal Group #
1	Infective and Parasitic Disorders	017,0171,0179-0189, 020-031,0319-0339, 035-0399,050-0619, 067-0689,071-0759, 079-0790,0792-0902, 0904-0939,095-1049, 113-1149,116-1309, 132-1349,136-1369	1-12
2	Endocrine, Nutritional and Metabolic Disorders	193-1949,226-2269, 240-2689,269,2699, 270-2731,2734,2736-2739,275-2799	13-24
3	Mental Disorders	290-3159,790-7902, 7930,794-7949	25-36
4	Disorders of the Nervous System	013-0139,0191,040-0469,062-0669,0940-0949,191-1929,225-2259,238,2381-2389, 320-3589,430-4389, 7720-7722,780-7808, 781,7814-7818,791-7919,850-8549	37-39
5	Disorders of the Circulatory System	0930-0939,390-4029, 404-4299,440-4459, 451-4519,453-4549, 456,4561-4569,458-4589,782-7826,7829, 795-7959,Y100	40-59
6	Disorders of the Respiratory System	010-0129,0190,034-0341,115-1159,0310, 135-1359,160-1639, 212-2129,231-2319, 450-4509,460-5199, 776-7769,783-7837	60-70
7	Disorders of the Digestive System	000-0099,014-0149, 070-0709,140-1599, 210-2119,230-2309, 2690-2691,2732-2733, 2735,452-4529,455-4559,4560,520-5779, 784-7858,Y102	71-84
8	Disorders of the Genito-urinary System	016-0169,0192,112, 131-1319,174-1749, 180-1899,217-2239, 233-2379,403-4039, 580-6299,786-7867, 789-7899,792-7929, Y090,Y101	85-94
9	Disorders of the Skin and Subcutaneous Tissue	0170,0791,110-1119, 172-1739,214-2149, 216-2169,232,2322, 680-7099	95-102
10	Disorders of the Musculo-skeletal System and Connective Tissue	015-0159,0193-0196, 170-1719,213-2139, 215-2159,2320,2321, 274-2749,446-4479, 710-7389,787-7876, Y104	105-109
11	Accidents, Poisonings and Violence	800-8489,860-9999	110-122
12	Disorders of the Eye	0172,076-0789,0903, 190-1909,224-2249, 2380,360-3793,7810-7812,Y006,Y122	123-132
13	Disorders of the Ear	0173,380-3899,7813	133-143
14	Other		
	Special Conditions and Exam without Sickness	Y00-Y005,Y007-Y089, Y091-Y099,Y103,Y105-Y121,Y123-Y13,Y300-Y302	144-154
	Disorders of the Blood and Blood-Forming Organs	280-2899	
	Complications of Pregnancy, Childbirth and Puerperium	630-6789	
	Congenital Anomalies	740-7599	
	Certain Causes of Perinatal Morbidity and Mortality	760-7719,7729,773, 774-7759,777-7799	
	Symptoms	782,7823,788-7889, 793-7931,7938-7939, 796-7969	
	Miscellaneous	019,0199,195-1999, 200-2099,227-2289, 238-2399,448-4489, 457-4579	

Table 1

PATIENT CHARACTERISTICS CONSIDERED FOR GROUPING

Diagnosis	Type of Visit
Secondary Diagnosis	Reason for Visit
Presenting Problem	referral
Seriousness of Problem	periodic examination
Age	follow-up of acute problem
Psychotherapy	post-operative visit

Table 2

RANKING OF PHYSICIAN TIME

APG	DESCRIPTION	TIME (MINUTES)
	HIGHEST:	
28	Psychiatric Disorder, first visit, referral	48.2
33	Psychiatric Disorder, revisit for old problem, requires psychotherapy	44.8
27	Psychiatric Disorder, first visit, not referred, with anxiety, depression, obsession, or drug abuse	42.2
26	Psychiatric Disorder, first visit, other problem	38.2
44	Circulatory Disorder, first visit, referred, with shortness of breagh, chest pain, or heart murmur	36.9
	LOWEST:	
99	Skin disorder, revisit without periodic exam, with impetigo, warts, or acne, age 0 - 18	9.6
116	Accident, poisoning, or violence, revisit for an old problem, with diagnosis of sprain, laceration, contusion, or eye injury with surgical aftercare	9.1
120	Accident poisoning or violence revisit for a new problem with a diagnosis of sprain, laceration, contusion, or eye injury with surgical aftercare	8.4
145	Other disorders, receiving vaccination	6.4
65	Respiratory revisit without periodic examination, for medication	4.8

Table 3

DISORDERS OF THE CIRCULATORY SYSTEM
REVISIT FOR OLD PROBLEM

APG	DESCRIPTION	TIME (MINUTES)	%EKG
52	Periodic examination	24.6	33%
51	Referred	20.7	17%
50	Chest Pain with Secondary Diagnosis	20.2	43%
49	Chest Pain without Secondary Diagnosis	16.4	31%
48	Hypertension	13.4	6%
47	Other Revisit with Secondary Diagnosis	17.2	22%
46	Other Revisit without Secondary Diagnosis	15.4	16%

Table 4

PATIENT RECORD AND PATIENT LOG

B Nº 881078

ASSURANCE OF CONFIDENTIALITY—All information which would permit identification of an individual, a practice, or an establishment will be held confidential, will be used only by persons engaged in and for the purposes of the survey and will not be disclosed or released to other persons or used for any other purposes.

B Nº 881078

PATIENT LOG

As each patient arrives, record name and time of visit on the log below. For the patient entered on line #2, also complete the patient record to the right.

PATIENT'S NAME	TIME OF VISIT
1	a.m. / p.m.
2	a.m. / p.m.

Record items 1-12 for this patient

CONTINUE LISTING PATIENTS ON NEXT PAGE

PATIENT RECORD
NATIONAL AMBULATORY MEDICAL CARE SURVEY

1. DATE OF VISIT — Mo / Day / Yr
2. DATE OF BIRTH — Mo / Day / Yr
3. SEX — 1 ☐ FEMALE; 2 ☐ MALE
4. COLOR OR RACE — 1 ☐ WHITE; 2 ☐ NEGRO/BLACK; 3 ☐ OTHER; 4 ☐ UNKNOWN
5. PATIENT'S PRINCIPAL PROBLEM(S) COMPLAINT(S), OR SYMPTOM(S) THIS VISIT (In patient's own words) — a. MOST IMPORTANT; b. OTHER
6. SERIOUSNESS OF PROBLEM IN ITEM 5a (Check one) — 1 ☐ VERY SERIOUS; 2 ☐ SERIOUS; 3 ☐ SLIGHTLY SERIOUS; 4 ☐ NOT SERIOUS
7. HAVE YOU EVER SEEN THIS PATIENT BEFORE? — 1 ☐ YES; 2 ☐ NO
If YES, for the problem indicated in ITEM 5a? — 1 ☐ YES; 2 ☐ NO
8. MAJOR REASON(S) FOR THIS VISIT (Check all major reasons)
01 ☐ ACUTE PROBLEM
02 ☐ ACUTE PROBLEM, FOLLOW-UP
03 ☐ CHRONIC PROBLEM, ROUTINE
04 ☐ CHRONIC PROBLEM, FLARE-UP
05 ☐ PRENATAL CARE
06 ☐ POSTNATAL CARE
07 ☐ POSTOPERATIVE CARE — (Operative procedure)
08 ☐ WELL ADULT/CHILD EXAM
09 ☐ FAMILY PLANNING
10 ☐ COUNSELING/ADVICE
11 ☐ IMMUNIZATION
12 ☐ REFERRED BY OTHER PHYS/AGENCY
13 ☐ ADMINISTRATIVE PURPOSE
14 ☐ OTHER (Specify)
9. PHYSICIAN'S PRINCIPAL DIAGNOSIS THIS VISIT — a. DIAGNOSIS ASSOCIATED WITH ITEM 5a ENTRY; b. OTHER SIGNIFICANT CURRENT DIAGNOSES (In order of importance)
10. DIAGNOSTIC/THERAPEUTIC SERVICES RENDERED/PROVIDED THIS VISIT (Check all that apply)
01 ☐ NONE
02 ☐ LIMITED HISTORY/EXAM
03 ☐ GENERAL HISTORY/EXAM
04 ☐ CLINICAL LAB. TEST
05 ☐ BLOOD PRESSURE CHECK
06 ☐ EKG
07 ☐ HEARING TEST
08 ☐ VISION TEST
09 ☐ ENDOSCOPY
10 ☐ OFFICE SURGERY
11 ☐ DRUG PRESCRIBED OR DISPENSED
12 ☐ X-RAY
13 ☐ INJECTION
14 ☐ IMMUNIZATION/DESENSITIZATION
15 ☐ PHYSIOTHERAPY
16 ☐ MEDICAL COUNSELING
17 ☐ PSYCHOTHERAPY/THERAPEUTIC LISTENING
18 ☐ OTHER (Specify)
11. DISPOSITION THIS VISIT (Check all that apply)
1 ☐ NO FOLLOW-UP PLANNED
2 ☐ RETURN AT SPECIFIED TIME
3 ☐ RETURN IF NEEDED, P.R.N.
4 ☐ TELEPHONE FOLLOW UP PLANNED
5 ☐ REFERRED TO OTHER PHYSICIAN/AGENCY
6 ☐ RETURNED TO REFERRING PHYSICIAN
7 ☐ ADMIT TO HOSPITAL
8 ☐ OTHER (Specify)
12. DURATION OF THIS VISIT (Time actually spent with physician) — MINUTES

HRA 34-3 REV. 3-76

DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
PUBLIC HEALTH SERVICE
HEALTH RESOURCES ADMINISTRATION
NATIONAL CENTER FOR HEALTH STATISTICS

O.M.B. 258-R1498

The National Ambulatory Medical Care Survey: 1975 Summary Series 13, Number 33, U.S. Department of Health, Education, and Welfare Public Health Services, National Center for Health Statistics, Hyattsville, Maryland, January, 1978.

Figure 1

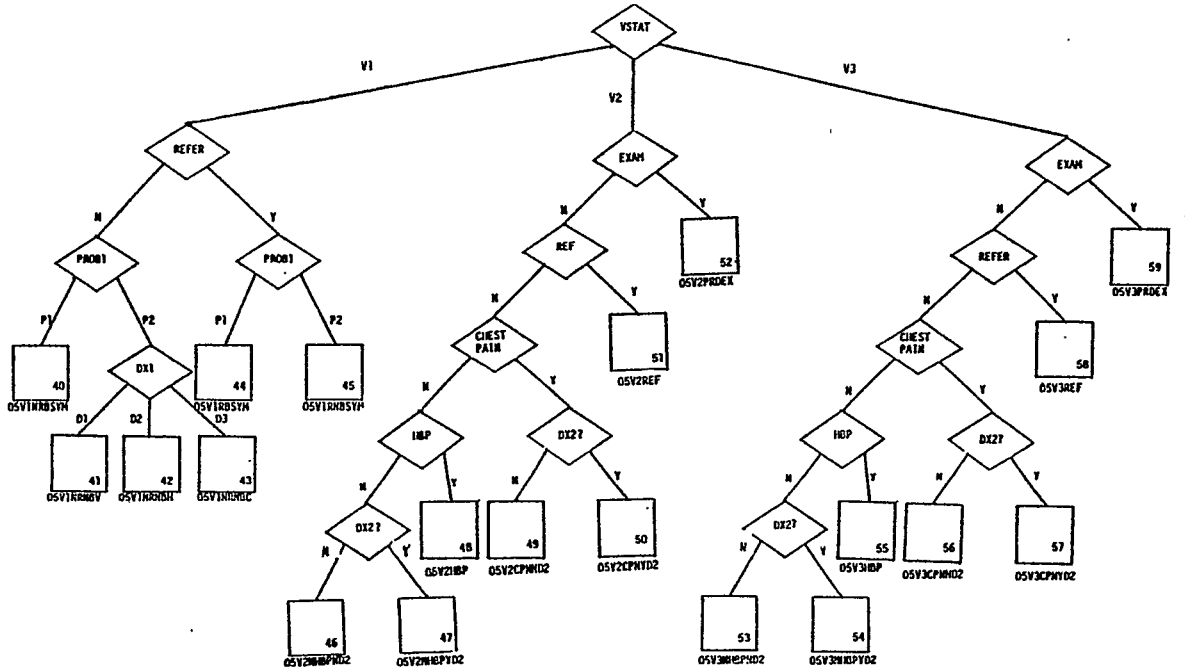

Figure 2 Tree Diagram Illustrating Partitioning of Disorders of the Circulatory System

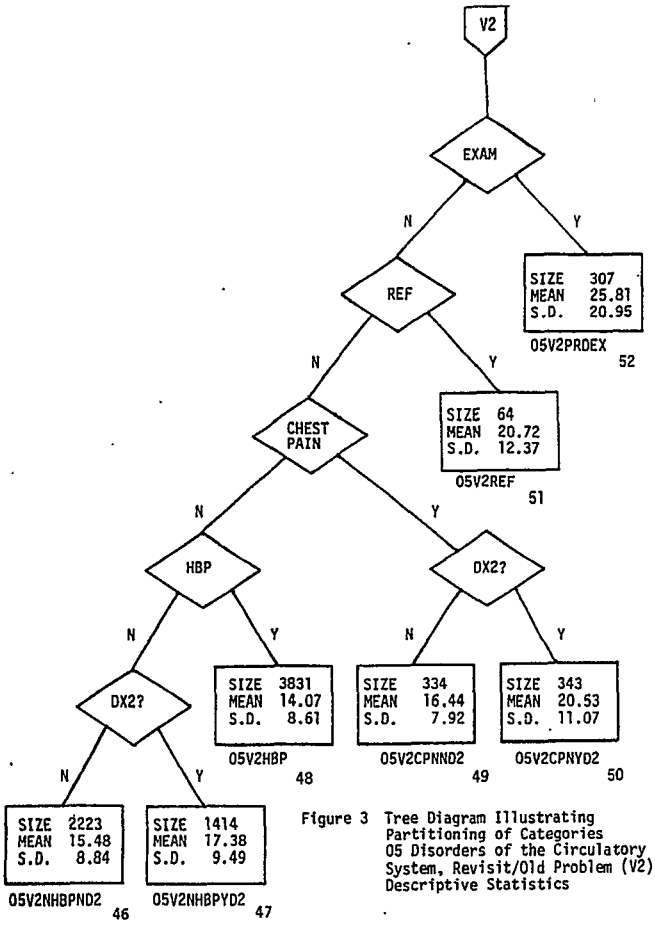

Figure 3 Tree Diagram Illustrating Partitioning of Categories 05 Disorders of the Circulatory System, Revisit/Old Problem (V2) Descriptive Statistics

References

[1] U.S. Department of Health, Education and Welfare: Ambulatory Medical Care Rendered in Physicians' Offices: United States, 1975. Advance Data from Vital and Health Statistics, No. 1, 1977.

[2] R.B. Fetter, Y. Shin, J.L. Freeman, R.F. Averill, J.D. Thompson, "Case Mix Definition By Diagnosis Related Groups," Medical Care Supplement, February 1980, Vol. 18, No. 2.

THE USE OF THE HOSPITAL DISCHARGE SURVEY IN A STUDY OF TONSILLECTOMY INCIDENCE: UNITED STATES, 1970-1977

Jean L. Freeman, James F. Jekel, and Daniel H. Freeman, Jr., Yale University

1. Introduction

The National Center for Health Statistics (NCHS) is the principal organization for providing health data on the U.S. population. These data are collected through the various components of the National Health Survey. The Center routinely publishes statistical summaries in the Vital and Health Statistics Series. However, in order to accommodate the more varied and extensive analyses that users of the data require, the Center has made these data available to the public in the form of public use micro-data tapes. Yale University has received copies of many of the survey tapes, principally through a special program between the Department of Epidemiology and Public Health and NCHS. Members of the University community have been engaged in a number of studies utilizing these data, especially those from the Hospital Discharge Survey and the National Ambulatory Medical Care Survey. This paper presents a brief overview of these research projects followed by a more detailed discussion of one study which utilized the Hospital Discharge Survey to monitor the frequency of a major surgical procedure - an examination of tonsillectomy incidence over the period 1970 to 1977.

2. Overview of Studies Utilizing NCHS Survey Data

The titles of studies conducted or in the process of being conducted at Yale in either the Department of Epidemiology and Public Health or the School of Organization and Management are listed in Figure 1. Since this paper is part of a session concerned with uses of hospital and ambulatory data, attention is limited to those projects conducted with the Hospital Discharge Survey and the National Ambulatory Medical Care Survey.

The paper by Lichtenstein [11] presented at this conference describes the application of the National Ambulatory Medical Care Survey (NAMCS) in the development of case mix measures for ambulatory care. In addition, the survey was used by a group in the Department of Epidemiology and Public Health working on a review of upper extremity disorders. Specifically, they were interested in assessing and documenting the magnitude of the problem of hand and arm diseases and injuries and used the NAMCS data to determine the number of physician visits in 1976 by persons with those problems.

The Hospital Discharge Survey (HDS) has been the most frequently used dataset. As evident from the titles, the studies vary considerably in terms of subject matter and the types of questions they address. The first study, on abortions, examined the impact of the 1973 Supreme Court ruling liberalizing access to induced abortion on the rate of hospitalizations for abortion [4].

The incidence of acute traumatic spinal cord injury in the United States was determined using HDS since previous national estimates of the incidence were extrapolations of rates in restricted geographic areas. The key feature of this study was the operationalization of what constituted an incident case of acute traumatic spinal cord injury [5].

In the third study based on HDS case mix and length of stay statistics for the New England region were obtained by Diagnosis Related Groups or DRGs for pediatric patients and compared to similar statistics for hospitals in a New England HSA [25].

The fourth study was exploratory and suggested the topic for the fifth study presented here on tonsillectomies. It examined the patterns of hospital use in the United States over the period 1971-1975 by adolescent women, aged 11-19 [8]. These patterns were investigated using Diagnosis Related Groups or DRGs as the framework for describing reasons for hospitalization. After childbirth, the second major reason for hospitalization was for hypertrophy of tonsils and adenoids. Practically all of the patients in this group had a tonsillectomy and/or adenoidectomy. While the frequency of the operation was declining, the number and rate still seemed high, particularly for this age group, and it was decided to examine this trend in tonsillectomies further for all age and sex groups.

3. Trends in Tonsillectomy With or Without Adenoidectomy Background

In 1965 tonsillectomy with or without adenoidectomy was the most common major surgical procedure in the United States with an estimated 1.2 million operations performed [16]. Since then its popularity has declined with physicians favoring a more conservative treatment approach to sore throat and middle ear disease, such as medical management with antibiotics or lesser surgical procedures as myringotomy. While the operation is generally considered to be a relatively harmless procedure, there are accompanying risks of psychic trauma with childhood tonsillectomy and serious complications from anesthesia and post operative hemorrhage [2,3].

In view of the operation's high frequency and associated risks, it is surprising that the therapeutic efficacy of tonsillectomy with or without adenoidectomy has never been satisfactorily determined. There have been a few published prospective studies comparing operated and controlled groups [9,10,12,13,14], but their results have been seriously questioned by other investigators due to flaws in their respective designs, which include nonrandomization of subjects into the operated group, the exclusion of subjects with the most serious indications for surgery, inappropriate controls, and followup based on parental reports [2,20,22]. Bluestone and Paradise [20,21] are currently engaged in a clinical trial which is designed to avoid the defects of these earlier studies.

It is understandably difficult to develop appropriate indications for tonsillectomy and/or adenoidectomy in the absence of information regarding their benefits. However, both practitioners and academic researchers have expressed concern over the unwarranted application of these procedures and have attempted to define reasonable

indications for each operation. Over a decade ago Haggerty [7] recommended that tonsillectomy with adenoidectomy be performed only for serious persistent nasal or pharyngeal obstruction, when there is difficulty with swallowing or for repeated episodes (4 or 5 in one year) of bacterial tonsillitis. For otitis media, he recommends adenoidectomy alone after alternative medical and drug treatments have not produced satisfactory results. He does not feel that the combined operation should be performed over 8 years of age. Older children should be watched for a year, during which time the indications would probably disappear.

Haggerty's critical and conservative attitude toward tonsillectomy and/or adenoidectomy surgery is reflected in more recent sources for surgical indications, in particular pediatrics textbooks [1,24] and the American Academy of Pediatrics (A.A.P.). Criteria developed by the A.A.P. are being used by Professional Standards Review Organizations (PSROs) as part of their admission criteria for tonsillectomy and adenoidectomy surgery [6]. There is high agreement among sources regarding the necessity of surgery when enlarged tonsils and/or adenoids cause nasal or pharyngeal obstruction sufficient to interfere with breathing or swallowing. However, while all sources indicate surgery may be of benefit for patients with recurrent tonsillitis and otitis media, they give different opinions regarding the number of required episodes.

Little is known about the incidence of tonsillitis by age and sex. However, data from the Health Interview Survey indicate that the conditions sore throat and otitis media are most prevalent in children under 6 and decrease as a function of age thereafter [18,19]. Therefore, in light of this information and Haggerty's recommendation that the combined operation not be performed on children over age 8, it appears that tonsillectomy is most appropriate for children under age 8.

This study examines the decline in tonsillectomy rates over the period 1970 through 1977 and investigates whether this trend was common to all age and sex categories. Of particular interest is whether the decline during this period was greater in those age categories for which the procedure seems least appropriate - over 8 years.

Methods

The data presented in this paper were collected by the Hospital Discharge Survey for the years 1970 through 1977. HDS is conducted yearly by the National Center for Health Statistics for calculating hospital utilization statistics by geographic region, patient demographic characteristics (age, sex, race, marital status), diagnoses, surgical procedures, and hospital attributes (bed size, ownership). The survey's scope includes patients discharged from nonfederal short stay (average length of stay less than 30 days) hospitals with at least six beds for inpatient use, located in the 50 states and the district of Columbia. The sample design, data collection, and data processing procedures are documented extensively elsewhere [15]. Survey data were obtained from NCHS and the National Technical Information Service in the form of public use micro-data tapes.

Each observation in the database represents a single discharge in the sample and has an associated weight factor that was used in determining estimates of total discharges with a particular operation. Estimates were computed separately for all listed operations of tonsillectomy with adenoidectomy and tonsillectomy without adenoidectomy. The estimates for all listed operations of tonsillectomy with adenoidectomy include all operations coded as 21.2 in any one of the three operation fields appearing on the medical abstract. Likewise, estimates for all listed operations of tonsillectomy without adenoidectomy include all operations coded as 21.1. Associated standard errors were computed on the basis of relative standard errors estimated from unpublished interpolation tables provided by NCHS.

Age and sex specific surgical rates were computed for each of the procedures to control for possible demographic changes. The surgical rate is the ratio of the number of hospital discharges with the operation during a given year to the number of persons in the civilian non-institutionalized population as of July 1 of that year. The number of persons in the civilian non-institutionalized population was derived from published estimates of the total population and the proportion of the total population institutionalized, provided by the United States Bureau of the Census [23].

The analysis is descriptive and consists of 1) a summary of the rate of tonsillectomies during the period 1970 through 1977 and 2) an examination of the change in the rates between 1970 and 1977 for each age and sex category.

Results

Tables 1 and 2 contain the number and rate per thousand, with standard errors, of tonsillectomies with adenoidectomy and tonsillectomies without adenoidectomy performed in United States' nonfederal short stay hospitals as estimated by the Hospital Discharge Survey for the years 1970 and 1977. A histogram of the rates for each operation over the eight years is given in Figure 2. From these it is observed that the frequency and rate of tonsillectomy with or without adenoidectomy has declined over this period. Almost one million tonsillectomies were performed in 1970 at a rate of 4.8 per 1000 population. By 1977, the number had dropped to slightly over 600,000 or 2.9 per thousand.

An examination of the separate trends in the two operations reveals that the decline observed in total tonsillectomies is primarily due to the decline in tonsillectomy with adenoidectomy, which fell from about 737,000 or 3.7 per thousand to about 400,000 or 1.9 per thousand in 1977. On the other hand, there was little variation in the number and rate of tonsillectomy without adenoidectomy over the eight years. About 200,000 operations were performed each year or slightly over 1 per thousand.

It is evident from the rates that each operation has a distinctive age and sex distribution. Tonsillectomy without adenoidectomy is relatively rare in children under 9 and appears to increase with age up through the late teens, after which it begins to decline in frequency and rate. The median and modal age is in the interval 15 to 19 years. Approximately 45% of the operations are performed on persons aged 20 years and older. Overall, females have almost twice the number and rate of tonsillectomy without adenoidectomy as males. Both sexes have comparable rates up through

age eight and females have higher rates at all ages over eight. For ages 9 through 19 rates for females are at least double those for males.

Tonsillectomy with adenoidectomy is a more popular procedure than tonsillectomy without adenoidectomy. For the total population, incidence rates for the combined operation are about three times as high as those for tonsillectomy performed separately. The peak age, as well as the median, of tonsillectomy with adenoidectomy is in the range 5 to 8 years, ten years younger than that for tonsillectomy without adenoidectomy. Approximately 30% of the operations are performed on persons over age 8. Males have a slighly higher rate than females, but the difference is not significant. However, it is noted that males appear to have higher rates than females through age eight, after which females predominate.

With respect to changes in the rates between the survey years, there appears to be little or no change in the rate of tonsillectomy without adenoidectomy. Further, what changes we do observe in specific age/sex categories appear to be due to sampling error. On the other hand, a decline of almost 50% was noted in the rates of tonsillectomy with adenoidectomy for both sexes. The percentage change for ages 8 and under (35-41 percent) is comparable to that for ages 9-19. However, age groups 20-29 and 30+ experienced greater declines of 58 and 68% respectively.

Conclusion

In conclusion, data from the Hospital Discharge Survey revealed that the number and rate of tonsillectomy surgery has declined considerably over the period 1970 to 1977. The decline is attributed almost entirely to tonsillectomy with adenoidectomy and was of approximately the same magnitude (35 to 41 percent) for all age groups under 20. The percentage decline was greater (58 to 68 percent) for ages 20 and above. Moreover, the sex differential observed in certain age groups in 1970 persisted in 1977. For both operations, females appear to have higher rates at ages over 8, in particular ages 9 through 19.

It should be noted that the majority of tonsillectomies occur in conjunction with adenoidectomies. Therefore, it could be argued that the decrease in tonsillectomies may be attributed to a change in medical practice with physicians performing adenoidectomy separately. However, while the frequency of adenoidectomy without tonsillectomy has increased over this period, the number and rates are too small to account for the greater part of the decline in tonsillectomies.

Although the trend has been toward declining rates, the operation performed separately or in combination with adenoidectomy is still one of the most frequently performed major operations in the United States and is the principal reason for pediatric hospitalization. Without an accurate knowledge of costs versus benefits it is difficult to assess the extent of unnecessary surgery. As noted above, Haggerty recommended that the combined procedure not be performed on children over age 8. In 1977 approximately 50% of all tonsillectomies were performed on persons in these age ranges. If half the operations were of questionable value, then 200 million dollars[1] may have been misallocated. But, more importantly over 300,000 persons ran unnecessary risks of serious complications and an unknown number of children and their families suffered adverse psychological effects of hospitalization.

Hospital discharge data have frequently been cited as a useful source of information for the surveillance of health and disease conditions. This particular study illustrates their utility as a monitoring mechanism for therapeutic procedures as well.

NATIONAL AMBULATORY MEDICAL CARE SURVEY (NAMCS)

Case Mix Definition in Ambulatory Care

Physician Visits for Hand and Arm Diseases and Disorders

HOSPITAL DISCHARGE SURVEY (HDS)

Hospitalization for Complications of Abortion and Association with Legal Induced Abortion in the United States 1971-1975

Incidence of Acute Traumatic Spinal Cord Injury in the United States

DRG Regional Norm Setting for Pediatric Hospitalization

Reasons for Hospitalization of Adolescent Women in the United States: 1971 to 1975

Trends in Tonsillectomy and Adenoidectomy Rates, United States: 1971 to 1977

HEALTH EXAMINATION SURVEY (HES) - CYCLE I

The Association Between Hypertension and Obesity

HEALTH INTERVIEW SURVEY (HIS)

Morbidity Conditions Affecting Cosmetologists

Socio-economic Status and Physician Visits: A Comparison of Utilization Patterns for Prevention vs Treatment

HEALTH AND NUTRITION EXAMINATION SURVEY (HANES)

Psycho-social Factors Affecting the Development of Arthritis

Figure 1

Yale University projects with NCHS public use micro-data tapes

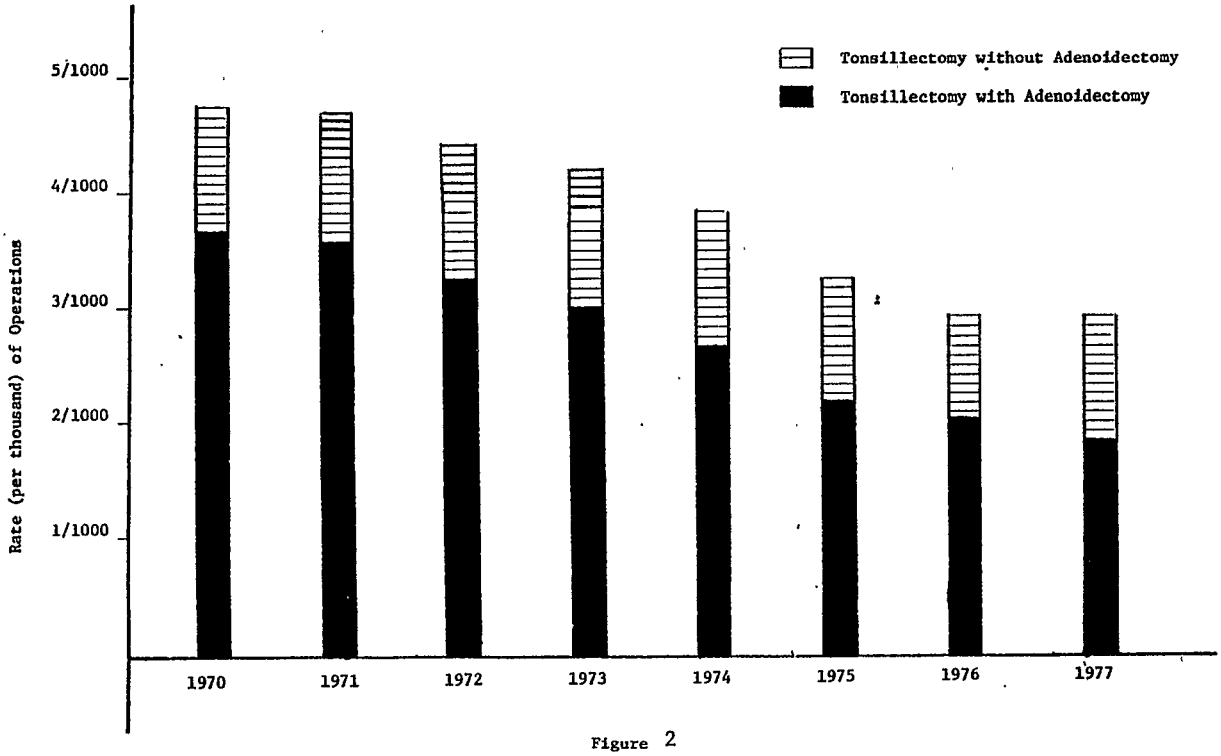

Figure 2

Estimated rate per thousand population of all listed operations of tonsillectomy without adenoidectomy and tonsillectomy with adenoidectomy for persons discharged froms short stay hospitals: United States, 1970-1977

Table 1

Estimated number (with standard error) of all listed operations of tonsillectomy without adenoidectomy and tonsillectomy with adenoidectomy for persons discharged from short stay hospitals by age and sex: United States, 1970 and 1977

Operation	Age	1970 Total	1970 Male	1970 Female	1977 Total	1977 Male	1977 Female
Tonsillectomy without Adenoidectomy	All	220,648 (17,777)	79,477 (8,133)	141,171 (12,809)	216,025 (17,478)	66,751 (7,133)	149,274 (13,366)
	<=4	4,221 (934)	2,347 (606)	1,874 (526)	3,921 (887)	2,760 (680)	1,161 (366)
	5-8	7,660 (1,450)	4,018 (903)	3,642 (842)	8,933 (1,611)	4,277 (942)	4,656 (995)
	9-14	30,353 (3,945)	10,453 (1,794)	19,900 (2,881)	34,044 (4,311)	11,110 (1,886)	22,934 (3,218)
	15-19	79,174 (8,111)	24,866 (3,421)	54,308 (6,109)	74,262 (7,731)	18,249 (2,727)	56,013 (6,252)
	20-29	70,636 (7,440)	26,665 (3,600)	43,971 (5,215)	68,471 (7,269)	20,030 (2,893)	48,441 (5,604)
	30+	28,604 (3,784)	11,128 (1,889)	17,476 (2,650)	26,394 (3,574)	10,325 (1,776)	16,069 (2,501)
Tonsillectomy with Adenoidectomy	All	737,004 (45,017)	362,171 (25,992)	374,833 (26,675)	401,051 (28,047)	200,574 (16,457)	200,477 (16,450)
	<=4	167,948 (14,578)	95,831 (9,334)	72,117 (7,560)	96,208 (9,366)	55,295 (6,192)	40,913 (4,935)
	5-8	355,326 (25,616)	180,714 (15,347)	174,612 (14,985)	184,495 (15,565)	99,974 (9,676)	84,521 (8,486)
	9-14	160,717 (14,121)	68,180 (7,246)	92,537 (9,059)	86,149 (8,595)	35,983 (4,493)	50,166 (5,768)
	15-19	35,880 (4,483)	10,197 (1,758)	25,683 (3,504)	25,763 (3,512)	6,474 (1,279)	19,289 (2,826)
	20-29	13,558 (2,207)	6,080 (1,218)	7,478 (1,425)	7,169 (1,381)	2,275 (595)	4,894 (1,026)
	30+	3,575 (830)	1,169 (368)	2,406 (614)	1,267 (393)	573 (218)	694 (250)
Tonsillectomy with or without Adenoidectomy	All	957,652 (55,227)	441,648 (30,271)	516,004 (34,115)	617,076 (39,193)	267,325 (20,618)	349,751 (25,307)
	<=4	172,169 (14,837)	98,178 (9,528)	73,991 (7,709)	100,129 (9,689)	58,055 (6,420)	42,074 (5,043)
	5-8	362,986 (26,036)	184,732 (15,579)	178,254 (15,202)	193,428 (16,065)	104,251 (10,024)	89,177 (8,793)
	9-14	191,070 (15,936)	78,633 (8,069)	112,437 (10,676)	120,193 (11,276)	47,093 (5,489)	73,100 (7,638)
	15-19	115,054 (10,880)	35,063 (4,407)	79,991 (8,172)	100,025 (9,680)	24,723 (3,406)	75,302 (7,812)
	20-29	84,194 (8,464)	32,745 (4,185)	51,449 (5,861)	75,640 (7,839)	22,305 (3,150)	53,335 (6,026)
	30+	32,179 (4,129)	12,297 (2,046)	19,882 (2,879)	27,661 (3,696)	10,898 (1,857)	16,763 (2,576)

Table 2

Estimated rate per thousand (with standard error) of all listed operations of tonsillectomy without adenoidectomy and tonsillectomy with adenoidectomy for persons discharged from short stay hospitals by age and sex: U.S. 1970 and 1977

Operation	Age	1970 Total	1970 Male	1970 Female	1977 Total	1977 Male	1977 Female
Tonsillectomy without Adenoidectomy	All	1.106 (.089)	0.828 (.085)	1.363 (.124)	1.018 (.082)	0.652 (.070)	1.360 (.122)
	<=4	0.246 (.054)	0.269 (.069)	0.223 (.063)	0.257 (.058)	0.354 (.087)	0.156 (.049)
	5-8	0.487 (.092)	0.502 (.113)	0.472 (.109)	0.650 (.117)	0.610 (.134)	0.691 (.148)
	9-14	1.219 (.159)	0.825 (.142)	1.628 (.236)	1.513 (.192)	0.969 (.165)	2.078 (.292)
	15-19	4.219 (.432)	2.670 (.367)	5.746 (.646)	3.597 (.374)	1.772 (.265)	5.412 (.604)
	20-29	2.471 (.260)	2.018 (.273)	2.860 (.339)	1.887 (.200)	1.141 (.165)	2.586 (.299)
	30+	0.303 (.040)	0.252 (.043)	0.347 (.053)	0.254 (.034)	0.214 (.037)	0.290 (.045)
Tonsillectomy with Adenoidectomy	All	3.693 (.226)	3.772 (.271)	3.619 (.258)	1.890 (.132)	1.959 (.161)	1.826 (.150)
	<=4	9.799 (.851)	10.968 (1.068)	8.583 (.900)	6.318 (.615)	7.102 (.795)	5.497 (.663)
	5-8	22.611 (1.630)	22.575 (1.917)	22.650 (1.944)	13.420 (1.132)	14.261 (1.380)	12.565 (1.259)
	9-14	6.457 (.567)	5.382 (.572)	7.570 (.741)	3.829 (.382)	3.140 (.392)	4.545 (.521)
	15-19	1.912 (.239)	1.095 (.159)	2.717 (.371)	1.248 (.170)	0.629 (.124)	1.864 (.273)
	20-29	0.474 (.077)	0.460 (.092)	0.486 (.093)	0.198 (.038)	0.130 (.034)	0.261 (.055)
	30+	0.038 (.009)	0.027 (.008)	0.048 (.012)	0.012 (.004)	0.012 (.005)	0.013 (.004)
Tonsillectomy with or without Adenoidectomy	All	4.798 (.277)	4.599 (.315)	4.983 (.329)	2.908 (.185)	2.610 (.201)	3.186 (.231)
	<=4	10.045 (.866)	11.237 (1.091)	8.806 (.918)	6.575 (.636)	7.456 (.825)	5.653 (.678)
	5-8	23.098 (1.657)	23.077 (1.946)	23.123 (1.972)	14.070 (1.169)	14.872 (1.430)	13.236 (1.305)
	9-14	7.676 (.640)	6.208 (.637)	9.198 (.873)	5.342 (.501)	4.109 (.479)	6.623 (.692)
	15-19	6.132 (.580)	3.765 (.473)	8.463 (.865)	4.845 (.469)	2.401 (.331)	7.276 (.755)
	20-29	2.945 (.296)	2.479 (.317)	3.346 (.381)	2.085 (.216)	1.271 (.179)	2.848 (.322)
	30+	0.341 (.044)	0.279 (.046)	0.395 (.057)	0.267 (.036)	0.226 (.038)	0.302 (.046)

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Footnotes

[1] This amount is based on Bluestone's estimate of $670 per operation (including hospital charges and laryngologist's fees) [2].

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Some Methodological Issues in the Production of National Health Manpower and Facilities Statistics

Concurrent Session G

METHODOLOGY FOR OBTAINING NATIONAL COUNTS OF HEALTH PROFESSIONALS

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1. Introduction

There is a need to know the total number of people who are licensed to practice in individual health professions. This number is easy to obtain for individual States since a person will supposedly have at most one license for the profession in any one State. However, many health professionals have licenses in more than one State so that a National count of professionals cannot be found by simply summing licenses over the States. NCHS is currently faced with this situation for obtaining National figures for optometrists and pharmacists.

Several methods have been suggested for deriving National figures which will represent counts of professionals rather than counts of licenses. To help the reader better appreciate the overall situation as well as the virtues and shortcomings of each method proposed for deriving National counts, reference will be made to the recent National Inventory of Pharmacists. Hence, this Inventory will be described first.

2. 1978 National Inventory of Pharmacists

Pharmacists in the United States were surveyed by mail from February 1977 through June 1979, with the bulk of the pharmacists being surveyed during 1978. Approximately 147,000 questionnaires were sent to licensees and applicants for licenses in pharmacy over the entire survey period. Information was requested of everyone surveyed about names used on both the current and prior licenses, mailing address, birthdate and birthplace, race, ethnicity, sex, principal place of work and residence. If the pharmacist was practicing his profession or, if not working in pharmacy, residing in the State which issued the license, additional information was requested on education and work situation.

The survey was conducted on a State by State basis. For most States the survey questionnaire was sent with license renewal forms and with license application forms. For the three or four remaining States the questionnaires were sent independent of the licensure mechanism. Because licensure cycles varied from 1 to 3 years across the States, the data were collected from the pharmacists at different points in time for individual States. The result is that data for some States are as much as one to two years older than data for some other States.

Each of the 23 States participating in manpower components of the Cooperative Health Statistics System (CHSS) collected and processed the data for the professionals licensed in their respective State and then provided NCHS with a data tape which contains a record for every license held in the State at the conclusion of the survey in the State. The remaining States sent the returned survey forms to the survey contractor for NCHS together with a list of names and addresses for pharmacists licensed within the State at the time the survey began. The contractor processed the data and followed up on nonrespondents included in the lists provided by the States. Since a professional could renew his license in a State without returning the survey questionnaire, it was not possible for the contractor to tell definitely who had licenses at the end of the survey. Hence, a record was included in the State tapes produced by the contractor for every pharmacist listed as being licensed at the beginning of the State survey, regardless of response, except those whose forms were returned by the post office. The result is that some records may be included in some State tapes for people no longer licensed in the profession. It was felt, however, that professionals will probably renew their licenses in at least one State except in the rare instances of retirement or death. Since most survey questionnaires were sent with license renewal forms, it was assumed when the post office returned the forms that the pharmacist had moved and was not interested enough in retaining a license with that State to send the licensure board a new address so he could renew the license. The contractor also included records in the State file for new license applicants who returned the questionnaire but not for applicants who failed to return the questionnaire since the contractor was given no information about the non-responding applicants. Hence, it is possible that some people were licensed at the end of a State survey but for whom a record was not included in the State tape.

Survey questionnaires were returned for about 92 percent of the licensees listed at the end of the survey period in each CHSS State. The number of questionnaires returned in the surveys for non-CHSS States was about 80 percent of the total number of licenses in lists provided by States to the contractor minus the post office returns. The 80 percent should be viewed as a lower bound on the response rate for non-CHSS States since it is felt that some nonrespondents probably did not renew their license by the end of the survey in the individual States and, hence, were not really eligible for inclusion in those States' surveys.

Obviously the data for nonrespondents are incomplete. For nonrespondents with records in the tapes for non-CHSS States, the only information available is the name and the address used in sending license renewal forms. For nonrespondents to the CHSS State surveys, at least information collected in the normal licensure procedure is available. This varies with State and may include birthdate, birthplace, race, sex, and education.

In addition to complete nonresponse by individuals, there is item nonresponse caused by a respondent's failure to answer every question adequately. As a result of both complete and item nonresponse in the pharmacy survey, the percent of records containing data on a specific item ranges from an average of about 83 percent for education to an average of about 89 percent for birthdate for States whose data tapes have been completely processed thus far.

The data are also subject to respondent errors and data processing errors. No measure exists for the amount of respondent error in the data, but it is assumed to be small in general. Reportedly fewer than 1 percent of the individual characters in the data files are erroneously punched or coded. While these errors may be small, they must also be considered when designing procedures to produce a National count of professionals from the State files.

After all State tapes are edited and put in a standardized format, they will be merged into one file so that a computerized process can be used to help derive a National count of people licensed in the profession.

3. Methods for Obtaining Counts of Professionals

As indicated earlier several methods have been suggested for deriving a national figure for the number of licensed professionals. Each of the methods suggested for National counts will now be discussed in turn. It will be assumed for each that a file containing a record for every license in the nation exists or can be constructed.

3.1. Record Linkage

The simplest concept that may be used for producing National counts is that of linking records for individuals by using information which uniquely identifies each individual and then removing the duplicate records from the file. In selecting an identifier for use in linking records, care must be taken to select one which can be obtained with reasonable assurance in most if not all the records in the file. Obviously the item chosen as an identifier must be unlikely to be identical for two or more individuals.

Names by themselves are not unique since two or more people can share a common name. Indeed, at least two distinct pharmacists have already been found who share an unusual name.

A well known example of an identifier that is unique is the Social Security Number. Supposedly no two people have the same number. However, professionals are reluctant to report this number and, hence, it is not proposed for use in solving the problem at hand.

Birthplaces are not unique to individuals in general, it is unlikely that two people in the same profession were born in the same city and, even if two such people were born in the same city, it is very unlikely that their names would be the same. However, in the pharmacy survey, the response rate for birthplace was only 85 percent on the average with as few as 60 percent responding for the item for some States. Also, in retrospect, it is felt that those born in other countries would not correctly report the birthplace in some instances. Hence, it was decided that birthplace should not be used in an attempt to link records.

A substitute that has been proposed for birthplace in future surveys is the town or city of professional work on a fixed date, say January 2, 1980, or if the person did not work in the profession at that time, the town or city of residence. The place of work or residence on a fixed date by itself will not be unique, especially for individuals in more densely populated areas of the country. However, it will be very unlikely that two professionals working or living in the same town or city on the same date will have the same name so that the combination of that town or city and name may be considered a unique identifier for most professionals. It is believed that most professionals would be willing to report the city or town of work or residence for a fixed date. At least, in a preliminary feasibility test, all three pharmacists who were asked in June of 1979 where they worked on January 1, 1977 named a place.

Whatever item is chosen as an identifier for a linking operation, data processing errors and nonresponse in the item will prevent linkage of records pertaining to an individual. Variation in response given for the identifier between records for an individual will also prevent linkage. Hence, one cannot depend solely upon a single linking operation to derive National counts.

3.2. Record Matching

Instead of using only a unique identifier to link records, other pieces of available information common to records in the file may be used to match records for the same individual. Records can be matched when unique identifiers are absent but the accuracy of the result is not as sure. As is the case for unique identifiers used in a linking process, the information chosen for use in the matching process should be available in most if not all records in the file and it should be fairly constant across all records for the individual.

In the pharmacy survey, name and address are available in every record and may be used for matching with some exceptions. An individual's name may differ between two records due to marriage or court decree which occurs between responses to the survey from different States. An individual may also choose to use different abbreviations or nicknames on licenses from different States. To assure that all records pertaining to an individual are identified, even when the individual used different names on licenses from different States, records will be matched using both the name on the current license and the name reportedly used by the individual for a prior license, both of which names are requested in the survey.

Addresses for an individual will differ if the individual moves between the times data are collected about the individual. Since most people do not move very often, most individuals will have only one address over the entire survey period that can thus be used to help confirm matches between records pertaining to the individual.

Birthdate, birthplace, sex, race, and education are also available for use in matching records and they are constant for every individual over time in the survey. As noted earlier, data is available on the average in 83 to 89 percent of the records in the State tapes.

In a match operation, there is plenty of room for errors, especially where information used in the match is missing, incorrectly keypunched or coded, or misreported on one or both records that

are compared. For example, in the absence of birthdates or year of graduation, two records could appear to pertain to the same person when in fact the two records may be for a father-son pair, one or both of whom did not use a generation code such as Jr. or Sr. on their licenses. Two records pertaining to the same person may appear to belong to distinct individuals if a nick-name or an abbreviation is used in one of the records and not the other and only a mailing address is present in one of the records and it differs from the address in the other record. Keypunch and coding errors or response errors in the name, birthdates, etc., may also make two records appear to pertain to different individuals even when all data items are present in both records.

In addition to the things already mentioned, a major problem with the matching process is due to computer limitation. Because the computer will only match records in the sequence in which records occur in the files, it is possible that two records pertaining to the same individual will never be compared for determining their match status. This is particularly true if processing or reporting errors occur in the critical data item used for sequencing records. In the match process presently proposed for obtaining National counts, the files are sorted four different ways, each using a different set of data items, in order to assure that even records with errors will have a chance to be compared if they pertain to the same individual. For example, the first item used in one sort will be the last name while in another sort the first item used will be the first name. The match operation will then be done for each of the four sorts. It is possible that duplicate pairs of records will be obtained as a result of the four separate match operations but the computer can eliminate the duplicate pairs easily.

3.3. Record Weighting

The process of matching records is tedious and subject to various errors. To avoid the complexities of matching, it has been suggested that instead of trying to purge the files of duplicates, leave all records in the file and simply assign a weight to each record in such a manner that the sum of weights for all records pertaining to any one individual will equal one. The number of individuals licensed in the particular profession would then be the sum of weights over all records in the file.

For example, the stipulated condition on the weights could be satisfied if the weight assigned to each record were the inverse of the number of States in which the individual were licensed. If an individual were licensed in 4 states, then the weight assigned to each of his records would be one-fourth and his four records would contribute a total of 4 X 1/4=1 to the National count of professionals when all the weights are summed.

Computation of such weights requires information from the professionals. The information needed for each record should be constant over the period of time in which the survey is conducted to collect the information. Otherwise the weights computed for all the records pertaining to an individual will not add to one, as required. Consider the case where the information needed is the number of States in which the person is licensed and the present survey which was conducted at different times for different States. The weighting method would produce erroneous National counts because the number of States where an individual held a license can vary over the survey period. If the individual acquired a license between the times he responded to the surveys for different States, then the information on the number of States of licensure included in records pertaining to the individual would differ, thus causing the individual to be improperly counted because his weights would not add to one.

Weights assigned to records pertaining to an individual will also not sum to one if respondent error, keypunching, or coding errors, or non-response occur in information used for the weight.

3.4. Record Sampling

Instead of matching or weighting all the records in the entire file, a simple random sample of records may be matched or weighted to produce estimates for the National counts of professionals. When sample records are matched, these estimates can be produced using an estimator that was first proposed by L. Goodman.[1/] In order to produce an estimate using Goodman's estimator, one must determine the number of persons who have one record, two records, three records, etc., in the sample. These counts are found by matching only the records in the sample. The estimate is produced by inflating each count by an expression that includes the inverse of the probability of selection and, finally summing over the inflated counts. Goodman's estimator is unbiased as long as the largest number of records pertaining to a person is less than the sample size. This condition should easily be satisfied.

Goodman's estimator can have a large sampling variance, especially when there are a large number of individuals possessing more than one license. The problem of producing estimates using Goodman's estimator that would have tolerable variances is addressed in a paper by B. Graubard and R. Casady.[2/] They generalize Goodman's estimator to utilize a simple random sample of disjoint clusters of records. It is suggested that the clusters be formed using identifying information on the records such as a name (records with the same name would be placed in the same cluster) while attempting to keep the clusters relatively small (say no more than five records). If the clustering is done well then the number of persons having records in more than one cluster would be small which should result in estimates that have lower variances.

An advantage to using a sample of records is that matching or weighting is required for a smaller number of records. This means more care and quality control can be exercised in the data collection and processing and in the matching or weighting operation. The resulting reduction in nonsampling errors can offset the sampling error.

4. Summary

To derive National counts of licensed health professionals, one may purge duplicate records for individuals from a file containing records for every license in the nation. This may be done by linking or matching records on the basis of information commonly collected from licenses. On the other hand, one may leave all the records in the file and assign a weight to each record in such a way that the weights assigned to the records pertaining to an individual will sum to one. The National counts produced under any of these methods are subject to error because of response errors, processing errors, and non-response.

Instead of the entire file of records, a sample of the records from the file may also be used with either a matching or weighting scheme to produce National counts. The counts derived on the basis of a sample are subject to sampling error as well as the nonsampling errors which affect the counts derived on the basis of the whole file. However, the sampling error may be offset by reducing the nonsampling errors through better care and quality control in data collection and processing which can be afforded on a sample but not the whole file.

Hence, a number of methods exist for deriving National counts of licensed professionals. The choice among them depends upon the quality of available data and the resources that can be spent on such a project.

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A MULTIFRAME PROCEDURE FOR ESTIMATING UNDERCOUNTS OF FACILITIES IN NATIONAL LISTS

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Introduction

One of the principal components of the national data systems maintained and operated by the National Center for Health Statistics (NCHS) is a series of health facility inventories and sample surveys. This includes the Master Facility Inventory (MFI), the National Hospital Discharge Survey (HDS), national surveys of nursing and personal care homes, and other institutional population surveys.

The MFI, in addition to being a valuable source of national data on the number and distribution of the various types of health facilities in the United States, serves as the sampling frame for the other health facility surveys. It is, therefore, very important that the MFI be kept as complete as possible and that its level of undercoverage be known. MFI coverage is maintained annually through an Agency Reporting System (ARS), composed primarily of state licensure agencies. Measurement of completeness of coverage is accomplished through a procedure called the Complement Survey.

History and Methodology for the Complement Survey

The Complement Survey is an application of a general technique often called "Multiframe Survey." In this application there are two frames, the MFI and an area sample list. From an area probability sample, all institutions found in sample areas are identified and the probability with which each comes into the sample is determined. One can obtain unbiased estimates of the number of institutions in the population by summing reciprocals of selection probabilities associated with sample institutions. Alternatively, an estimate can be obtained by adding the number of facilities in the MFI to the weighted sum of facilities in the area lists that are not on the MFI. The precision of estimates based on this latter procedure is largely a function of the completeness of the list frame; the more complete the list frame, the smaller the relative standard error of the estimated undercoverage.

Even though an area probability sample could be designed to maximize the chance that health facilities and institutions are located in sample areas, it has been believed that circumstances do not justify the cost of an independent survey for this purpose alone. Thus, beginning with the first survey in 1963, the Complement Survey has been conducted in conjunction with an ongoing survey.

The first Complement Survey was based on the design of the National Health Interview Survey (HIS). The sample for this survey included all of the segments (clusters of about 6 housing units each) that were in the HIS design between 1957 and 1962 for a total of about 36,000 segments. Institutions located in those segments, either fully or partially, were matched with those listed in the 1963 MFI. About 100 institutions were found in the area segments and only 4 of these were not listed on the MFI. The gross undercoverage was estimated to be of the order of 5 percent in terms of places and 2 percent in terms of beds. This evidence was interpreted to mean that actual gross undercoverage was less than 10 percent for places and less than 5 percent for beds, meaning that the relative standard errors of estimates were of the order of 50 percent. Although the standard errors of estimates were large, the survey provided evidence that the types of places omitted from the MFI tended to be small and primarily were places providing nursing and personal care to the aged and infirm.

Several complement surveys have been conducted since 1963. Some were in conjunction with the HIS, and others were conducted as part of the Current Population Survey (CPS). Although useful to provide gross undercoverage estimates, none of these efforts proved to be totally satisfactory because of a basic sample design change made in 1963 in both HIS and CPS. Instead of sampling compact clusters of housing units, using an area frame, segments were formed from lists created during the 1960 Decennial Census. Newly constructed housing units since 1960 were represented in the sample by a sample of building permits issued since 1960. Unfortunately for the Complement Survey, the sample of building permits did not include new construction of hospitals and institutions since both HIS and CPS exclude the institutional population. The current HIS and CPS designs still use list sampling in urban areas, and therefore they are less than ideal instruments to measure undercoverage in the MFI.

The 1980 Complement Survey

The 1980 Complement Survey is being conducted under contract between NCHS and the Research Triangle Institute (RTI). It is being done in conjunction with the National Medical Care Utilization and Expenditure Survey (NMCUES) that RTI is conducting, in collaboration with the National Opinion Research Center (NORC), for NCHS and the Health Care Financing Administration (HCFA).

The national area probability sample for NMCUES, based on two independent samples (one selected by RTI and the other by NORC), is being employed as the Complement Survey sample. The RTI sample consists of 16 self-representing Primary Sampling Units (PSU's) and 43 PSU's selected with probability proportioned to 1970 population size. For NMCUES, there were three or more sampling stages within each PSU, resulting in 404 segments of about 60 addresses. Sample housing units to be included in the survey were finally selected from among these addresses. The NORC design is somewhat similar, consisting of 76 PSU's and 405 segments of approximately 100 addresses each from which NMCUES sample housing units were selected. The geographic area encompassed by a PSU is generally a county or group of counties; the segments, while varying in size depending on population density, are generally about the size of a city block.

The 1980 Complement Survey is a research project designed to develop a methodology for making estimates of MFI undercoverage that have minimum mean square errors. Basically, the study requires "canvassing" of different sized sample areas to identify facilities that exist within their respective boundaries. One level of canvassing is at the PSU level (PSU Canvass) and another at the segment level (Segment Canvass). One would expect that undercoverage estimates based on the PSU Canvass would be more precise than estimates based on the Segment Canvass. On the other hand, one would expect that the canvass would be more accurate for small areas, especially for small facilities that may be less visible than a large hospital or institution, for example. Also, canvassing within small areas involves actual observations while walking or driving through the areas, while PSU-level "canvassing" involves searching and collating lists such as telephone or other published directories, querying officials, and so forth, which is a somewhat subjective procedure. An important feature of the design is that the Segment Canvass must be done independently of the PSU Canvass since an important part of the study is to compare estimates from the two procedures.

The Segment Canvass

Two field data collection activities, the Segment Inspection and the Sample Unit Inspection were included in the Segment Canvass. The NMCUES field staff also served as the data collection staff for the Segment Canvass. Each data collector received training at a standardized group training session conducted by the RTI/NORC field supervisor to whom he/she would report during fieldwork.

The Segment Inspection activity required that a field data collector visit each of the 809 RTI/NORC sample segments to inspect the geographic area included in the segment for inpatient health facilities. Field assignments included, for each segment, a sketch map with segment boundaries clearly delineated and a larger area map showing the location of the segment in relation to communities, highways, and other observable features. If, on arrival at the segment, the data collector could not identify the boundaries with certainty, RTI/NORC statisticians were contacted for assistance. Once the boundaries were identified, the data collector travelled through the entire area to identify all existing facilities of interest, paying particular attention to structures such as unidentified storefront buildings, complexes of institutional-style buildings, and other places that might contain a hidden facility. Finally, a knowledgeable resident of the area was asked to review the segment sketch map and brief definitions of the types of facilities to be identified and to advise the data collector of any known facilities within the area. The results of the inspection were recorded on a listing form for review and processing at RTI/NORC. As a quality control procedure, supervisors independently inspected a randomly selected sample of at least ten percent of each data collector's work.

The Sample Unit Inspection activity was intended to obtain data on hidden facilities, within apparent residential units, that might be of especial significance to the analysis. NMCUES required that more than 8,000 sample housing units and group quarters, selected from the listed addresses within the 809 area segments, be contacted and screened to determine the presence of defined reporting units (e.g., families, individual residents, unrelated lodgers, etc.) for which interview data would be gathered. In completing this screening, data collectors determined whether the unit was or was not associated with an inpatient health facility. Results of these investigations within each segment were reported to RTI/NORC on a special form. Quality control procedures were again implemented to independently validate a randomly selected sample of at least ten percent of each individual's work.

The PSU Canvass

The objective of the second component of the Complement Survey, the PSU Canvass, was to develop comprehensive lists of inpatient health facilities within the entire area of each PSU of the RTI/NORC sample. Because of the size of each PSU, application of direct investigative procedures such as those used in the Segment Canvass was not feasible. It was important, therefore, to determine the most productive sources and the most efficient canvassing methods. Those selected included national, state, and local-level sources that would likely provide maximal data at reasonable cost.

Consideration of national sources led to the decision to search selected, published national directories and to include an available national file of health providers not previously used in the development of the Master Facility Inventory.

In preparation for the national directory search, an investigation was conducted to identify and select the most appropriate directories. Selection was based on comprehensiveness, availability, cost, copyright date, and uniqueness. The investigation included computer searches of relevant bibliographies; review of the resources of large university, public, and specialized libraries; and contacts with national organizations that might have lists or directories of health facilities. Once selected and acquired, the directories were searched to identify facilities within the RTI/NORC PSU's.

While various Federal agency lists or directories had been used to develop and update the MFI, recent developments indicated that master files might have been developed that could be of particular importance to MFI maintenance. Investigation revealed that one of the national files that might be most valuable is the Master File of Health Care Providers maintained by the Health Care Financing Administration. This file will be included as a PSU Canvass, national-level data source.

State sources contacted for assistance included governmental and non-governmental agencies and organizations. Telephone contacts, with follow-up letters explaining the purpose and requirements of the survey as necessary, were made with appropriate state governmental agencies and state-level offices of health-related professional organizations in the 37 states in which PSU's were located. To avoid duplicate

contacts, an exception was made to the otherwise independent nature of the RTI/NORC Complement Survey data collection effort. States unique to the NORC sample were assigned to RTI while states unique to the NORC sample were assigned to NORC; the remaining states were randomly assigned.

One of the objectives of the Complement Survey, in addition to the major objective of measuring the coverage of the MFI, is to evaluate the overall effectiveness of the Agency Reporting System (ARS), which depends largely on input from the state government level. Thus, it was considered important to include data from such sources and two approaches were used to acquire such information. For those states that were contributors to the ARS through a Cooperative Health Statistics System (CHSS) facilities component, the office of the individual responsible was telephoned; for other states, the state health officer or other appropriate official was called. If the individual contacted initially indicated that a list could be furnished, the RTI/NORC caller probed to determine whether the list would be comprehensive (i.e., include all facilities of interest known at the state governmental level) and, if so, requested that it be furnished. If it seemed that the list would not be comprehensive, information was sought about other potential sources. Such sources were then contacted for assistance in obtaining the desired lists.

Also on the state-level, extensive efforts were made to obtain data from non-governmental sources. During contacts with state government representatives, RTI/NORC callers asked for information about such sources that might have knowledge of inpatient health facilities within the state. In addition, telephone directories from capital city areas of states within which PSU's were located were searched to identify organizations that might be able to assist with the list compilation. Each was sent a mailing with a letter explaining the purpose of the study and requesting that an accompanying form, on which sample counties within the state were listed, be completed by entering the name, address, and telephone number (and administrator's name, if known) of each potential MFI facility known to exist in each sample county. Provision was made on the form to indicate that the organization had no knowledge of inpatient health facilities. Organizations that did not respond within a reasonable period of time were contacted by telephone interviewers, who used standardized follow-up procedures to complete a list, obtain commitment to mail a list, or determine that the organization could not furnish needed information.

Procedures similar to those employed for state-level contacts were implemented to obtain data from local-level sources. Efforts were made to obtain lists of facilities within PSU's from county and municipal governmental departments and from appropriate non-governmental organizations that might be aware of facilities to whom they referred clients which, because of variances in state reporting and licensing requirements, might not be known to state-level sources. To determine the most productive procedures for obtaining data at the local governmental level, a small pilot study was conducted to compare results of personal visit and telephone contact approaches. It was determined that telephone contacts would be efficient and productive. Calls were made to Departments of Health (or similar sources) for counties and major municipalities within RTI/NORC PSU's. The caller explained the survey and requested assistance in obtaining lists and identifying other governmental data sources within the geographic area of interest. Follow-up calls were made as necessary to identified sources to obtain lists of facilities of which each had knowledge.

As at the state-level, extensive contacts were made with local non-governmental organizations to obtain information about any facilities that might not be known to local governmental units. Current telephone directories were searched, mailings were made to organizations identified as potential data sources, and telephone follow-ups were made to organizations from which a response was not received within a reasonable time.

A comprehensive telephone directory search activity was included in the PSU Canvass as an additional source of local-level information. Telephone exchanges serving RTI/NORC PSU areas were identified and directories obtained. Trained clerks, working with close supervision, searched the Yellow Pages of all directories and developed lists, by PSU and county, of inpatient health facilities identified.

As part of the Complement Survey, a special effort is being made to assess the effectiveness of telephone directory Yellow Pages as a source for the development of lists of health facilities. Based on the assumptions that facilities do have telephones but that all facilities are not listed in the Yellow Pages, a sample of white pages from each directory was searched and facilities identified were listed. Lists prepared from Yellow Pages will be compared with lists from the associated white pages and the results used to construct estimates of Yellow Page coverage.

Identifying and Surveying Non-Matches

Facility information from the various sources was received in a variety of formats. While many respondents had listed facilities by type and by county on the Complement Survey form furnished by RTI/NORC, others provided photocopies of existing lists, computer printouts, and printed directories. All materials were edited upon receipt and, if necessary, relevant data was abstracted onto a Complement Survey form. The editing process included reviews to insure that entries were complete and that appropriate codes (e.g., general source codes, county codes, PSU numbers, etc.) were correctly assigned.

In preparation for matching with the MFI lists, the data was keyed and machine-readable files produced. Consolidated lists were then computer generated, resulting in printouts of facility information for each PSU. Within PSU, the data was listed by county, and for each county was ordered by type of facility and alphabetically by facility name.

The consolidated lists were then matched against similarly formatted lists produced from the MFI tape. Trained clerks at RTI and NORC

independently compared each organization's Complement Survey lists with the MFI lists. Non-matches were identified as potential "new-births" (i.e., facilities that are not on the MFI) and as "MFI non-matches" (i.e., MFI facilities that are not on the Complement Survey list).

RTI and NORC will each survey the potential "new-births" within their respective national samples. The survey will be conducted to obtain data necessary to determine whether the identified unit is, indeed, a facility as defined for the MFI. A brief, one-page questionnaire will be mailed to each facility along with a letter explaining the purpose of the survey. Follow-up mailings and telephone calls will be made to facilities for whom a response has not been received within a reasonable time to insure that maximal response is achieved.

Analysis of Complement Survey Results and Methods

Analysis of the Complement Survey data will be conducted by RTI statistical scientists. The analytical activities will be designed to provide estimates of MFI undercoverage, evaluations of the Agency Reporting System input to the MFI, and recommendations concerning the most effective methods for updating and evaluating the MFI in the future.

The major analytical objective will be to furnish estimates of current MFI undercoverage. Appropriate statistical techniques will be applied, independently, to Segment Canvass results and to PSU Canvass results to produce estimates from each for the three main types of facilities included in the MFI (hospitals, nursing homes, and other inpatient health facilities) as well as an estimate of overall MFI undercoverage. Application of RTI and NORC segment weights to non-match facilities identified as in-scope as a result of the Segment Canvass will provide national estimates of facilities not included in the MFI; similarly, application of PSU weights to non-match facilities identified by means of the PSU Canvass will produce national estimates of excluded facilities based on the PSU-level approach. National estimates produced through a weighted combination of the segment and PSU results can also be produced. Sampling and mean-square errors of the Segment Survey estimates and of the PSU Canvass estimates will be computed and comparative analyses of the two approaches will be made to assess which methods produced the best estimates. Based upon these analyses, national estimates of MFI undercoverage will be reported.

The Complement Survey results will also be analyzed in an effort to assess the effectiveness of the Agency Reporting System (ARS). The undercoverage estimates will, of course, reflect the adequacy of the system. If the estimates for any type of facility point to a significant level of undercoverage, the ARS sources can be assumed to be inadequate and additional evaluation will be recommended.

A specific element of the ARS evaluation will involve comparison of data received as a result of the state-level PSU Canvass activity. Aggregate data received from the states that provide input into the ARS through the CHSS will be compared with aggregate data received from other states. Similarly, data from other sources can also be compared to determine the extent to which data received through the ARS differs in value for MFI maintenance from that received from sources not directly employed in updating the MFI.

Another objective of the Complement Survey is to make methodological recommendations for the continuing maintenance and assessment of the MFI. This will involve consideration of the effectiveness of each major survey component in terms of its suitability for either maintenance or assessment activities and the cost of implementation. Within each component, activities will be similarly evaluated, for example, the contribution to the current survey of lists derived from the various PSU Canvass sources and the cost of obtaining and processing the lists will be considered. Cost data from the Segment Survey and the PSU Canvass will be used to optimize each of the survey activities and their possible variations or combinations in an effort to identify designs that will maximize facility coverage for given total expenditures. Recommendations for future MFI maintenance and evaluation will be based on the results of this analysis.

Summary

The current Complement Survey differs considerably from previous surveys. It is similar in that it includes a component, the Segment Canvass, involving collection of data through field inspections to identify facilities within sample segments of a large, national area probability sample. It differs, however, in the inclusion of the PSU Canvass, which will extensively tap a variety of sources including some never before employed as a source of data for maintenance or evaluation of the MFI. The analysis activities associated with the current survey will be conducted primarily to develop an improved methodology for making estimates of MFI undercoverage. In addition, the Agency Reporting System will be evaluated and documented recommendations for the improvement of future maintenance and evaluation of the MFI will be prepared.

New Applications for Medicare Data

Concurrent Session H

NEW USES FOR OLD DATA: A MEDICARE HOSPITAL CASE MIX INDEX

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I. Introduction

The continuing rapid inflation in hospital costs is both well known and well documented. In recent years, a variety of major reforms to the current hospital reimbursement method have been suggested as partial solutions to this problem. There is general agreement, however, that any new reimbursement method must take explicit account of variations among hospitals in the clinical mix of inpatient cases, if payment equity is to be achieved.

The purpose of this paper is to describe and evaluate a measure of hospital inpatient case mix for Medicare patients, developed in the Office of Research, Demonstrations and Statistics in the Health Care Financing Administration. The intent of the Medicare case mix index (MCM) is to measure the relative costliness of each hospital's mix of Medicare cases.

We begin with a brief overview of the central issues that must be addressed in developing such a measure. Next, we describe the data and the methods used in construction of the Medicare case mix index. In the fourth section we analyze several general types of error that may exist and their effects on the index. We conclude with a brief summary of our findings and their implications.

II. GENERAL OVERVIEW

A. Case Classification

Our intent is to identify the relative costliness of different kinds of cases. There are, however, thousands of diagnoses listed in the ICD-9-CM Manual. Many of these are potential reasons for the admission of a patient to the hospital. In addition, patients with any given problem may have either mild or severe manifestiations; they may have co-morbid conditions on admission or suffer a complicating condition during the stay. Moreover, they may be treated medically or surgically, and surgical treatment may involve procedures with different levels of risk. Finally, the nature of the problem may be only partly understood at the time of admission, requiring both diagnostic and treatment procedures, or it may be fully understood as in admissions for elective surgery.

The number of possible combinations of diagnoses, procedures, complications and admitting status is obviously very large. The number of combinations that occur with significant frequency, however, is much smaller, and many of these are similar in terms of the quantity of resources required in diagnosis and treatment. These facts should permit classification of hospital cases into a manageable number of categories that are reasonably homogeneous in terms of resource use and cost.

Thus, the first requirement in the process of constructing a case-mix index involves the development of these patient categories. The ideal classification system would consist of mutually exclusive categories in which the expected resource use within each category is homogeneous. The categories could then be used to reduce the dimensionality of the data.

B. Cost Weights

The cost of treatment will differ among these categories. Thus, the second requirement in the process of constructing a case mix index is to create a set of weights which measure the cost of treating patients in each category. Then, if the proportion of hospital patients in a given category is multiplied by the cost weight associated with that category and these products are summed across all categories, we obtain a measure of the hospital's expected cost given its case-mix. The hospital's value of expected cost may then be divided by the national average expected cost over all hospitals to create a case-mix index. The index values directly represent the relative costliness of each hospital's mix of cases compared to the national average mix of cases.

III. THE MEDICARE CASE-MIX INDEX

The purpose of this section is to describe the actual construction of the Medicare case mix index. We discuss the method used to classify Medicare patients, the data, the construction of the weights, and the calculation of the index.

A. The Classification System

A patient classification scheme called Diagnosis Related Groups (DRGs) was developed at Yale University using data from a half million records from 118 New Jersey hospitals, 150,000 records from Yale New Haven Hospital and 52,000 records from South Carolina.[1] All diagnoses were initially divided into 83 mutually exclusive and exhaustive categories called Major Diagnostic Categories (MDCs). The specification of the MDCs was developed by a committee of clinicians using the following guidelines: that the MDCs must be clinically consistent; they must have a sufficient number of patients; and they must cover the complete range of codes without overlap.

The set of records in each MDC, screened to eliminate deaths and bad records, was then partitioned, using the CLASSIFY algorithm and a set of prespecified independent variables, to suggest subgroups of cases that may be differentiated with regard to the dependent variable, length of stay (measuring resource use). Suggested subgroups were examined to see if the proposed distinctions were clinically sensible.

The independent variables used to split the Major Diagnostic Categories were intentionally limited to those variables descriptive of the patient that are readily available on most discharge abstracts, such as age, sex, primary and secondary diagnoses and surgical procedures. This process resulted in a set of 384 mutually exclusive and exhaustive categories.

The patient classification categories used to classify Medicare cases are a subset of the 384 Yale DRGs. Three pairs of Yale DRGs were

distinguished on the basis of specific clinical information not available in the Medicare data. Therefore they were collapsed to three more general categories. In addition, Yale DRG 384 contains cases with diagnosis "unknown." On the assumption that this means diagnosis unrecorded, this DRG was excluded from the calculation of the case-mix index. Further exclusions resulted from the application of a statistical reliability criterion described in the section on index calculation below.

The remaining categories represent collections of patients that are reasonably homogeneous with respect to length of stay. Given that the DRG's were separately derived for each Major Diagnostic Category (MDC), and given the high correlation between length of stay and the cost of care within MDC's, it is likely that many DRG categories are also reasonably homogeneous with respect to resource use.

B. The Data

The Medicare Program reimburses hospitals for inpatient care provided to its beneficiaries on the basis of incurred costs as reported to fiscal intermediaries. Although hospitals are not paid accumulated charges for each Medicare discharge, they also submit a detailed bill for services rendered to each Medicare patient. For each beneficiary whose social security number ends in 0 or 5, the hospital submits a narrative description of the patient's diagnoses and surgical procedures along with the charge information on the bill. When these sample bills reach the HCFA central office, the diagnostic information is coded in the ICD-9-CM coding system and then translated to ICDA-8 codes. Surgical procedure information is also coded in the ICDA-8 system. The coded clinical information and the billed charge data are maintained in a statistical file called MedPAR (MP). For 1978 this file contains approximately 1.7 million sample patient records.

The Medicare cost report (MCR) provides a source of audited cost data for all hospitals reimbursed under the program. The hospital uses certain allocation principles and exclusion rules (e.g., Medicare does not pay any portion of the cost of treating pediatric patients), to derive the estimated Medicare share of total allowable costs and Medicare costs per Medicare patient day. (In general, Medicare pays the estimated Medicare cost per day for each day of care provided to a Medicare beneficiary). On specific schedules of the Medicare Cost Report the hospital reports data on Medicare per diem routine costs, Medicare special care per diem costs and on the ratio of cost to charges for each hospital ancillary department. These data were available for each of 5,662 hospitals in 1978.

C. Construction of the Cost Weights

Given these data and the DRG classification system, cost weights for the case-type categories can be calculated in six steps.

Step 1. Classify all cases into DRGs.

Step 2. Compute adjusted cost for each case.

The second step in the calculation of the weights is to create an adjusted cost for each case by (1) multiplying the number of days the patient spent in a regular room (MP) by the hospital's routine cost per day (MCR); (2) multiplying the number of days the patient spent in a special care unit (MP) by the hospital's special care unit cost per day (MCR); (3) multiplying the ancillary charges (MP) by the relevant departmental cost to charge ratios (MCR). These adjustments are intended to make the billed charges more comparable across hospitals by eliminating at least the gross effects of cross-subsidization between hospital service departments.

Step 3: Adjustments for Variation Due to Teaching Activity and Hospital Wage Levels.

The next step is to adjust the data for the effects of variations in the level of teaching activity and hospital wage rates so that the cost values will be comparable across hospitals. Although space limitations prevent a full description, these adjustments are essentially computed by successively dividing the adjusted cost values by (1) an index of teaching activity based on residents per bed from annual Medicare institutional certification surveys, and; (2) an index of hospital wage levels based on hospital employment and earnings data, for SMSA and non-SMSA areas, from the Bureau of Labor Statistics.

Step 4: Elimination of Outlier Cases from Each DRG.

We know that some of the cases in each DRG are misclassified or are extreme values for other reasons. In order to prevent unusual cases from affecting the weights, maximum and minimum cost values are defined for each DRG. Cases beyond these limits are removed from the calculation of the weights.

Step 5: Computation of the Weight.

The weight for any DRG is the arithmetic mean of the remaining standardized costs.

Step 6: Elimination of Unreliable DRG's.

The mean value computed in step 5 is the weight for each DRG. However, some DRG's contain so few cases that the mean values are unreliable, and should be eliminated. Given the observed variation in the cost values in any DRG we developed an estimate of the minimum number of cases that the DRG must contain in order to meet a pre-established precision criterion. This resulted in the elimination of 52 DRG's and, along with the four DRG's eliminated earlier, left 328 DRG's as the basis of the Medicare case mix index.

D. Calculation of the Case Mix Index

For any hospital (h), we can now calculate the proportion (P_i) of its sample patients falling into any of the remaining DRG's. These proportions multiplied by the weights, (W_i) from step 5, and summed across all DRGs give a measure of the relative costliness of the hospital's case mix.

This value (CM_h), is converted to index form by dividing by the national average (CM_N). For hospital "h" this is:

$$CM_h = \sum P_i W_i$$

$$CMI_h = CM_h / CM_N$$

This series, for all hospitals, is the Medicare case mix index.

IV. Evaluation of the Reliability and Validity of the Index

It would be irresponsible to consider implementing a new reimbursement method, in which the case mix measure would be a key element, if the measurement process was invalid or unreliable. There are at least two approaches to this problem.

First, we can identify, and assess the significance of, a variety of problems in the data used to construct the index. That is, we can evaluate the sensitivity of the index values to various kinds of data errors. The second approach is to examine the relationship of the case mix index to other key variables in light of our a priori expectations. The key findings of each of these approaches are discussed below.

A. Problems with the Data and Their Effects on the Index

Given the characteristics of the data and the method of construction, the index values may be distorted by three general types of errors: sampling error; inaccurate adjusted cost values for individual cases, and; classification error in assigning cases to the DRG's. In this section we describe the sources of these errors and their effects on the key components of the index - the case type proportions and the category weights.

1. Sampling Error

The Medicare case mix index is based on claims data from the MedPar file. These data represent a 20 percent sample of all Medicare inpatient hospital bills rather than a 20 percent sample of the bills submitted by each hospital. As a result, we know that some low volume providers (usually small or specialty hospitals), will have too few cases in the file to permit the calculation of reliable estimates of their Medicare case mix index values.

Our analysis of this problem showed that we must have at least 20 records for any hospital in order to meet our reliability criterion. Therefore we eliminated all hospitals with less than 50 beds and children's hospitals from further analysis, leaving 4,113 of the original 5,662 hospitals.

2. Errors in the Adjusted Cost Values for Individual Cases

Potential errors in the estimated cost values may arise from our use of hospital-wide average values (for routine per diem costs, special care per diem costs and departmental cost to charge ratios), in computing the adjusted cost values for individual cases. These cost values should be expected to vary from one DRG to another. In addition, the adjustments that are made in order to remove the effects of variations among hospitals in teaching activity and wage levels, may be inaccurate for some hospitals. They are certainly inaccurate for individual DRG's.

The combination of these errors will affect the distribution of the standardized cost values in each DRG. Therefore, they have the potential to reduce the reliability of the estimated DRG weights. Although the extent of each type of error is unknown, it is reasonable to suppose that the magnitudes of the net errors in the means of the DRG cost distributions (weights), are generally quite small. We would also expect, however, that the direction of the error in the weights would vary by DRG category, with low cost categories biased upward and high cost categories biased downward. Thus the net effect of these errors is to compress the weights somewhat.

3. Classification Errors.

Classification errors in the assignment of cases to case type categories (DRG's), arise from inaccurate clinical data and from grouping cases (based on the category definitions), that are dissimilar in terms of resource use.

a. Errors in the Clinical Data

The nature and extent of the problem of errors in the clinical data have been well described in a study performed by the Institute of Medicine[2]. In that study the authors noted the finding that the error rate for principal diagnosis codes declined as cases were aggregated from the fourth digit level of the ICDA code to the level of the DRG's. Nevertheless, between 20 and 30 percent of the records in the MedPAR file may be expected to have an erroneous principal diagnosis at the DRG level. In addition, a significant percentage of the records are incomplete. Although secondary diagnoses were present, they were not reported.

These errors in the clinical data have the effect of assigning the cases involved, and their associated cost values, to the wrong DRG. This distorts the proportions of cases in the DRG's for any hospital that reported erroneous or incomplete clinical descriptions. It also affects the distribution of the standardized cost values in each DRG and, therefore, the category weights. The cost values for each DRG (especially categories without secondary diagnoses) will become less homogeneous and the DRG weights will become less distinct than they would be in the absence of data errors.

b. Errors in the DRG Definitions

The second type of error in classification results from improper grouping of dissimilar cases (in terms of resource use), due to inadequacies of the DRG definitions. The IOM did not make any attempt to evaluate the effectiveness of the DRG's in discriminating among dissimilar cases. Thus the extent of this kind of error has not been measured. However, we expect that the effect of classification error will be similar to the effect of errors in the clinical data: as the amount of error increases, the proportions of cases for each hospital become more random; the cost values within each DRG become less homogeneous, and; the DRG weights become less distinct.

The combined effect of the two kinds of classification error (and error in the cost values as well), on the case mix index is complex. The results depend upon the degree to which these errors are random. We know that error rates in the clinical data vary by DRG, and we suspect that errors due to the DRG definitions vary in the same way. What is important here, however, is whether the

difference in costliness, between the correct DRG and the assigned DRG, is random or not, over all DRG categories. It also matters whether the errors in DRG proportions are random across hospitals. If both are random, then the case mix index values will tend to collapse toward the mean value. That is, the case mix index will be less sensitive to real differences in costliness among hospitals.

On the other hand, we know that incomplete reporting of secondary diagnoses will result in allocation of the affected records to lower cost DRGs. The results will be an upward bias in the weights for those lower cost DRGs, a net downward bias in the index values for hospitals that reported incomplete data and a slight net upward bias for hospitals that reported complete data.

4. Error Simulation Results

In order to study this issue further we simulated the effect of random error on the index. Using 1.4 million cases we selected various percentages of the cases at random and reassigned them to different DRG's. On the assumption that a classification error would be more likely to result in assignment of the case to a DRG within the same Major Diagnostic Category (MDC), we reallocated 70 percent of the cases to DRG's within the original MDC. The remaining 30 percent of the selected cases were reassigned to DRG's in other MDC's. Of course, when a case was reassigned, it's cost value was also reassigned.

We then recalculated the DRG proportions for all hospitals and the DRG weights for all categories by same method used originally. With these data and the original data we simulated the case mix index values for all hospitals for three index definitions: erroneous proportions with original weights; original proportions with erroneous weights, and; erroneous proportions with erroneous weights. Table 1 shows the effect of the additonal error on various parameters of the distribution of case mix index values (for the 4,113 hospitals), compared to the parameters of the original index distribution.

Classification error clearly has the effect of compressing the distribution. The range of the index values and the standard deviation of the distribution clearly decreases in the presence of error in either of the index components. The only difference is that the effect of error in the proportions is somewhat more random than that for errors in the weights. The combined effect of errors in both components is similar. In all three cases, the degree of compression increases with the amount of additional error.

The last column of the table shows the correlation between the erroneous index values and the original index values. These values measure the stability of the index in the presence of errors in the components and in combination. The results suggest that errors in the proportions cause more serious distortion than errors in the weights. This should be expected since errors in the proportions affect the index values for individual hospitals directly, while errors in the weights result from the combined effects of errors from all hospitals. Thus, the weights are less sensitive to error.

The compression of the index causes the values to be overstated for hospitals with low values, and understated for hospitals with high values. This effect is increased for hospitals with original case mix values further away from the average case mix. On the other hand, (based on a plot of the results), even with 30 percent error added to the data, the vast bulk of the erroneous index values are within ± 10 percent of the corresponding values in the original index.

B. Relationship of Medicare Case Mix to Other Variables

In evaluating the reliability and validity of the case mix index, it is important to know how errors of measurement affect the index values. It is even more important to know how such errors affect the apparent relationship between Medicare case mix and Medicare cost per case.

The Medicare case mix index is intended to

Table 1

Simulation Results: Effects of Simulated Error on the Distribution of the Case Mix Index

% Error	Parameters of the Index Distribution: minimum	maximum	mean	standard deviation	correlation with original value
			Original Index		
	.588	1.852	1.031	.098	---
			Errors in the Weights		
10%	.592	1.791	1.026	.086	.9957
20%	.590	1.699	1.023	.077	.9879
30%	.590	1.635	1.020	.069	.9751
			Errors in the Proportions		
10%	.584	1.680	1.027	.088	.9733
20%	.590	1.614	1.023	.080	.9279
30%	.587	1.553	1.020	.073	.8618
			Errors in the Weights and Proportions		
10%	.595	1.637	1.023	.078	.9753
20%	.607	1.526	1.018	.064	.9367
30%	.619	1.444	1.014	.054	.8864

reflect the relative costliness of each hospital's mix of Medicare cases. Given the construction of this measure, we expect that a hospital with a 10 percent higher MCM value would have a 10 percent higher Medicare cost per case (MCC), compared to otherwise similar hospitals. That is, if we have been successful, the relationship between MCM and MCC will be proportional. Thus, the validity of the application of the case mix index in reimbursement depends upon how closely its actual relationship to cost per case meets this expectation.

1. Method

In order to evaluate the relationship between the Medicare case mix index and Medicare operating cost per case, we estimated the parameters of a behavioral cost function.[3] The technique used, ordinary least squares regression, allows measurement of this relationship while simultaneously controlling for the effects of other independent variables which are expected to affect costs. These variables include area variation in hospital wages; bedsize; level of teaching activity and the size of the SMSA in which the hospital is located.

The estimated cost function is linear in logarithms. That is, the values of each variable were transformed into logarithms before the cost function was estimated. This approach is based on the assumption that the relationship between cost per case and each independent variable is multiplicative rather than additive.

a. Interpretation of Coefficient Estimates

The coefficients of continuous variables in a cost function of this type are direct measures of the degree to which a relationship is proportional. Coefficient values less than one imply a less than proportional relationship. For example, the wage index (LWI), coefficient value is .82. This means that a 10% increase in the wage index is associated with a 8.2% increase in Medicare cost per case. A coefficient greater than one is interpreted in a similar fashion. A ten per cent increase in the Medicare case mix index value, for example, is associated with a 12.2% increase in cost per case. The empirical estimates for all variables are discussed below.

b. Results.

The estimated coefficient values and associated t statistics (in parentheses), based on data for 4,113 hospitals were as follows:

Estimated LMCC = 7.27 + 1.22 LMCM
(27.67)
+ 0.82 LWI + 0.70 LRES/B
(31.06) (15.41)
+0.05 LBEDS + 0.06 SVC + 0.11 MCV
(7.44) (5.24) (10.86)
+0.22 LCV
(20.19) Adjusted r^2 = .72

The regression "explains" 72% of the variation in Medicare cost per case for the included hospitals. The coefficient values are generally as expected. After controlling for other factors which influence hospital costs, case mix (LMCM), has a significant independent effect. However, the coefficient (1.22) is significantly higher than we anticipated. The coefficient of the wage index (0.82), is the same as the share of hospital expenditures attributable to labor-related costs in the HCFA market basket. The city size dummy variables (SCV, MCV, LCV), indicate that hospitals in cities are more expensive than otherwise similar rural hospitals. This effect increases with city size. The bedsize coefficient is significant and positive. Larger hospitals are more expensive on a per case basis.

Teaching activity (RES/B), bears a significant positive relationship to cost per case, even when case mix differences are controlled for. Given the definition of this variable, its coefficient in the equation has a different interpretation than that of continuous variables such as case mix. A simplified interpretation is that the coefficient value of .70 implies that the hospital's estimated cost per case would be increased by approximately 7.0% for every additional .1 in its resident to bed ratio. Thus a teaching hospital with a ratio of FTE residents to beds of .2 would be expected to have costs per case about 14.0% higher than an otherwise identical hospital with no residents.

2. Potential Distortions in Measured Relationships

The coefficient of MCM is greater than anticipated i.e., the effect of case mix is more than proportional. There are two reasons for the discrepancy; at least one significant ommitted variable, and errors of measurement in the included variables. All coefficient estimates are affected in various degrees by these problems. Given its importance in this evaluation, these problems are described in terms of their effects on the coefficient estimated for MCM.

a. Omitted Variables

An omitted variable is an important but unmeasured factor in a relationship. If this unmeasured factor is positively correlated with both the dependent and the independent variables in a regression, the coefficient estimates of the included independent variables will be biased upward.

An example of a variable omitted in this analysis is the hospital's overall case mix. This variable is positively correlated with MCC and MCM. Therefore the coefficient estimated for MCM includes the co-variant effect of this omitted variable. As a result, (at least) the MCM coefficient estimate is biased upward. This is true for any included variable (wages, teaching, bedsize, SMSA size) that is also positively correlated with overall case mix.

A similar case results from the fact that we were not able to remove the costs of salaried physicians from Medicare total operating costs per case (the dependent variable). It is reasonable to suppose that these costs are positively correlated with both case mix and teaching status. If so, this problem will also bias our estimate of the effects of both variables upward.

b. Errors in the Case Mix Index

The second reason the coefficient value is greater than one is the effect of errors in the

case mix index. We have shown earlier that the net effect of errors in classification is to reduce the variance of MCM.

In order to study the effect of this problem we re-estimated the cost function using the erroneous case mix index values from the error simulation. Table 2 shows the effect on the estimated MCM coefficients of introducing various percentages of additional error in the case mix index. As the additional error rate moves from 5% to 30%, the coefficient of MCM increases. Thus error in the variable causes the coefficient estimate to be biased upward.

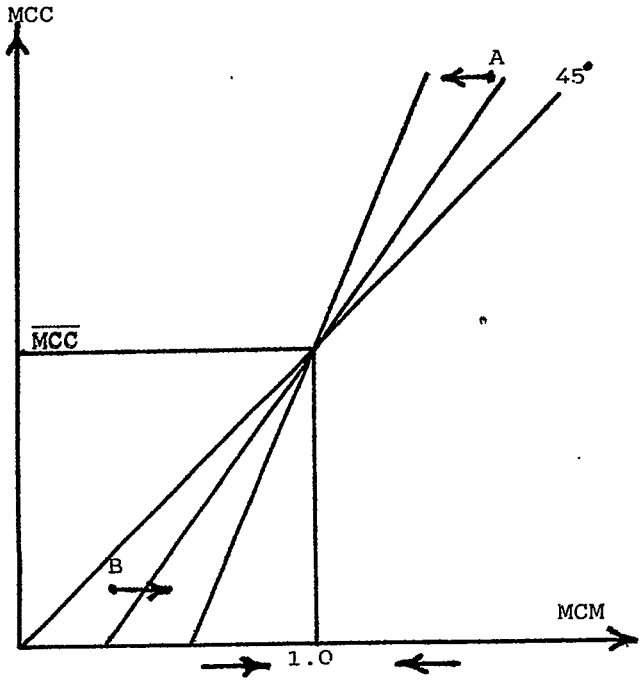
TABLE 2- Effect of Additional Error on Coefficient Estimates

% Additional Error	Estimated Coefficient
0	1.20*
5%	1.28
10%	1.36
15%	1.44
20%	1.50
25%	1.54
30%	1.60

* These coefficients were estimated on a data set that contained only 1.4 million records for 3,996 hospitals.

The explanation of this result is readily apparent in Chart 1, below.

Chart 1
Coefficient Change Due to Compression Effect of Error



A regression line always goes through the mean value of both the dependent and independent variables. Medicare cost per case values do not change as error is added to MCM. MCM values, however compress toward one, their mean value.

For example, point "A" in Chart 1, representing a hospital with high MCC and high MCM, will shift to the left (toward MCM = 1) as error is added to MCM. Point B illustrates the same effect for a low MCC, low MCM hospital. A regression line drawn through these points will appear to have rotated in a counter-clockwise direction as a result of increased error. The rotation is due to the reduction in variance (compression) of MCM. Since the slope of this line is the coefficient of MCM, a steeper line means a higher coefficient value. The 45° line is a reference line, indicating an exact proportional relationship, and a coefficient of one. As error increases, the slope of the line increases and the MCM coefficient value increases.

Unfortunately we are not able to subdivide the total bias in the coefficient estimate into its component parts (the effect of errors in the variable versus the effect of omitted variables). In all cases, however, the direction is clear: the coefficient of MCM is biased upward.

IV. Summary and Conclusions

Our tests of the Medicare case mix index have shown that it gives a good approximation of the variation in Medicare case mix across all hospitals. It is, however, not perfect. It is affected by the presence of various kinds of error in a specific way: the index is compressed. This means that for low MCM values we tend to overstate actual Medicare case mix, and for high MCM values we tend to underestimate the actual complexity of the hospital's Medicare patient mix. In addition, hospitals that reported inaccurate and (especially) incomplete data may have index values that are badly understated.

It is important to keep in mind, however, that most of these data have originated in what has been, up until now, a passive reporting system. These data have not been used for any purpose that could have had any consequences in terms of reimbursement or program participation.

If case mix based reimbursement is implemented, however, it is reasonable to suppose that the quality of the data will be drastically improved. Therefore, many of the problems that we have identified will disappear within a short time after implementation. It also follows that the degree of sensitivity of the index, measured in this analysis, overstates the magnitude of the problem that may be expected to prevail after implementation.

Nevertheless, the limitations of the index should be recognized, by appropriate allowances for the effects of error, in any proposal reform of the reimbursement method.

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SOME USES OF CLAIMS DATA FOR THE ANALYSIS OF SURGICAL PRACTICES*

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I. INTRODUCTION

Data collected in the routine administration of health insurance programs offer some unique advantages for the epidemiologic analysis of medical practices. This report shows how claims based data can be used to describe surgical services performed among small geographic markets. The example, based on claims based data obtained from the Medicare Part B program in the state of Maine, is limited to the market for ophthalmology, a surgical specialty frequently used by the elderly population. We show how the data can be used to (1) obtain an empirical description of geo-markets for specialty services; (2) estimate the per capita inputs of physicians to these markets; (3) measure the per capita rate of use of ophthalmologic services by Medicare enrollees living in these markets; (4) measure the per capita rate of reimbursements and aggregate charges for these services among enrollees living in the markets; and (5) characterize aspects of the outcome of these services. The illustrations are relevant for use in a number of regulatory, planning and policy contexts, some of which are discussed briefly at the conclusion of this paper.

II. BACKGROUND AND GENERAL METHODOLOGY

Details concerning the methods for small area analysis have been presented elsewhere.[1] Specific aspects of the methods used to develop the social indicators described here are presented in subsequent sections. This section provides background and a brief overview of the Medicare Part B claims data base.

The data files established to administer the Medicare Part B program are an important and underused source of information about the medical care system. Their richness derives from the level of detail necessary to administer the policies of the program. Payment to physicians is on a fee-for-service basis, and a complete record of services must be kept. Enrolled persons are entitled to be reimbursed for a portion of the costs they incur in purchasing care, but only after they have met an initial out-of-pocket deductible. The amount reimbursed for a specific service is not fixed on a national basis, but rather is determined by local market circumstances: the amount "allowed" for a specific service is determined by statistical profiles of the charging behavior for the specific service by similarly trained physicians living in the same locality.

To make the necessary administrative decisions on who gets what, the records of Medicare transactions include information on:

- who is enrolled in the program (and who terminates enrollment through withdrawal or death), including mailing address with zip code
- who receives services (including a record of all services received)
- who provides services (and a record of all services provided)

The above information is contained in three data files which are used in the daily transactions of the program. These are the patient history or claims files; the enrollee file; and the provider file. We have organized these files into a unit record covering each transaction. Table 1 lists the data items we have found useful for small area analysis. The data items correspond closely to those called for in the uniform hospital or ambulatory data sets, with the exception that diagnosis is not necessarily available. The coding convention used for surgical and diagnostic procedures is considerably more detailed: it is designed primarily for billing purposes and therefore distinguishes rather precisely among procedures so that the relative cost of a particular procedure may be determined. (For example, there are several code designations for lens extraction, each indicating a different operative technique. There are extensive codes for diagnostic procedures. For example, the data show whether one or two chest x-ray films were taken.) There are also other significant items: each patient is distinguished by his Social Security number; the provider of service is also identified; the charge for the service and the amount actually reimbursed (the "allowed dollars") are listed; and the place and type of service are noted.

TABLE 1
DATA AVAILABLE FOR ANALYSIS
MEDICARE PART B

Physician Board Cert.	Reported Dollars
Specialty Code	Allowed Dollars
Physician Number	Incurred Data
State Code	(Patient age, sex, race)
Procedure Code	Date of Death
Place of Service	Patient Identifier
Type of Service	Zip code of Physician
Service Count	Zip code of Patient

Claims data can be a useful surrogate for most of the "general purpose" data components proposed under the Cooperative Health Statistics System (CHSS). These include each of the utilization components, acute care, long term care and ambulatory care; and also the physician manpower component. The Medicare data possess some advantages not available under the CHSS.

First, the data support detailed patient origin studies which can be used to define certain types of medical market areas (such as the ophthalmology geo-markets illustrated here).

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Second, the patient origin data can be physician specific and can therefore be used to estimate physician labor inputs (per capita) to local markets (such as the per capita estimate of ophthalmologists presented here).

Third, the Medicare transaction records contain much more detail on the services provided than do the abstracts proposed under CHSS. Therefore, some aspects of the small-area epidemiology of medical care practices can be studied in greater detail.

Fourth, the presence of charge data and of "allowed dollars" (the amount actually reimbursed by Medicare) makes possible a range of economic and social policy analyses that cannot be done with the CHSS components (such as the reimbursement per capita analysis presented here).

Fifth, since a count of the enrolled population is kept current, the enrollment file provides a moving census at the small-area level, and uncertainty about the "true" population base is substantially less than for many analyses that depend on census estimates.

Sixth, the records are of individuals and, unlike the CHSS utilization data, are not restricted to episodes of care; this makes it possible to obtain the accumulated experience of an individual across a given time interval. Further, because individuals are removed from enrollment at the time of death (regardless of place of death), follow-up studies concerning the association between medical care use and mortality are possible. An example of this use is presented in this paper.

III. USE OF MEDICARE CLAIMS DATA TO IDENTIFY GEO-MARKETS FOR MEDICAL CARE: OPHTHALMOLOGY MARKETS IN MAINE

Patient origin studies of physician services in Maine have resulted in the aggregation of the primary geographic unit (the zip code) into three nested market tiers. The least aggregated tier is the primary physician area, based on patient origins for ambulatory visits to primary care physicians, which are defined as general practitioners, osteopathic physicians (without mention of specialty) and general internists. The second level is the community hospital market, based on patient origin studies of acute hospital admissions. The third is the market for specialty services not always provided in the community hospital setting. This level of aggregation is specialty specific and based on patient origin studies of ambulatory visits to physicians who perform the services of the specialty. We have elected to keep the boundaries of the three levels of aggregation nested so that the geographic unit used in a particular patient origin study is the next less aggregated market. The analysis has resulted in 81 primary physician and 42 community hospital areas. In all patient origin studies, aggregation is based on assignment of the demographic unit to the market containing the place of service where the plurality of residents of the unit receive their services. (To maintain geographic continuity of the primary physician area, a few exceptions were made in the assignment of sparsely populated rural zip code units.)

In the example presented here, all ambulatory visits to physicians who either performed major surgery on the eye (e.g., lens extractions) or claimed ophthalmology as their specialty were used for the patient origin study. The study resulted in the aggregation of hospital areas into 15 ophthalmology market areas which are shown in Figure 1. Table 2 gives some principal characteristics of these areas.

FIGURE 1

OPHTHALMOLOGY SERVICE AREAS IN MAINE
1977

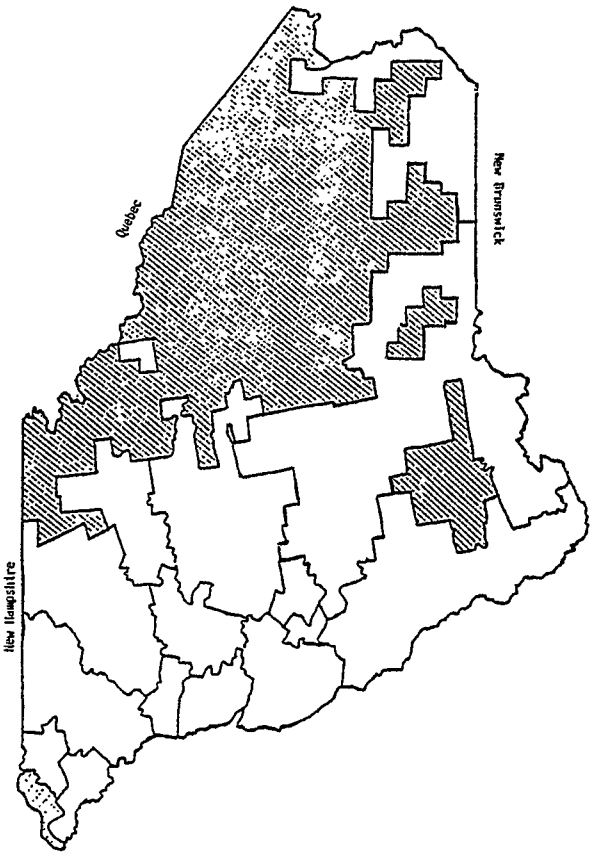


TABLE 2
CHARACTERISTICS OF OPHTHALMOLOGY SERVICE AREAS, MAINE, 1977

Area Number	# HA's° in Area	Population	Resident Visits+ Number	% in Area	Physician Visits× Number	% in Area
1	2	192,050	3,253	92	3,724	80
2	9	180,206	2,006	78	1,914	82
3	3	136,575	3,782	89	3,972	85
4	1	65,622	1,958	49	1,059	90
5	6	106,348	4,280	82	5,548	63
6	2	63,021	2,231	75	1,937	86
7	1	35,538	1,167	61	1,098	65
8	1	31,576	985	76	1,031	73
9	1	23,977	725	51	543	69
10	1	23,338	580	76	738	60
11	3	30,696	1,068	52	874	63
12	5	51,843	1,211	85	1,162	88
13	5	75,348	861	61	553	95
14	1	13,740	478	72	560	62
15	1	6,111	438	55	385	63

°Number of Hospital Areas collapsed into Ophthalmology Areas
+Visits of local residents to all physicians; percent is for visits to within-area physicians
×Visits to physicians practicing within area; percent is for visits of within-area residents

IV. USE OF MEDICARE CLAIMS DATA TO ESTIMATE RESOURCES ALLOCATED TO DEFINED POPULATIONS: LABOR INPUTS OF OPHTHALMOLOGISTS

The Medicare Part B claims data can be used to estimate the numbers of physicians who, on a per capita basis, served the populations of any geographically defined service areas. The method produces an estimate of the number of physicians

who provided services to the enrolled Medicare population. Under the assumption that patient origins for the under-65 and the over-65 populations are similar, the results can be generalized to estimate the full-time equivalent number of physicians who provide service to the entire population. (This assumption is currently being tested by comparing patient origins for physician claims data under the Medicaid and Blue Shield programs to the Medicare results.)

To estimate physician manpower input to a given area the place of residence of all the patients seen by a particular physician was investigated. A decimal fraction of each physician is assigned to an area: it is the percent of all his or her patients who reside in the area. For example, if physician A sees 100 patients and 20 of them are from area X, then area X gets .2 of a full-time equivalent. The activities of other physicians are similarly investigated and the number of equivalents assigned to service area X are added to obtain an area total. This estimate, strictly speaking, is an estimate of the labor input by physicians who provide services to the population of the area. The technique is analogous to the methods used in small area analysis for allocation of hospital expenditures and beds, except that physicians are allocated and ambulatory visits rather than hospital admissions are used for allocation.

The accuracy of the estimate depends on several factors. First, as mentioned above, it depends on the assumption that patient origins for the under- and over-65 groups are similar; second, it depends on knowing when a physician who is allocated is a single full-time physician. There are several problems related to this issue. One is that the Medicare physician code sometimes represents more than one physician, since partners often bill under a single number for services rendered by any or all. In the use of this technique, special attention must be given to an investigation of this possibility and corrections made. Also, some physicians have more than one code number. This problem must also be resolved. A third problem is to know when a physician is engaged in less than full-time practice. This is not revealed by the Medicare file and must be found out independently. We have resolved most of these issues by use of the manpower file available from the Cooperative Health Statistics System.

The result of the use of this method is illustrated for ophthalmologists in Tables 3, 4 and 5. Table 3 shows for each ophthalmologist, the number of his or her patients that came from four ophthalmology market areas. For example, ophthalmologist 1 saw a total of 365 patients during the twelve month billing sample; 307, or 84%, were from the area in which his practice is located. Physician 14 saw 1705, 1059 of whom were from his immediate area. In total, there were 16 ophthalmologists who saw a significant portion of patients in these areas. The mean number of patients seen per physician is 553; the range is from a low of 101 to a high of 1705.

Table 4 shows the proportion of patients seen by these physicians in each of the areas; the sums of the columns represent the estimate for the total amount of full-time equivalent physician effort expended in the area during the twelve-month billing period.

The data from Tables 3 and 4 are summarized in Table 5. The Table gives for each area the number of physicians who are active in the area by the location of their practices. It also gives the man-years of primary physician effort invested within the area. Note that in 3 areas most physician effort is from physicians who practice there. The Table also gives the full-time equivalent number of physicians serving the area as a per capita rate. The rate is based on the full population and is obtained by dividing the man-years of ophthalmologist effort invested in the area by the 1970 census population.

TABLE 3
NUMBER OF CLAIMS BY AREA BY OPHTHALMOLOGIST
Maine Medicare Claims File, Oct. 1976-Sept. 1977

	Ophthalmology Ambulatory Claims by Area					
M.D.	A	B	C	D	All Other Areas	Total
1	307*	0	40	13	5	365
2	80*	1	9	2	9	101
3	271*	0	15	18	16	320
4	242*	0	10	13	27	292
5	167*	0	29	18	61	275
6	136*	0	6	0	0	142
7	345*	0	19	29	14	407
8	6	503*	19	0	37	565
9	1	404*	15	0	27	447
10	97	148	546*	31	182	1004
11	35	84	604*	11	113	847
12	33	178	643*	11	122	987
13	0	16	208*	1	5	230
14	64	367	1059*	11	204	1705
15	51	0	15	607*	0	673
16	42	0	12	416*	18	488
TOTAL	1877	1701	3249	1181	840	8848

* Local physician

TABLE 4
PROPORTION OF CLAIMS BY AREA BY OPHTHALMOLOGIST
Maine Medicare Claims File, Oct. 1976-Sept. 1977

	Ophthalmology Ambulatory Claims by Area				
M.D.	A	B	C	D	All Other Areas
1	.84	-	.11	.04	.01
2	.79	.01	.09	.02	.09
3	.85	-	.05	.06	.04
4	.83	-	.03	.04	.10
5	.61	-	.11	.07	.11
6	.96	-	.04	-	-
7	.85	-	.05	.07	.03
8	.01	.89	.03	-	.07
9	-	.90	.03	-	.07
10	.10	.15	.54	.03	.18
11	.04	.10	.71	.01	.14
12	.03	.18	.65	.01	.13
13	-	.07	.90	-	.03
14	.04	.22	.62	.01	.11
15	.08	-	.02	.90	-
16	.09	-	.02	.85	.04
All Other	1.21	1.24	1.75	1.05	-
TOTAL	7.33	3.76	5.75	3.16	-

TABLE 5
CHARACTERISTICS OF OPHTHALMOLOGISTS SERVING MAINE OPHTHALMOLOGY MARKET AREAS

Numbers, Man-Years of Effort and Equivalent Numbers of Ophthalmologists per 10,000 Population

	Ophthalmology Service Areas			
	A	B	C	D
Number of Physicians Active in Area				
--Practicing in Area	7	2	5	2
--Practicing out of Area	28	23	40	20
Man-Years of Physician Effort within Area				
--Local Physicians	5.7	1.8	3.4	1.8
--All Physicians	7.3	3.8	5.8	3.2
--% of Effort from Local MD's	78	47	59	55
FTE MD's per 10,000	4.1	5.8	5.4	6.2
Ratio to GMENAC Standard+	.69	.97	.90	1.03

+Graduate Medical Education National Advisory Committee--see Discussion.

This subclassification of physicians into specialty and activity class is only one example of the way physician manpower can be analyzed on a small-area basis. Others of possible policy or planning value include age of physician, educational background and subspecialty.

V. USE OF MEDICARE CLAIMS DATA TO MEASURE UTILIZATION

In defining medical service areas and in estimating the allocation of resources, Medicare data may be used to estimate the experience of the entire population. But the data's uses for measuring the utilization of specific services, such as an appendectomy, a diagnostic x-ray or an electrocardiogram, are restricted more narrowly to the specific population-at-risk, namely, Medicare patients. While preliminary studies show that within a particular area the utilization experience of the over-65 population is commonly similar to that of the population under 65, the value of claims data for demonstrating differences in utilization experience among areas does not depend on this. Lewis' demonstration of variations among subscribers of the Blue Cross program in use of surgery was a valuable contribution to our understanding of the epidemiology of medical care practices, and this contribution was independent of the question of what was happening to the remaining portion of the population at risk.[2] By the same token, the demonstration of variations in use of services among Medicare enrollees makes a contribution to an understanding of the nature of local medical care markets. Further, since it is precisely this population that is the target of a major federal utilization review program (PSRO), the Medicare claims data are specific for that program.

By virtue of the benefit structure of the Medicare program, costs incurred during a patient's hospitalization exceed the deductible, and, thus, the events become recorded in the Medicare claims files. For this reason, the Medicare data is a sufficient source of data for measuring the hospitalization experience of nearly every American citizen who is over 65 years of age. The Part A file provides data for generating discharge rates, patient day rates, average lengths of stay and costs. These can be measured, for all causes and for selected causes of admission. The Medicare Part B file can be used to measure the rates of use of in-hospital services among defined populations, particularly their rate of use of surgery. This use is illustrated in Table 6 which gives the procedure rates for the most common surgical procedure performed by ophthalmologists, lens extractions for cataracts. The population unit selected for this study is the primary physician area, described above. Data are presented in the table for areas with more than 2,000 Medicare enrollees. There is considerable variation in the rate of use of procedures between primary physician areas, with a range in rates between high and low members about three-fold. Chi-square tests for significance of differences between expected and observed numbers of cases are significant ($p = .01$) in eight of 22 areas (with the expected values based on the rate for all Maine enrollees).

TABLE 6
LENS EXTRACTIONS AMONG MEDICARE ENROLLEES LIVING IN PRIMARY PHYSICIAN AREAS (WITH ENROLLEE POPULATIONS OF 2,000 OR GREATER)

Area	Enrl. Pop.	Observed Cases	Expected Cases	Rate per Thousand	Chi^2
6	6044	133	89.52	22.91	21.1
21	2415	52	35.77	21.53	7.4
25	2987	61	44.24	20.42	6.4
19	12876	258	190.70	20.04	23.7
35	2186	41	32.38	18.76	2.3
42	2368	42	35.07	17.74	1.4
18	3295	55	48.80	16.69	.8
48	2309	37	34.20	16.02	.2
83	2188	35	32.41	16.00	.2
32	2205	35	32.66	15.87	.2
9	2025	31	29.99	15.31	.0
27	2694	41	39.90	15.22	.0
45	6735	102	99.75	15.14	.1
4	4087	60	60.53	14.68	.0
8	19869	284	294.28	14.29	.4
64	2378	31	35.22	13.04	.5
43	5252	61	77.79	11.61	3.6
58	11466	127	169.82	11.08	10.8
79	2526	26	37.41	10.29	3.4
77	2272	20	33.65	8.80	5.5
38	5380	43	79.68	7.99	16.9
2	2137	7	31.65	3.28	19.2

VI. USE OF MEDICARE CLAIMS DATA TO MEASURE REIMBURSEMENTS AND CHARGES: PER CAPITA REIMBURSEMENTS AND CHARGES, AND CHARGES AND REIMBURSEMENTS PER CASE FOR LENS EXTRACTIONS

The claims data indicate the amount reimbursed for each service provided to Medicare enrollees, and this information can be used to measure the per capita rates of reimbursement to populations located within each geographic market. This use of the data is illustrated in Table 7 which gives, for lens extractions, the surgery rate, the average reimbursements per case and the reimbursements per enrollee for the same primary physician areas listed in Table 6. There are considerable differences in the reimbursements per enrollee which range from a low of two dollars to a high of nearly fourteen dollars per enrollee. The reimbursements per case

(obtained by dividing the total reimbursements to resident enrollees by the number of procedures undertaken on the resident population) show less variation, with the highest reimbursements per case at 663 dollars per case and the lowest at 458 dollars per lens extraction.

TABLE 7
SURGERY RATE, REIMBURSEMENTS PER CASE AND REIMBURSEMENTS PER ENROLLEE FOR LENS EXTRACTIONS

Area	Surgery Rate	Reimb. per Case ($)	Reimb. per Enrollee ($)
2	3.3	617.86	2.02
77	8.8	505.39	4.45
79	10.3	464.06	4.78
38	8.0	597.75	4.78
58	11.1	458.40	5.08
43	11.6	614.42	7.14
8	14.3	518.76	7.41
83	16.0	502.29	8.03
9	15.3	529.62	8.11
27	15.2	541.96	8.25
64	13.0	662.90	8.64
4	14.7	590.67	8.67
18	16.7	550.85	9.19
45	15.1	623.69	9.45
48	16.0	590.01	9.45
32	15.9	619.23	9.83
35	18.8	524.15	9.83
42	17.7	641.54	11.38
19	20.0	619.85	12.42
6	22.0	565.81	12.45
25	20.4	635.20	12.97
21	21.5	646.07	13.91

VII. USE OF MEDICARE CLAIMS DATA TO INVESTIGATE OUTCOMES OF MEDICAL CARE: DEATHS FOLLOWING LENS EXTRACTION

Medicare claims data linked to the Medicare enrollment file (the HISKEW file) can be used to measure mortality and complication rates following surgical interventions. The use of this data set for obtaining survival information is illustrated for lens extractions in Table 8 which reports one-year follow-up information on 678 female patients who received lens extractions during a twelve-month billing period, October 1975-September 1976. Thirty-four, or 5%, of these patients were dead within one year following their surgery. The mortality rate among males (not shown) was 7.7 percent. When compared to the mortality experience of the entire Medicare enrollee population of Maine, these rates are not significantly different.

VIII. DISCUSSION

This paper has illustrated some uses of Medicare data for the epidemiological investigation of surgical practices. Although the illustrations are restricted to ophthalmologic services, similar analysis can be performed for the services of each medical and surgical specialty. The information generated by small area investigation of medical care practices has a number of applications for health planners, regulators and policy analysts, as well as for epidemiologists interested in the evaluation of

TABLE 8
DEATHS WITHIN ONE YEAR OF SURGERY LENS EXTRACTION, FEMALES

Age	# Cases	# Dead Within One Year	% Dead	RR*
65-69	70	1	1.43	1.08
70-74	154	3	1.95	0.80
75-79	153	8	5.23	1.45
80-84	186	11	5.91	1.06
85-89	89	6	6.74	0.76
90-99	26	5	19.23	1.09
All Ages	678	34	5.01	

*Relative Risk: Compared to all Medicare Enrollees in same age/sex group.

the outcome of medical care practices. The discussion focuses on three areas of interest--physician manpower planning, cost containment, and assessment of medical care outcomes--to illustrate some of these applications.

Manpower planning. In recent years, the problem of the geographic distribution of physicians has become one of national importance. Recently enacted health manpower legislation calls for the identification of health scarcity areas as the target for special Federal attention, including the placement of physicians to alleviate the scarcity. The statistical indicators used in designating health scarcity areas are not based on current utilization patterns, and uncertainty exists concerning the status of local markets before and after the placement of new physicians. The analysis presented here directly assesses the geographic distribution of physician labor input to local markets. The indicator, full-time equivalent physicians per 1,000 population, can be directly compared to standards for physician distribution, however they may be set. This use is illustrated in Table 5 which compares the full-time equivalent numbers of ophthalmologists per 10,000 population in four ophthalmologic markets for Maine to the standard of need for ophthalmologists developed by the Graduate Medical Education National Advisory Committee.[3] Two of the four areas have rates which are about equal to the need estimate by the Committee, and a third area is within 10 percent. Additional recruitment of physicians into these markets would result in per capita rates above standard. Area A, however, has a thirty percent deficit in ophthalmologists and, given the current distribution of services, is, by the Committee's standard, in need of additional physician input. Such data, made available to physicians, hospital managers and health planners, could substantially influence the current methods of physician recruitment which do not take population use rates into account. Similar indicators generated at the community level of geographic aggregation would provide a direct means for assessing the relative scarcity of primary physician input.

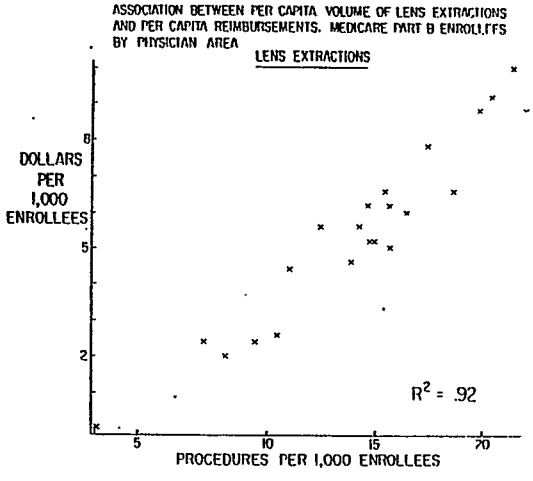
Cost containment. The opportunity to measure per capita reimbursements for specific

services and to relate variations in these rates to variations in (1) average reimbursements per case and (2) service use rate per capita, allows for the complete evaluation of the following "medical care equation":

Reimbursements per Enrollee	=	Services per Enrollee	X	Average Reimbursements per Service

The evaluation of this equation indicates that cost containment strategies that do not include a focus on the cost implication of decisions to hospitalize a patient and to undertake a procedure miss the most important variable contributing to variations in consumption rates among local markets. This is illustrated for lens extractions in Figure 2. The figure shows that 92 percent of the variation in per capita reimbursements is accounted for by variation in procedure rates ($R^2 = .92$); variations in reimbursements per case account for only 22 percent of variation ($R^2 = .22$). The uses of such indicators in cost containment strategies would depend on the context of the program. For example, in the case of the Professional Standards Review Organization, it could include special appropriateness review of cases in high procedure rate areas.

FIGURE 2



Outcome assessment. It is now widely recognized that medical innovations have not generally been subjected to rigorous validation prior to their widespread use by the medical community, and information on the expected risks and gains of alternative methods of treatment does not exist as part of a systematic, accepted body of scientific knowledge. Claims data can provide information on the outcome of existing practices and document emergent or unanticipated complications of newly adopted technology. Mortality analysis is one such use. For example, for surgical evaluations, the Medicare claims data represent a registry of significant surgical events that have occurred to nearly the entire population over sixty-five years of age. Data similar to that reported above for lens extractions in Maine can be obtained for most procedures so that the survivorship probabilities can be known with much greater precision than is now the case. Further, by longitudinal analysis of significant complications following medical or surgical interventions, population specific morbidity rates can be obtained. One important example of such use for ophthalmologic services is the documentation of complications caused by implantation of an intraocular lens following lens extraction: Significant post-operative events were documented in the study population indicating an overall complication rate of about 13 percent.[4] While outcome studies based on claims data will not contribute much to the understanding of the improvement in the quality of life associated with the use of services, the population registry provided by the data set could provide random samples of patients for more direct follow-up of outcomes. In view of the growing concern about the utility of elective medical and surgical interventions in the United States, use of claims data for this purpose should be actively investigated.

Summary and conclusions. Medicare Part B claims data can be used to (1) define local medical market areas; (2) estimate physician labor input to these markets; (3) measure per capita rates of services and reimbursements to the Medicare enrollees resident in the market areas; (4) measure mortality and complications following diagnostic and surgical interventions. In this paper, examples of these uses are illustrated for ophthalmologic services, and some planning and policy implications of the information are discussed. Medicare Part B claims data exist for all jurisdictions in the United States and, if more widely used, would make a substantial contribution to the data base needed for the implementation of health planning, health manpower, and technology assessment programs.

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Health Promotion and Disease Prevention: Tracking Progress in the Eighties

Second Plenary Session

HEALTH PROMOTION AND DISEASE PREVENTION: TRACKING PROGRESS IN THE EIGHTIES

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> "Life is one long struggle between conclusions based on abstract ways of conceiving cases, and opposite conclusions prompted by our instinctive perception of them as individual facts."
>
> - William James

William James strikes to the heart of the dilemma facing policy makers who daily confront decisions which must be based on fragile information. On the other hand, the field of health policy has seen some very impressive strides over the last generation, as the result of a much deeper base of information for improved health programs.

Indeed, those of us who enjoy good health in this country and abroad owe a great deal to data--and to the science of data collection and analysis.

It was careful analysis of data on disease occurrence which has allowed us to identify and reduce substantially, or even eliminate, a number of the infectious diseases that have confronted us over the centuries. The eradication of smallpox, officially declared earlier this year by the World Health Assembly, is probably the most prominent example of this success.

It was careful analysis of data which has allowed us, through studies such as the Framingham Heart Study, to identify some of the major risk factors for cardiovascular diseases and thereby accelerate our progress against heart disease and stroke.

It was careful analysis of data that has allowed us to identify pockets of infant mortality, target our efforts more carefully, and achieve the substantial gains that we have seen over the course of the last decade.

In sum, it was careful analysis and use of data which has allowed us to make tremendously impressive gains in our health status over recent years.

And those gains have been substantial. A comprehensive litany is not necessary, but a notation of some of the more prominent may be useful:

- infant mortality declining to less than 13 deaths per 1000 live births, one-tenth what it was at the beginning of the century;
- smallpox eradicated;
- heart disease and stroke dropping dramatically, 36 percent for stroke over the last ten years, 23 percent for heart disease;
- life expectancy increasing by 2.7 years in the last decade alone.

Through scrutiny of the trends over the last decade, these gains have allowed us to dispel a number of myths that have persisted in some respects for centuries: first, the myth that no disease could be eradicated, yet we have seen the eradication of smallpox declared just last year; second, the myth that all chronic diseases are inevitable consequences of the aging process, yet we have seen that we can identify risk factors for many of those chronic diseases, and, moreover, have made substantial gains against some of them; third, the myth that your doctor is the person most important to your health, yet many of those risk factors are behavioral in nature and we as individuals can do a fair amount to improve our own health.

Our understanding of our control over diseases and their sequelae has been enhanced through diligent efforts to chronicle and analyze the gains--chief among them, those of the National Center for Health Statistics. Likewise, careful use of the data will help us to chart our future course for health care in this country.

An important step in planning for the future was the release last year of the first Surgeon General's Report on Health Promotion and Disease Prevention. That report, is appropriately entitled Healthy People, and it reviews the major health problems of Americans, assesses their preventability, and lays out an agenda of future activities.

Some notion of the major targets of that agenda is provided by a review of the country's ten leading causes of death (Chart I).

Chart I

Causes of Death, 1975
(Total Population, Age 1+)

Cause	Deaths	%Total
Heart Disease	715,472	38.8
Cancer	365,549	19.8
Stroke	193,859	10.5
Other Accidents	56,046	3.0
Influenza/Pneumonia	53,456	2.9
Motor Vehicle Accidents	45,573	2.5
Diabetes	35,219	1.9
Cirrhosis of Liver	31,581	1.7
Arteriosclerosis	28,882	1.6
Suicide	27,062	1.5

Another way to examine the problems is in terms of potential years of life lost--the aggregate number of years lost by deaths which occur before age 75 (Chart II). In this chart those causes of death more likely to strike younger people--namely, traumatic injuries--assume more prominent positions on the list. But, in both formulations, chronic diseases represent approximately 75 percent of the burden inflicted by the ten leading causes of death.

Chart II

Potential Years of Life Lost, 1975
(Total Population, Age 1-74)

Cause	Years Lost	%Total
Heart Disease	4,471,254	23.8
Cancer	3,841,801	20.5
Motor Vehicle Accidents	1,838,602	9.8
Other Accidents	1,568,618	8.4
Stroke	869,352	4.6
Suicide	824,038	4.4
Homicide	823,257	4.4
Cirrhosis of Liver	583,727	3.1
Influenza/Pneumonia	370,324	2.0
Diabetes	268,726	1.4

This has of course not always been the case. Chart III lists the ten leading causes of death in 1900. The three leading causes are all infectious diseases, while cancer--the second leading cause today--ranked only eighth in 1900.

Chart III

Ten Leading Causes of Death
U.S.A., 1900
Information Reported on Ten States
(ICDA-5th Revision)

Causes	Rate per 100,000
Pneumonia/Influenza	202.2
Tuberculosis	194.2
Diarrhea, Enteritis, and Ulceration of Intestines	142.7
Diseases of Heart	137.4
Intracranial Lesions of Vascular Origin	106.9
Nephritis	88.6
All Accidents	72.3
Cancer and Other Malignant Tumors	64.0
Senility	50.0
Diptheria	40.3

Source: National Center for Health Statistics

While this shift in the profile of diseases has occurred, with chronic diseases emerging as the predominant threats, health overall has dramatically improved over the course of this century. Chart IV lists the death rates for the major life stages in 1900 compared with those in 1978.

Chart IV

Death Rates by Age
United States, 1900 and 1978
(Per 100,000 population)

	1900	1978
Infants	16,240	1,434.4
Children (ages 1-14)	870	42.9
Adolescents and Young Adults (ages 15-24)	590	117.5
Adults (ages 25-64)	1,270	527.6
Older Adults (ages 65+)	8,220	5,293.5

Two important features are notable about the comparison in death rates by life stage between 1900 and 1978: (1) this century has seen major health improvements for every life stage; and (2) the problems confronting people at these different life stages vary from stage to stage.

With respect to the first point, the gains have not only been substantial, but they have also been constant. The sole exception lies with the adolescent and young adult age group, which has had an erratic course in the death rates over the last 20 years. In fact, today's death rate for young people (117 deaths per 100,000 in 1978) stands somewhat greater than it was in 1960 (106 deaths per 100,000).

This raises the second point--the variation in problems from group to group. Chart V draws this feature out in a comparison of the potential years of life lost for ages 1 to 64 versus the potential years of life lost for ages 1 to 74.

Chart V

Years of Potential Life Lost
U.S.A., 1975

AGES 1-64

Cause	Total Years Lost	% of Total Years
All Accidents	2,589,552	25.1
Cancer	1,802,820	17.5
Diseases of Heart	1,769,180	17.2
Homicide	625,806	6.1
Suicide	588,276	5.7

AGES 1-74

Cause	Total Years Lost	% of Total Years
Diseases of Heart	4,471,254	23.8
Cancer	3,841,801	20.5
All Accidents	3,408,455	18.1
Cerebral Vascular Disease	869,352	4.6
Suicide	829,109	4.4

Source: CDC, BSS, HAPPS

The aggregate number of years of life lost from death due to any cause prior to age 75 roughly approximates, except for the ascendance of suicide, that seen in the overall mortality tables presented in Chart I: first, heart disease; second, cancer; third, all accidents; fourth, cerebral vascular disease; fifth, suicide.

But if the scale is lowered by only ten years, taking the potential years of life lost for ages 1 to 64 (instead of 74), some impressive shifts are seen in the profiles of the leading causes of potential years of life lost. From 1 to 64, the leading causes are: first, accidents; second, cancer (as it was previously); third, diseases of the heart; fourth and fifth, homicide and suicide. Clearly the traumatic problems of accidents and homicide ascend into prominence with this formulation.

It is important to note that these are not problems we have traditionally treated as major public health problems in this country. Yet they clearly are problems that have to be addressed if substantial further improvements are to be obtained for the health of the population. That is, in some respects, one of the prominent lessons of the Surgeon General's Report on Health Promotion and Disease Prevention, Healthy People.

The central lesson of that report is that the health of the American people has never been better, and in addition, that there are different problems at different life stages which must be effectively addressed if further gains are to be attained. Further, many of those problems are not traditional public health problems, but they must be assimilated as mandates of the public health sector.

Chart VI presents the categories of goals set forth in the Surgeon General's report, goals for each of the five life stages, to be attained by 1990. These goals are quantified in the report.

The healthy infant goal is to reduce infant mortality by 35 percent to a level below nine deaths per 1000 live births; for healthy children, the goal is to reduce childhood mortality by 20 percent; for adolescents and young adults, 20 percent; for adults, by 25 percent; and for the elderly population, the goal is to reduce the average annual days of confinement of older adults by 20 percent to below an average of 30 days per year. In addition to noting those overall goals, there are two prominent subgoals noted for each category, determined by the major preventable problems for each age group.

Chart VI

Health Status Goals

Goal One:	Healthy Infants (below age 1)	
	Subgoal:	To reduce the incidence of low birth weight infants
	Subgoal:	To reduce the incidence of birth defects
Goal Two:	Healthy Children (age 1-14)	
	Subgoal:	To enhance childhood growth and development
	Subgoal:	To reduce childhood accidents and injury
Goal Three:	Healthy Adolescents/Young Adults (age 15-24)	
	Subgoal:	To reduce death and disability from motor vehicle accidents
	Subgoal:	To reduce the misuse of alcohol and drugs
Goal Four:	Healthy Adults (age 25-64)	
	Subgoal:	To reduce heart attacks and strokes
	Subgoal:	To reduce the incidence of cancer
Goal Five:	Healthy Older Adults (age 65 and over)	
	Subgoal:	To increase the proportion of older people who can function independently
	Subgoal:	To reduce premature death and disability from influenza and pneumonia

Most of the subgoals are determined according to the leading causes of death. There are exceptions, however. For example, because children have the lowest death rate of any of the groups, the principal problem is not death itself, but the habits and patterns developed in early life which affect them in later life. So the first subgoal stated for children is enhancing childhood growth and development.

Likewise, for young adults and adolescents, in addition to targeting motor vehicle accidents, the subgoals emphasize the importance of reducing misuse of alcohol and drugs. In this instance the subgoals would vary, depending on the target socioeconomic group. The principal cause of death for young black males between the ages of 15 and 24 is murder.

The simple specification of quantified goals does not in itself provide the understanding of how they are to be achieved. Chart VII, on the other hand, does provide somewhat clearer direction in this regard.

Chart VII

Prominent Risk Factors

Cause of Death:	Risk Factor:
Heart Disease	Smoking*, hypertension*, elevated blood cholesterol* (diet), lack of exercise, diabetes, stress
Cancer	Smoking*, worksite carcinogens*, environmental carcinogens, alcohol, diet
Motor Vehicle Accidents	Alcohol*, no seat belts*, speed*, roadway design
Other Accidents	Alcohol*, drug abuse, smoking (fires), product design, handgun availability
Stroke	Hypertension*, smoking*, elevated blood cholesterol*, stress
Homicide	Stress*, handgun availability*, alcohol
Suicide	Stress*, alcohol, drug abuse
Cirrhosis of Liver	Alcohol*
Influenza/Pneumonia	Smoking*
Diabetes	Obesity*

* Major Risk Factor

Listed in the left column are the ten leading causes of death in terms of potential years of life lost from deaths occurring prior to age 74. In the right column are listed some of the prominent risk factors involved in those ten leading causes of death. The fact that these risk factors can now be specified is a remarkable achievement of the last generation of health research and data collection.

It is particularly interesting to note that the good news is that some of these risk factors identified are implicated in more than one cause of death. Smoking provides a notable example. By reducing smoking, substantial improvements could be achieved in our national health profile with respect to heart disease, cancer, accidents (from smoking related fires), stroke, and influenza and pneumonia.

It is also interesting to note that behavior is a dominant element of these cross-cutting risk factors. Indeed, behavior is involved in virtually all the leading causes of death, and by addressing three behavioral risk factors--smoking, alcohol use,

nutrition--substantial reductions could be achieved for eight of the leading causes of potential years of life lost.

The risk factors listed for each of the ten leading causes of death provide important direction as we develop national health improvement strategies. Such strategies can be viewed as forming three general groups (Chart VIII)--health promotion, health protection, and preventive health services.

Chart VIII

Health Strategy Targets

Preventive Health Services for Individuals:
- Family planning
- Pregnancy and infant care
- Immunizations
- Sexually transmissible diseases services
- High blood pressure control

Health Protection for Population Groups:
- Toxic agent control
- Occupational safety and health
- Accidental injury control
- Community water supply fluoridation
- Infectious agent control

Health Promotion for Population Groups:
- Smoking cessation
- Alcohol and drug abuse reduction
- Improved nutrition
- Exercise and fitness
- Stress Control

The preventive health services category includes those services traditionally embodying medicine's view of prevention--those services obtained from physicians and other health providers in clinical settings, related to family planning, pregnancy and infant care, immunizations, sexually transmissible diseases services, and high blood presure control.

The health protection set of activities includes those that are largely environmentally related: toxic agent control, occupational safety and health, accident control, community water supply and fluoridation, and infectious agents surveillance and control.

The health promotion group can be thought of as both the oldest and the newest of our national health strategies. This group is the oldest in that it is the set of activities that have been written about for the longest time, frequently in moralistic terms. It is the newest in that they address those risk factors about which epidemiologic data have been revealing more and more in recent years. Included are activities such as smoking cessation, alcohol and drug abuse reduction, nutrition, exercise and fitness, and stress control.

With the development of the analytic framework provided by the Surgeon General's report, the next step in the process of strategy formulation has been an effort to develop measurable objectives in each of the 15 areas listed in Chart VIII. Presumably, progress toward the goals broadly stated in the Surgeon General's report can be facilitated by focusing on specific and quantifiable objectives.

An example of successful application of this process is found in the childhood immunization initiative. Three years ago, the President noted that only 63 or 64 percent of children under 15 in this country were adequately immunized against childhood vaccine-preventable diseases. Consequently he established a measurable goal--90 percent adequately immunized--to be achieved within a two-and-a-half year period. The Department of Health, Education, and Welfare, in coordination with other departments and in coordination with State and local governments, then developed a sophisticated implementation plan to ensure that all of our various resources were levered effectively to try to achieve that goal. It was an effort which must be viewed as spectacularly successful.

The goal for school age children was attained and now the vaccine-preventable childhood diseases are generally at the lowest level ever. Measles may in fact be eliminated as an indigenous problem in this country within two years. The success is attributable to a program which sought to achieve a specific objective in a very structured way. Though there are limitations in the transferability of that model to other areas, the exercise is an important one to undertake.

For each of these 15 priority areas, the objectives have been established in four categories: objectives for improved health status; objectives for reduced risk factors; objectives for increased public and professional awareness; and objectives for improved services and protection. In all, approximately 190 objectives have been established across these 15 areas.

It must be noted that there is considerable variability in the status of the scientific understanding which underlies development of objectives in the various categories. For example, among the health status objectives, because the relationship between high blood pressure and stroke is so well defined, it is feasible to establish a specific objective for reduction in stroke deaths based on anticipated control of blood pressure. On the other hand, the relationship between stress and various disease outcomes is so speculative at this point that a numerical determination of the improved health status is virtually impossible. Among the reduced risk factor objectives, establishing an objective on exposure to the risks of smoking is much easier than is establishing an objective on exposure to atmospheric sulphates, or even one on adoption of certain exercise levels (which are frequently misreported by individuals).

Likewise, there is tremendous variability in the status of the data pools available for each objective. While the data abound for smoking profiles of various populations, there are to date virtually no data on unmanaged stress.

It is encouraging, however, that of the 190 objectives distributed across these 15 areas, about 112 are now measurable, given current data sources. The most productive of the national data systems for tracking the objectives are those that you might expect: the National Vital Registration System, the Health Interview Survey, the Health and Nutrition Examination Survey, the Hosptial Discharge Survey, and the National Ambulatory Medical Care Survey.

Of the 112 objectives which can currently be tracked with existing systems, 69 can be tracked by existing NCHS systems and the remainder by systems established by a number of other agencies. The other 43 objectives trackable by current systems are drawn from eight other Health and Human Services agencies (such as the Center for Disease Control, and the Health Care Financing Administration), and six non-DHHS agencies and departments across the government.

The potential sources of those data not currently measured or available include 12 different Health and Human Services agencies, (in addition to the National Center for Health Statistics), eight other governmental agencies, and at least a dozen private organizations ranging from the Association of State and Territorial Health Officers to the Joint Committee for Accreditation of Hospitals, the Health Insurance Association of America, and even public opinion polling organizations.

An analysis of the availability of data by categories of objectives is interesting. Of the 56 health status objectives, about 50 are currently measurable; of the 46 reduced risk factor objectives, about 35 are currently measurable; and of the 46 improved services objectives, about 23 are currently measurable. But of the 42 public and professional awareness objectives, only four are currently measurable.

It is clear from our apparent disinterest in assessing awareness that we are accustomed to treating people as passive participants in their own health--an attitude which presents a compelling program challenge. Our most difficult gains will lie in health promotion and behavior enhancement, and those gains will only come if adequate data are available to track our progress. Some notion of future needs is contained in an analysis of the categories of data sources for the 112 objectives currently available. The data for 46 objectives are now available from surveys, 39 are available from surveillance systems, and 35 are available from administrative record reports.

Of those that are not now measurable, 40 could be obtained from surveys, 13 from surveillance systems, and 17 from administrative records reports. Most could be accomplished as add-ons to existing agency activities; except in a few instances, new systems need not be created in order to track progress toward these objectives.

The problem becomes a little bit different when assessing the areas we may wish to generalize. Specifically, these objectives are national, and they are intended to be adapted to State, county and even sub-county levels in similar exercises at those levels. But special analytic efforts will clearly be needed to undertake such an exercise below the State or county level. In addition, special analytic efforts will be needed to help identify new and previously unrecognized problems that will require changes in our objectives.

Most prominent in this overall effort to establish new and important uses for emerging data sources is the complexity of the task involved. Dr. Oliver Wendell Holmes once said that "Knowledge and timber shouldn't be much used until they're seasoned." That is an admonition which ought to be kept prominently posted as we piece splinters of data together to fashion a foundation for better health in this country.

But the task that we are embarking on is a genuinely exciting task, one that should provide a special mission to all those at this gathering and one that we can anticipate will yield genuine gains over the coming years to the health of the American people.

Utilization of Vital Statistics Data in Environmental and Occupational Health Studies

Concurrent Session I

A DEATH CERTIFICATE ANALYSIS OF OCCUPATION AND BLADDER CANCER

William H. Cooper and Scot E. Moss, Bureau of Health Statistics

There has been increasing interest in recent years with regard to occupational health especially where cancer is involved. The findings on asbestos and vinyl chloride are examples of this concern which has been expressed at the federal, state, and local levels. This has in turn been reflected in an increase in requests for data related to occupational health addressed to the Bureau of Health Statistics which is the designated Cooperative Health Statistics System agency for Wisconsin. These requests have come from planning agencies, program bureaus, and various researchers.

Thus, this study was undertaken with three purposes in mind. The first was to test the ability of our bureau, a state statistical services agency, to perform an epidemiologic study. The second was to determine the utility of the death certificate statement of occupation for research purposes. While we routinely produce tables of deaths by occupation, the use of these data in a manner of analysis beyond mere description has never really been checked out in Wisconsin. Finally, we hoped to make a small addition to our knowledge of the etiology of cancer.

Urinary bladder cancer, in particular, was chosen because a large body of evidence has accumulated indicating that exposure to bladder carcinogens in the work environment is a major component in the etiology of the disease. Although this figure could be expected to vary between locations, Cole, et al. [1], attributes 18% of male bladder cancers to the population's occupational exposure. In addition, the industrialized areas of New Jersey and regions centering on Detroit, Chicago, and Milwaukee are foci for some of the highest bladder cancer mortality rates in the United States as documented in the Atlas of Cancer Mortality for U. S. Counties: 1950-1969 by Mason, et al. [2]. The mortality rates for this disease show a marked positive correlation with industrialized urban centers and this pattern is consistent with the presumption that chemical carcinogenesis is an important mechanism of bladder tumor induction. The present study was proposed to evaluate the extent of these hazards associated with employment in southeastern Wisconsin, an area having high bladder cancer mortality rates. The design was such as to allow an assessment of the odds ratios associated with individual occupational and industrial categories.

METHODS:

The study area was determined from an examination of the Atlas of Cancer Mortality for U.S. Counties: 1950-1969 [2]. The map for white male bladder cancer shows an area of high rates in the predominantly urban southeastern corner of Wisconsin which extends down to encompass several counties in northern Illinois including the populous Cook county. High age-adjusted mortality rates in this area range from 8.5 to 9.3 per 100,000 population compared to a U. S. rate of 6.8 and a Wisconsin rate of 6.9 [3]. The four counties of Milwaukee, Racine, Rock, and Waukesha were included in the study because their mortality rates are significantly high compared to the U. S. rate and in the highest decile of all U. S. counties. In addition, two non-significant counties, Green and Walworth, were included because their rates were in the highest decile and because their addition formed a cluster of contiguous counties. An interesting point to make at this time is that while the first four counties are generally regarded as urban counties these last two are largely rural suggesting that farming as an occupation may be responsible for the elevated bladder cancer mortality. Such suggestions are always of intense interest in Wisconsin.

The study utilized information collected through the vital registration system of the state of Wisconsin. From these records 1028 deaths attributed to bladder cancer among white males occurred between 1960 and 1977 among residents of the six-county study area. These years were chosen for an entirely practical reason, i.e., most of the death certificate data was readily available on computer tape for these years. Each bladder cancer case was matched to a control which was randomly selected from the pool of certificates representing all white male deaths in the six counties during the study period, excluding those for which death was attributed to lung cancer, respiratory disease, or urinary tract cancers or diseases. Each control was matched on county of residence and within one year of both the age at death and date of death of the case. Comparability between the two groups was observed with regard to the unmatched variables of marital status and state of birth indicating a lack of bias in the selection of controls. In addition, diseases of the heart accounted for 52% and cancer for 17% of deaths among the controls which is about what would be expected based on the general population of white males over the age of 60.

The usual occupation of decedent is recorded on his death certificate and routinely coded at the time the certificate is processed according to the 1960 edition of the Census Bureau's Alphabetical Index of Industries and Occupations [4]. However, for certain broad occupational classifications, such as laborer or manager, the value to epidemiological research is limited without further information on the nature of the industry or business. Therefore, to supplement this information, we included the industry in which the decedent was employed as an additional variable which was coded by the authors at the time of the study according to the 1971 Census Bureau scheme [5].

The analysis of the relationship of occupation and industry to bladder cancer mortality followed the usual methods for the matched pair design [6]. The odds ratio was calculated as an approximation to the relative risk and tested for difference from unity by the McNemar test.

RESULTS:

The frequency of employment within the manufacturing related occupations was greater among bladder cancer cases than controls and was associated with an odds ratio of 1.12. Table 1 shows that the category of craftsmen, showing a significant odds ratio of 1.30, was primarily responsible for this excess, with managers contributing to a lesser extent. However, risks were not uniformly greater than unity among manufacturing occupations. In particular the category of laborers was associated with an odds ratio of .67. Among the non-manufacturing sector only clerical workers bore a risk comparable to those employed in manufacturing. Risks among the other categories were either very near or below unity.

Table 2 gives a listing of the numbers of bladder cancer cases and controls employed within specific occupations classified within the category of craftsmen. The higher frequency of cases within this category can in large measure be attributed to relative excesses of cases within the occupations of typesetters, shoemakers, patternmakers, tool and die makers, metal molders, blacksmiths, locomotive engineers,foremen, and painters.

The assignment of each certificate to a specific industry yielded the frequency distribution of employment by industry for cases and controls as displayed in Table 3. No odds ratio associated with any industry was significantly different from unity; however, elevated risks were noted in several industries including mining; wood and paper; stone, clay, and glass; painting; chemicals; and printing. A further subcategorization of certain industries whose employees previous studies had indicated as being at high risk of dying of bladder cancer again revealed no odds ratios which were significantly different from one as seen in Table 4. In fact, the frequency of controls employed in several of these industries exceeded the number of employed cases.

The number of cases and controls employed within occupational and industrial categories was stratified along the three matching variables of age at death, year of death, and county of residence in order to discern any change in risk over age, time, or place within any particular cagegory. We observed that all of the excess number of cases occurring in the chemical and printing industries could be traced to Racine county. A second point is that excess risk for craftsmen was found rather uniformly across counties, as well as over the years of the study, however, this excess risk was limited to persons dying before the age of 75 for whom there was associated an odds ratio of 1.7 ($p<.001$). This result suggests that bladder cancer may either be induced at an earlier age or may be more aggressive among persons employed as craftsmen relative to those who are not craftsmen.

DISCUSSION:

The high bladder cancer mortality rates in the vicinity of Detroit and Milwaukee have led to speculation of a hazard to the development of bladder cancer associated with employment in the automotive industry. A correlation study by Hoover, et al. [7] has shown that the percentage of men employed in the manufacturing of motor vehicles in U. S. counties where bladder cancer risk is excessive is significantly higher than the percentage of men employed in this industry nationwide. We recorded nearly equivalent numbers of cases and controls employed in this industry which clearly does not implicate the automotive manufacturing environment in the etiology of bladder cancer. A further subcategorization of this industry into individual occupational groups revealed no groups at elevated risk. A recent report by Baxter, et al. [8] on mortality among auto workers in England issued similar findings.

The excess number of cases within the craftsmen category is substantial and it is noteworthy that within this group typesetters, shoemakers, and painters were all found to be at elevated risk, especially since findings of other studies have led to the suspicion of a bladder cancer link with the printing and leather industries and exposure to paints.

The findings of a two-fold excess in mortality of cases employed in the wood and paper industry is perhaps the first time that this industry has been implicated as a possible source of bladder carcinogens. The elevated risk in the chemical industry is consistent with the correlation found by Blot and Fraumeni [9] that male bladder cancer rates are higher in counties with chemical manufacturing plants. That study also confirms our results for the printing industry which is suspect because of the exposure of printers to inks and organic solvents. However, this relationship has not been demonstrated consistently as studies by Cole, et al. [1] and Lloyd, et al.[10] have found no such association.

We uncovered no excess bladder cancer deaths within several industries suspected to be linked to the disease. In contrast to studies by Cole, et al. [1] and Wynder, et al. [11] no relation of bladder cancers to the leather industry was observed with the exception of shoe repair which consists entirely of shoemakers, an occupation noted above to be at elevated risk. Also, we could not confirm Anthony and Thomas' [12] report of excessive risk in textile workers. Rubber making is not an appreciable industry in southeastern Wisconsin so the risk associated with this industry could not be assessed. However, other studies have found high rates of bladder cancer mortality among these workers [1, 13-16]. Some speculation has appeared [12] concerning the effects of exposure to certain cosmetic chemicals among hairdressers. No hazard was found to be associated with this occupation. Also, beer production, an industry dear to many in Wisconsin, was not found to be associated with increased risk of bladder cancer mortality. Finally, the suspicion raised earlier about farming as a high risk industry was not borne out. The odds ratio for this industry is essentially unity.

Failure to demonstrate a significantly high risk associated with an industry does not necessarily mean that a hazard does not exist within that industry. In this study several factors undoubtedly masked and possibly confounded the true underlying relationship of occupation to bladder cancer. First, the nature of a death certificate

study does not permit the gathering of information on individual histories of cigarette smoking. It has been reported by Wynder and Goldsmith [17] that nearly one half of all male bladder cancers are due to cigarette smoking. Thus the potential for masking a true occupational effect is great unless smoking is controlled for in the analysis. Coffee consumption, which is a possible etiologic agent of bladder cancer, could have interfering effects similar to smoking, though they would be much less pronounced. Secondly, the classification of a person into an occupational and industrial category based upon the scanty description recorded on the death certificate is a crude and error-prone method. Ideally one would like to obtain complete employment histories including the duration for which each position was held to assess the effect of occupational changes and evaluate the reliability of the death certificate information. Also, the extent to which occupational determinants of bladder cancer are also determinants of other major causes of death such as heart disease is unknown. This could result in the hiding of an occupational effect by introducing bias in the control group.

In conclusion, we would like to summarize the extent to which the original purposes behind this study were fulfilled. First, concerning the finding of specific high risk occupations or industries, although few of the results reached statistical significance several were suggestive. These may warrant further study through more intensive efforts such as follow-back interview studies, retrospective cohort studies utilizing historical information such as union records or studies using more sophisticated statistical techniques such as logistic models to adjust for cofactors. Next, with respect to the adequacy of Wisconsin's death certificate information for retrospective studies, we find that it is a useful resource for this type of study. In addition, it has been made more useful recently with a switch to the 1971 Census Bureau codes [5] for occupation and the addition of the statement of industry or type of business to the computer record. Finally, as to the ability of the bureau to conduct an epidemiological study, we find that we are quite capable in this area. However, we are essentially a service agency for health data with the result that original research is generally given low priority in the allocation of staff resources. Nor do we have the resources or the authority to conduct the more intensive follow-up studies suggested by the retrospective approach. A more productive arrangement would be a collaborative effort between the Bureau of Health Statistics and a disease prevention or control agency with the ability to take the next step in the process. Several such arrangements are currently under consideration.

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Table 1

NUMBER EMPLOYED AND ODDS RATIOS
ACCORDING TO MAJOR OCCUPATIONAL CATEGORIES

Category	Cases	Controls	Discordant Pairs	Odds Ratio	95% C.I.
Manufacturing	666	640	245 / 219	1.12	(.93, 1.35)
Managers	61	51	58 / 48	1.21	(.82, 1.79)
Craftsmen	336	279	247 / 190	1.30[a]	(1.07, 1.58)
Operatives	179	190	140 / 151	.93	(.73, 1.17)
Laborers	54	77	46 / 69	.67[b]	(.46, .98)
Not elsewhere classified	36	43	34 / 41	.83	(.52, 1.32)
Clerical	69	62	64 / 57	1.12	(.78, 1.62)
Farming	76	75	58 / 57	1.02	(.70, 1.48)
Professional	60	62	53 / 55	.96	(.66, 1.42)
Unknown or Unemployed	23	27	21 / 25	.84	(.46, 1.52)
Sales	82	99	77 / 94	.82	(.60, 1.11)
Service	52	63	47 / 58	.81	(.55, 1.20)
TOTAL	1028	1028			

[a] $p<.01$
[b] $p<.05$

Table 2

NUMBER EMPLOYED AND ODDS RATIOS ACCORDING TO
CERTAIN SPECIFIC OCCUPATIONS INCLUDED WITHIN THE CRAFTSMEN CATEGORY

Category	Cases	Controls	Discordant Pairs	Odds Ratio	95% C.I.
CRAFTSMEN	336	279		1.3[a]	
Typesetters	6	1	6 / 1	6.0	(.7, 52.0)
Shoemakers (except factory)	4	1	4 / 1	4.0	(.4, 37.4)
Pattern Makers (except paper)	7	2	7 / 2	3.5	(.7, 17.4)
Tool & Die Makers	16	7	16 / 7	2.3[b]	(.9, 5.7)
Metal Molders	8	4	8 / 4	2.0	(.6, 6.8)
Blacksmiths	6	3	6 / 3	2.0	(.5, 8.2)
Locomotive Engineers	6	3	6 / 3	2.0	(.5, 8.2)
Foremen	51	29	47 / 25	1.9[c]	(1.1, 3.1)
Painters	21	13	20 / 12	1.7	(.8, 3.5)
Tinsmiths, Sheetmetal Workers	9	6	9 / 6	1.5	(.5, 4.3)
Plumbers, Pipefitters	12	9	11 / 8	1.4	(.5, 3.5)
Carpenters	27	33	24 / 30	.8	(.5, 1.4)
Electricians	7	12	7 / 12	.6	(.2, 1.5)

[a] $p<.01$ [b] $.05<p<.10$ [c] $p<.02$

Table 3

NUMBER EMPLOYED AND ODDS RATIOS
ACCORDING TO MAJOR INDUSTRIAL CATEGORIES

Category	Cases	Controls	Discordant Pairs	Odds Ratio	95% C.I.
Mining	5	2	5 / 2	2.50	(.47, 13.32)
Wood & Paper	17	9	16 / 8	2.00	(.84, 4.75)
Stone, Clay, Glass	6	3	6 / 3	2.00	(.49, 8.23)
Painting	21	13	20 / 12	1.67	(.80, 3.46)
Chemical	15	11	14 / 10	1.40	(.61, 3.20)
Printing	19	14	18 / 13	1.38	(.67, 2.87)
Electrical	32	27	32 / 27	1.19	(.70, 2.00)
Transportation Mfg	44	41	39 / 36	1.08	(.68, 1.72)
Not Elsewhere Classified	134	129	112 / 107	1.05	(.80, 1.37)
Utilities & Communication	25	24	25 / 24	1.04	(.59, 1.84)
Transportation Operation	87	85	80 / 78	1.03	(.75, 1.41)
Agriculture	76	75	58 / 57	1.02	(.70, 1.48)
Wholesale, Retail	103	102	92 / 91	1.01	(.75, 1.36)
Food Products	45	45	44 / 44	1.00	(.65, 1.53)
Metal	65	67	60 / 62	.97	(.67, 1.39)
Machinery	81	85	73 / 77	.95	(.68, 1.31)
Construction (except painting)	77	82	67 / 72	.93	(.66, 1.31)
Professional Service, Business Services, & Government	155	175	123 / 143	.86	(.67, 1.10)
Petroleum & Rubber	3	5	3 / 5	.60	(.14, 2.59)
Leather	12	22	12 / 22	.55	(.27, 1.12)
Textiles	6	12	6 / 12	.50	(.18, 1.36)
TOTAL	1028	1028			

Table 4

NUMBER EMPLOYED AND ODDS RATIOS
WITHIN SUBCATEGORIES OF CERTAIN SUSPECT INDUSTRIES

Category	Cases	Controls	Discordant Pairs	Odds Ratio	95% C.I.
Leather					
Tanned, Curried & Finished	4	12	4 / 12	.3[a]	(.1, 1.1)
Leather Products	4	10	4 / 10	.4	(.1, 1.3)
Leather Repair	4	0	4 / 0	-	-
Textiles					
Dyeing & Finishing Textiles	1	2	1 / 2	.5	(0, 5.8)
Fabricated Textile Products	5	7	5 / 7	.7	(.2, 2.3)
Fabric Mills	0	3	0 / 3	-	-
Transportation Manufacturing					
Automobiles & Equipment	37	38	33 / 34	1.0	(.6, 1.6)
Miscellaneous Transportation Equipment	7	3	7 / 3	2.3	(.6, 9.3)
Printing					
Newspaper Publishing	1	4	1 / 4	.3	(0, 2.3)
Printing (except newspapers)	18	10	18 / 10	1.8	(.8, 4.0)
Miscellaneous					
Hairdressers	4	10	4 / 10	.4	(.1, 1.3)
Beer Production	12	16	11 / 15	.7	(.3, 1.6)

[a] $.05<p<.10$

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USE OF THE NATIONAL DEATH INDEX IN OCCUPATIONAL EPIDEMIOLOGY

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Records maintained by offices of vital statistics form a primary resource for studies of mortality of working populations. Today I will briefly describe these studies, discuss some of their problems and show how a national death index could greatly facilitate and improve the quality of these data.

Typically occupational epidemiology is undertaken where there is reason to believe that workers have been exposed to some disease causing agent. Where the disease of interest is cancer or some other disease with a long latent period, this exposure must have taken place sufficiently long ago to allow time for the disease to have developed and thus be observable. Since the magnitude of the disease excesses expected in most studies is not large, a sizable number of workers must be involved if any meaningful disease excess is to be detected.

To illustrate these points, I will describe a study I have been conducting on a possible relationship between airborne arsenic exposure and respiratory cancer. A population of workers at a large copper smelter at Tacoma, Washington is known to have had high exposures to arsenic trioxide as long ago as 1911 when this smelter started using high arsenic content copper bearing ore. Evidence of worker exposure to arsenic trioxide comes not only from air samples taken many years ago, but from very high urinary arsenic levels in these workers -- levels that can not be accounted for by other sources of arsenic.

We identified 2776 males who worked a year or more at the smelter during the period 1941-1964. We did not include men who terminated work at the smelter before 1942 since these are hard to trace and, moreover, if they died long ago cause of death ascertainment would be difficult. We did not include men first employed after 1963 since exposure to arsenic for these men would have been too recent to be likely to affect the occurrence of respiratory cancer.

Our objective was to trace all of the men in this cohort to determine current vital status, and if dead to establish the cause of death. Given this information, it is then possible to determine whether there is any excess in respiratory cancer, and if so determine what this excess is related to.

My first slide shows the results of this tracing. So far we have determined the vital status of all but 2.8% of the 2776 men in our cohort, and for the 1061 known to be dead we have obtained death certificates for all but 4.0%. This involved a considerable effort over a two year period. First, we used the personnel files at the smelter to determine who was still employed, who died while employed, who had retired under the retirement plan of the company operating the smelter, and for those retired who had already died. As the slide shows, this determination was as of a particular date -- in our case December 31, 1976. There were many men who simply quit or were fired and the smelter files usually had no information as to the whereabouts or vital status of these. Names and social security numbers for these men were sent to the Social Security Administration for comparison with their files. They were able to tell us whether they had a record of a death claim as of December 31, 1977, whether the men were currently paying in or drawing out of the social security system as of that date, or whether they had no current information. Where death was known to have occurred the Social Security Administration provided us with date of death and the name of the state in which the death claim was filed. We then tried to obtain certificates from the states. It isn't certain, however, that the state where a social security claim was filed was also the state where the death certificate was filed and this causes some problems. The other problem at this point is the group of men not known to be dead or who, as of our cutoff date, were neither paying into or drawing out of the social security system.

For a long time it was assumed that persons not known to be dead by the Social Security Administration were probably alive since even though a person may not be currently paying into or drawing out of the social security system, if that person died a claim would have been filed. The reason for believing this is that there is a death benefit of up to $255 usually paid to the undertaker for covered workers, and it is generally felt that undertakers are very conscientious about filing for this money. Many occupational epidemiologic studies in fact depend only on social security records. For example, a study of atomic energy workers at the Hanford plant in the state of Washington relied only on social security death determinations.[1] Much epidemiologic work carried out by companies contracting with industry also determine deaths by clearing only with social security files.

Recently there have been a number of studies that show that in fact many people with covered employment do die apparently without a death claim being filed with the social security system. I say "apparently" here since there is the possibility of clerical error when social security files are searched. Ott et al submitted a total of 1214 known deaths to the Social Security Administration among employees of a chemical manufacturing plant.[2] Only 94% of these were identified as dead by the Social Security Administration. Milham submitted known deaths among men who had worked at a aluminum reduction plant and only 81% were identified.[3] Shindell et al reported on an unpublished study by MacMahon in which 92 percent of known deaths were identified by the Social Security Administration.[4]

Believing that deaths among covered workers are not always reported or identified by the Social Security Administration, we undertook an intensive search for men not known to be dead or alive by the Social Security Administration using state drivers license files, veterans administration files, and personal contacts

with friends, relatives and neighbors, and found additional deaths. This was a time consuming and expensive effort. Even after all this, however, there are still some men who we can not trace. Some of these are probably dead. Moreover, there are some men we believe to be dead but for whom we can't find death certificates. These omissions may be important since we do not know how the mortality experience, or the cause of death distribution compares between the traced and untraced groups.

While we can't be certain about the bias introduced in occupational epidemiology by untraced cohort members and missing death certificates, we do have some indication that cohort members traced by different methods differ in their mortality experiences. Several years ago in a study of steelworkers Redmond and Breslin compared deaths known to employers with deaths not known to employers (terminations, etc.). They found that 55% of deaths from cancer were known to employers whereas 79% of deaths from heart and circulatory disease were known./5 Thus if their steelworker cohort had been traced only using employers records a disproportionate amount of cancer would have been missed. In a similar study Fox and Collier found that workers who terminate employment have generally higher death rates than those who do not./6

One of our students recently analyzed five of our studies to see if these findings hold generally./7 My second slide shows proportionate mortality ratios (PMR's) for lymphopoietic cancer -- a type of cancer of interest in many epidemiological investigations. No clear pattern emerges here. If follow-up was limited only to employer records PMR's are understated in two cases and overstated in three. One can not predict from this what kind of bias might be introduced by failure to trace all of a cohort.

Slide #3 shows the same data for respiratory cancer. Again no clear pattern emerges. In the study of copper smelter workers, which I discussed earlier, employer records slightly overstated a respiratory cancer excess. In the three of the four other studies employer records understated the PMR for respiratory cancer.

One of the things I learned early in carrying out statistical studies is that systematic bias is something we can handle and is no big problem. On the other hand, the kind of bias that may be present in individual occupational epidemiologic studies may not be predictable, and this is a problem.

The only solution I can see is to trace everyone -- or almost everyone. As indicated earlier this is very time consuming and expensive. A national death index would greatly facilitate this tracing. Occupational cohorts nearly always contain good identifying information. Certainly name and social security number is well recorded in employer records, and date of birth is in most cases accurate. A match on all three items would be a definite match with the national death index and two out of three, a probable match. Where matches occur information on the state in which death occurred would be available as well as a certificate number. Given these, locating death certificates would be greatly facilitated possibly reducing the work of searching for death certificates at the state offices of vital statistics by a third or more. Obviously this system needs to be tested where deaths identified by current methods such as those I've described can be compared with deaths identified through the national death index.

I had hoped that once a death is identified through the national death index we could avoid going back to individual states for death certificates, since rules, administrative procedures and personnel availability vary from state to state and this phase of these epidemiologic studies often introduces considerable delay, and sometimes there is some urgency. Since the end product of obtaining death certificates is assigning ICD rubrics I had hoped that the rubrics assigned by the NCHS could be made directly available avoiding the necessity for recoding death certificates and thus improving comparability to national statistics by which mortality in an occupational cohort is usually judged. I have learned that this is not possible due to confidentiality agreements between the states and the national government. I predict, however, that this will somehow be worked out.

I'm confident the national death index will make future occupational epidemiologic studies better, cheaper and faster. My only regret is the emphasis we must place on the word "future" since most new studies involve a search for deaths for many years prior to 1979 -- the first year of the national death index. For these studies the national death index is for the next generation. On the other hand during the next few years we will be updating many old studies and here the national death index should prove invaluable.

Summary

Occupational epidemiology usually involves determination of the mortality experience of a group of workers exposed to some agent suspected of causing disease. Where deaths occur among individuals actively employed or on retirement they are usually known to the employer. For workers who terminate death ascertainment is more difficult. Currently the primary tracing mechanism is through social security files. Recent studies have shown, however, that this tracing may miss around 10% of deaths among workers believed to be covered by social security. This may introduce serious bias in some occupational epidemiologic studies. An additional bias may occur where social security or other sources indicate a death has occurred but it is not possible to locate the death certificate. Data are presented to show that for individual causes of death these biases may vary from study to study. A national death index could provide a solution to this problem. Employer records from which occupational cohorts are developed usually contain all the information needed for matching with the national death index. Where matches occur it would be relatively easy to locate death certificates in state health department files. It may also be possible to avoid recoding

of death certificates if ICD rubrics assigned by the NCHS can be made available. The availability of a national death index will clearly make future occupational epidemiological studies better, cheaper and faster.

Slide #1

Vital Status as of December 31, 1976 of 2776 Copper Smelter Workers Who Worked a Year or More 1941-1964

Vital Status	Number	Percent
Alive	1639	59.0
Dead	1061	38.2
Death Certificate Obtained	1018	(96.0)
Death Certificate Outstanding	43	(4.0)
Lost to Follow-Up	76	2.8
Total	2776	100.0

Slide #2

PMR's for Lymphopoietic Cancer by Source of Information

Cohort	Deaths Known to Employer	Deaths Not Known to Employer	Complete Ascertainment
Copper Smelter Workers	63.6	116.2	89.9
Nickel Workers	120.0	-	109.3
Chemical Workers	78.3	156.1	95.6
Fibrous Glass Workers	125.2	102.9	110.7
Mineral Wool Workers	108.3	92.8	99.8

Slide #3

PMR's for Respiratory Cancer by Source of Information

Cohort	Deaths Known to Employer	Deaths Not Known to Employer	Complete Ascertainment
Copper Smelter Workers	211.4	152.9	181.4
Nickel Workers	115.0	32.7	108.1
Chemical Workers	68.8	111.6	78.1
Fibrous Glass Workers	41.7	107.2	84.1
Mineral Wool Workers	127.2	109.8	117.9

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INTERVIEW STUDIES WITH NEXT OF KIN OF PERSONS WHO DIED OF CANCER

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INTRODUCTION

Studies of the etiology of cancer and other fatal diseases often must involve the collection of information from relatives or friends of deceased patients. Although the assumption of accuracy of such information is of critical importance in any study, this is difficult to verify. Several studies have assessed the validity of interviewing the subject versus a surrogate respondent by comparing responses of pairs of subjects. However, these studies have nearly always been with husband-wife pairs and have concentrated on dietary information. Even if we assume that their conclusions of acceptable surrogate responses are also applicable to more general epidemiologic studies which include other respondents less familiar with the study subjects, we are often faced with the practical problem of the surrogates being unable to provide all the information requested. In order to estimate the amount of information obtainable from each of several types of surrogate respondents, we have compared frequencies of responses to a number of questions from two recently completed case-control investigations of respiratory cancer.

METHODS

Case-control studies were initiated in coastal areas of Virginia (1) and northeast Florida to investigate reasons for the exceptionally high mortality from lung cancer among residents of these seaboard areas. The Virginia study identified and successfully interviewed a total of 1011 lung and laryngeal cancer cases and controls from state mortality registries for 1972-76; 33% of those interviewed were black and 31% women. Mortality files were used to select deaths from lung cancer and other causes in Florida during 1976; this study also included an incidence survey whereby newly diagnosed cases and controls were ascertained from hospital discharge summaries. Together these two components resulted in a total of 807 completed interviews, all with males, of whom 22% were black.

Interviews were sought with the hospitalized patients, or with next-of-kin if the patient had died, with the following preferred order: spouse, child, sib, or other. Respondents for 85% of the subjects in Virginia and for over 90% of those in Florida were successfully interviewed by professionally trained interviewers using nearly identical questionnaires in the two states. In each area the primary reason for failure to interview was inability to locate the patient or next-of-kin, followed by patient or next-of-kin refusal to be interviewed. Table 1 shows the number of completed interviews in each survey by respondent type. In both mortality series the respondent was typically the spouse of the deceased. Information sought included lifetime histories of tobacco use, occupation, and residence, a history of other cancer and chronic lung diseases and several demographic variables.

We have chosen for comparison representative questions from each of these areas. These questions include several requiring a simple yes/no response as well as historical and quantitative information. A non-response is defined here to be either an actual "don't know" coded response or a blank response. Those subjects for whom a question was not applicable (e.g., for smoking history) were not included in the denominator when calculating the proportion of non-responses for that question. The proportions shown here are the observed proportions of non-response but the decisions as to whether the results could be combined for the two studies and for cases and controls were based on a categorical data analysis using the SAS procedure FUNCAT (2).

RESULTS

Table 2 presents the proportions of non-response by respondent type for the questions for which no differences were seen between Florida and Virginia or between cases and controls. Level of education was a categorical response to the question "What is the highest grade or year of school or college you (or the subject, for next-of-kin) completed?" Next to self response, the sib could answer most often, followed by spouse and child, with the "other" category being worst by far (15% non-response).

The next two results are shown for Florida only, as the Virginia responses to these questions were not available. Surprisingly the child was better able than the sib to give the subject's county of residence at birth. Again, the "other" category had the poorest response rate. The fourth line was in response to the question "Did you ever have any of the following chronic lung diseases?" followed by a list of 8 diseases. The spouse was best able to answer this, although all the response rates were good. The last question, concerning asbestos, was part of a materials-handled check-list, with non-response rates of 12 to 14% for the relatives and 22% for others.

Another interesting finding related to job exposures is that the number of jobs reported in the Florida study varied by respondent type. The subjects themselves reported an average of 8 jobs while the spouse reported 6, the sib and child 5, and other respondents reported less than 4.

Table 3 presents the results for questions with different response rates in the two study areas. Respondents in Tidewater Virginia may have been better able to report any employment in the shipbuilding industry because shipbuilding is such a major industry in that area (30% of the subjects in Virginia reportedly worked in the industry, compared to 18% in Florida). The smoking section is an example of how the use of a categorical response or improved techniques of probing by the interviewer can make a difference in response. Response rates for all 3 smoking questions were originally lower for Florida, but when the investigators estimated the number of years smoked from verbatim responses (e.g., "started smoking in his mid-teens") these response rates improved dramatically. The detailed smoking history was obtained by asking "Did you ever smoke for 6 months or longer?" for each of 8 categories of packs/day, along with the number of years smoked at that level. A non-response to any of these questions constituted a non-response to the entire detailed history. Thus over one-third of the subjects themselves and over 43% of the next-of-kin could not provide complete smoking histories. The purpose of this question was to estimate a lifetime dose for cigarette smoking.

Table 4 shows non-response to questions about a history of cancer in the subject's family. There were significant differences between response rates in the two study areas and by case-control status. As before, a non-response to the question about either parent or about any grandparent constituted an overall non-response. The proportion of non-response is lower for Florida cases than for controls in 8 of the 10 categories, which is consistent with a recall bias for cancer cases. The pattern for Virginia respondents is not as clear. More than half of the subjects themselves could not give complete cancer histories for all of their grandparents. The child was as poor a respondent for this question as an unrelated person, since they were being asked about their great-grandparents.

DISCUSSION

To summarize, these results suggest several ways to improve next-of-kin interview studies. First, the order of priorities to be followed when searching for a surrogate respondent should depend on the time frame of the majority of questions being asked. A surrogate respondent can best answer a question about an event that happened while he or she knew the subject well, as when they were living in the same household. For example, sibs tend to be the best respondents to questions concerning childhood exposures or events, such as age when the subject started smoking, but quite often can't provide information about the subject's recent past. Spouses, on the other hand, can easily answer questions about current habits or usual adult habits, residences, and occupation, especially if they were married for some time.

Secondly, consider restricting surrogate respondents to be first-degree relatives only (i.e., exclude the "other" category). The "other" category of respondent had the poorest response rate for nearly every one of our questions. In fact, the non-response rate for "others" was over 3 times that of the next worse respondent category for county of residence at birth and employment in the shipbuilding industry. This category of respondent is typically the most time-consuming and expensive to locate and interview. One also wonders about the validity of responses by persons in this category, such as a friend in the nursing home or an attending nurse in the hospital.

The relative savings possible by dropping this category of respondent altogether can be easily approximated. If we assume a baseline cost of c dollars to locate and interview the subject or his or her spouse and α, β, and γ times that cost to locate and interview a sib, child, or other respondent, respectively, then the relative proportion of interviewing costs that could be saved by not including respondents other than first-degree relatives is shown in Table 5. The proportional distribution of respondent types in the Florida study has been used for this calculation, but it can easily be generalized. Note that this proportion is independent of total sample size or base-line interviewing cost. To illustrate the dramatic savings that can be realized by this restriction of respondent type, consider a cost of $50 to interview the subject or spouse, $100 for the sib or child, and $200 for another type of respondent. For a sample of 1000 interviews, the total cost, again using the Florida respondent type distribution, is $72,500, of which $20,000 or 27.6% was spent on the "other" category of respondent. This simplified calculation represents an example that does not take into consideration any fixed overhead costs or the cost of respondent searches that ultimately do not result in completed interviews but the exercise can serve as an aid to study design. Professional interviewing firms with experience in a proposed study area should be able to provide ranges for the cost factors involved in the calculation.

Of course, excluding a respondent category will reduce the number of potentially successful interviews, but with the money saved one could afford to expand the time period of case ascertainment or geographic area so that the end result will be a larger

sample. When the target sample size is calculated by means of a value of the odds ratio (relative risk) or some other statistic to be detected as significantly different from the null hypothesis, then this calculated sample size needs to be inflated to account for losses due to respondent refusal, inability to locate a suitable respondent, and the estimated non-response (i.e., missing values) to questions of interest.

Finally, the level of non-response for some questions suggest that they shouldn't be asked at all, or at least that less specific information should be sought. For example, results of the Florida and Virginia studies could not be used to detect a familial aggregation of cancer, at least beyond first-degree relatives, or to estimate lifetime pack-years of cigarette use. Perhaps a lifetime dose could be better estimated from usual dose multiplied by # of years of use at that level.

A separate issue that we can only briefly discuss here is the validity of responses that are given by surrogate respondents. Rogot and Reid (3) recently reported the results of a comparison of 1800 next-of-kin responses to a mailed questionnaire with responses by the subjects themselves who had completed a similar questionnaire before their death during the previous year. The distribution of respondent types was very similar to that observed in our Tidewater Virginia study, although their response comparisons were not presented by specific surrogate category. Their finding that the degree of disagreement and also of non-response varied by topic, sex, and other factors is consistent with the results shown here.

The results of a large study of 300 pairs of spouse respondents to an ongoing Hawaiian health survey were reported by Kolonel, Hirohata, and Nomura (4). After exact responses were grouped, the rates of agreement were generally over 80%, but again there was variability by the type of question. They were unable to identify any respondent characteristics that could discriminate between good and poor respondents.

Smaller studies of validity have been reported (5-8), primarily comparisons of dietary patterns as reported by husbands and wives. These have generally concluded that spouses can adequately respond to questions concerning the study subject, but that, as expected, agreement worsens as questions become more detailed.

The patterns of non-response by respondent type presented here are consistent with the patterns of disagreement seen in these studies of validity. By examining these patterns by respondent type, we have been able to identify problem questions and suggest several ways in which interview studies could be improved.

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Table 1 - Number of Interviews According to Respondent Type

		Jacksonville, Florida		Tidewater, Virginia	
Self-	Cases	96	43%	0	
	Controls	250		0	
Spouse-	Cases	168	39%	298	57%
	Controls	145		279	
Sib-	Cases	24	4%	56	12%
	Controls	12		63	
Child-	Cases	30	7%	111	19%
	Controls	28		81	
Other-	Cases	26	7%	64	12%
	Controls	28		59	
Total	Cases	344		529	
	Controls	463		482	
		807		1011	

Table 2 - % Non-Response by Respondent Type - Florida and Virginia Combined

	Self	Spouse	Sib	Child	Other
Level of education	0	3.3	1.9	6.4	15.3
County of residence at birth (Fl.)	1.2	7.7	5.6	1.7	25.9
# years at 1st residence (Fl.)	1.2	15.0	16.7	15.5	22.2
Ever had chronic lung disease	0	0.2	3.9	2.4	5.1
Ever handled asbestos	0.9	13.4	14.2	11.6	22.0

Table 3 - % Non-response by Respondent Type and Study Area

		Self	Spouse	Sib	Child	Other
Ever worked in shipbuilding	Fl.	0.6	5.4	5.6	3.4	18.5
	Va.	-	3.3	0.8	1.6	12.2
Cigarette smoking						
Usual amount smoked	Fl.	5.9	12.5	29.0	11.8	20.5
	Va.	-	3.2	13.1	7.0	22.8
# years smoked	Fl.	0	6.6	9.7	9.8	18.2
	Va.	-	20.6	28.3	19.6	39.1
Detailed smoking history	Fl.	33.8	53.1	64.5	51.0	56.8
	Va.	-	43.3	57.6	44.8	63.0

Table 4 - % Non-response by Respondent Type, Study Area, and Case-Control Status

		Self	Spouse	Sib	Child	Other
Cancer in either parent						
case-	Fl.	11.5	35.1	12.5	33.3	61.5
	Va.	-	31.9	14.3	29.7	42.2
control-	Fl.	6.4	25.5	16.7	60.7	75.0
	Va.	-	20.1	9.5	28.4	47.5
Cancer in any grandparent						
case-	Fl.	53.1	73.2	41.7	86.7	80.8
	Va.	-	70.5	53.6	73.0	75.0
control-	Fl.	59.2	77.2	75.0	100.0	89.3
	Va.	-	68.5	61.9	72.8	78.0

Table 5 - Estimation of Relative Savings Possible by Exclusion of "Other" Respondents

	Self	Spouse	Sib	Child	Other
Cost/Interview	c	c	αc	βc	γc
Distribution of respondent type	40%	35%	5%	10%	10%

For sample size N, total interviewing cost (T) =
$cN\ [.75 + .05\alpha + .10\beta + .10\gamma]$

Relative savings by exclusion of "other" respondents
$cN(.10)\ \gamma/T = \gamma/[7.5 + .5\alpha + \beta + \gamma]$

The Use of Health Records in Environmental and Occupational Health Studies

Concurrent Session J

MAPPING CHEMICAL EXPOSURES

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I. INTRODUCTION

The purpose of this presentation is to give a preliminary report on a new technique that the Hazard Section of NIOSH is actively pursuing.

The Hazard Surveillance Section of NIOSH is charged with the responsibility to develop, compile, and analyze information on the number and distribution of workers exposed to potential occupational hazards to enhance the preventive aspects of occupational health.

It is natural, therefore, for the Hazard Section to be interested about the geographical dispersion of various industrial materials throughout the United States. Our interest in this stems from our need to stimulate interest in, and a greater awareness of potential occupational exposures to hazardous materials.

This awareness is very difficult to achieve because of two built-in confounding factors. Chief among these factors is the practice of tradenaming products. That factor only slightly overshadows the other, which is inadequate labelling requirements. Taken together, these two constitute a rather large impediment to the kind of awareness we feel it is necessary to build.

The Hazard Section does, however, have access to a unique resource which is useful in penetrating the mystique surrounding the question of who is potentially exposed to what in the work place. This report is an attempt to briefly describe that unique resource, and to introduce an intriguing new use of its data.

II. GOAL

The goal of the mapping project is to develop maps of the continental United States showing suspected locations and concentrations (if possible) of potentially hazardous exposure agents. Futhermore, insofar as practical, we would like to compare these maps and the underlying data with other data sources such as NCI's "Cancer Mortality by County: 1950-1959" (1) and their "Atlas of Cancer Mortality for U. S. Counties: 1950-1969." (2)

III RESOURCES

The principal resource used for the mapping project was NIOSH's National Occupational Hazard Survey Data Base. The National Occupational Hazard Survey (NOHS) was conducted during the period 1972 through 1974. It was a nationwide effort to gather information on potential workplace exposures to hazardous material through the use of 20 field surveyors who actually visited over 4,500 different plant sites throughout the United States.

The surveyor's job, to simplify it greatly, was to first interview the plant management about current practices within the plant, and then to conduct a detailed walk-through survey of the plant, noting occupational exposures to potential chemical, physical, and biological hazards. The surveyors also noted the conditions under which the exposures were occurring, and the control measures that were being applied.

The plants that were surveyed represented a national probability sample of selected industries. The result of that effort is a computerized data base which contains almost five million records, and which is useful for describing potential occupational exposures by industry, by occupation, and by exposure agent. (3)

NIOSH's experience in compiling this data base indicated that most of the workers' exposures were to products that were tradenamed as opposed to being in pure chemical form with the chemical adequately labelled. Some 70% of all exposures noted during the survey were, in fact, to tradenamed products. NIOSH then undertook a program of follow-up by writing to the 10,000 manufacturers of these tradenamed products to obtain the ingredients and the exact formulation of the product. This auxiliary effort, dubbed "TNIC" or Trade Name Ingredient Clarification yielded information which has proven to be invaluable for the mapping project. Because it contains exact product formulas, the TNIC data provides very valuable insights into the potential for occupational exposures to hazardous materials that were formerly obscured or disguised due to the twin problems of tradenaming and inadequate labelling. Of the approximately 80,000 different tradenamed products enountered in the course of the NOHS survey, about 64,000 or 80% have been resolved into components (exact formulas) through the cooperation of the manufacturers.

The secondary resource that the mapping project draws upon is the Dun & Bradstreet file. This computerized file contains information on 4.3 million companies throughout the United States. Each company record includes the company name and address, its size in terms of the number of people employed there, and its Standard Industrial Classification (SIC) code.

IV. METHODOLOGY

As a first step, a single important industrial material suspected of being in widespread usage throughout the United States was chosen as an appropriate vehicle for developing the methodology. This

material was chosen because it was suspected of being incorporated into a wide range of products which enjoyed a wide variety of uses within industry.

This material, asbestos, was used as the basis for a computerized search of the entire NOHS data base. The result was a compilation of all the plants in which NOHS surveyors had noted at least one worker potentially exposed to the material by virtue of his or her job, during the period 1972 through 1974. Any plant visit which indicated that workers in the plant used this material (or a tradenamed product which, upon resolution was found to contain this material) for periods totaling more than one-half hour per week in the aggregate served to nominate an entire industry for further consideration.

The list of industries nominated through this process by the NOHS data base was lengthy. It included one-hundred and forty-seven distinctly different industries, as delineated by the four-digit Standard Industrial Classification (SIC) code.

The length of the list was due, in part, to the ability of the integrated NOHS and tradenames data bases to penetrate the tradename barriers and detect obscure or unrecognizable exposures to the material. This is expected to become a regular occurrence in future attempts at mapping.

The list of nominated industries was then analyzed a number of ways, to determine the extent to which the NOHS study accurately reflected each of the industries in question. A set of decision rules was then developed which was capable of separating the list into two smaller lists of industries; one qualified for further consideration, and one unqualified. The decision rules were carefully applied to each of the industries on the candidate list.

The first rule specified that NIOSH surveyors must have observed the material in question at least twice in an industry during 1972-1974. The second rule specified that in addition to Rule #1, the NIOSH surveyors must have noted exposures to the material in question in at least 25% of the plants of that industry type that were visited. The two tests were designed to eliminate from further consideration those industries in which the NOHS data was too limited to provide a good case for continuing.

The fully qualified list of industries (see Table 1) then formed the basis for extracting the records of similar business establishments throughout the United States from the Dun & Bradstreet file. The entire Dun & Bradstreet file was searched for companies whose industry codes matched the twenty-five (25) on the "fully qualified industries" list. Records of approximately 60,000 business establishments were extracted using the matching procedure.

These records were then organized by county and analyzed with the aid of a widely-available computerized statistical analysis system. Results were tabulated and displayed on a county-by-county basis as a means of providing the researcher with some preliminary insight prior to readying the data for the cartography system.

The cartography system was county-based. It contained X and Y coordinates of all the county lines, and required only the proper county code and a code to indicate the desired shade of darkness for each of the counties. (2) The proper county identification code was not the one extracted from the Dun & Bradstreet file, however. Therefore, a code-conversion table was built and software developed which was capable of automatically translating the Dun & Bradstreet code to the preferred code.

The shade code was assigned to each county on the basis of the number of qualified industrial facilities within the county. To provide clarity and to achieve the greatest visual impact, the counties with the highest number of qualified facilities were shaded the darkest. Nine different shading protocols were investigated as a means of becoming familiar with the variation in subsequent outcomes that the different protocols afforded. As the maps show, it is possible to prepare shading protocol that becomes more selective until only the very, very high interest counties remain shaded on the map. It is important to stress that these maps are composites of all 25 of the "fully qualified" industries which you saw on that list.

V. RESULTS

The maps appear to corroborate the conventional wisdom that asbestos and asbestos-containing tradenamed products conceivably were used in industrial settings across most of the face of America.

The industries that were rated "fully qualified" tend to be found in conjunction with large population centers. There are, however, some notable exceptions. Fargo, North Dakota, and Sioux Falls, South Dakota, for example, with populations less than 100,000 persons, cannot be considered major population centers, yet each contains several "fully qualified" industries. Two large population centers in particular, Cook County, Illinois, and Los Angeles County, California, contain very large numbers of businesses that fit the "fully qualified" description.

These maps are not "rate" maps. That is, they are independent of population considerations and thus they serve only to

locate geographical areas with large numbers of fully qualified industries. They do not attempt to depict or predict high incidence rates of asbestos-related illnesses.

VI. LIMITATIONS

There are two principal limitations inherent in this technique which must be understood for correct interpretation of the results. First, the NOHS survey was not designed to be as statistically rigorous at the four-digit SIC code level as it is at the two-digit SIC code level. Some industries represented by four-digit codes, in fact were not visited during the survey. Those industries are not represented anywhere in the data. In addition, some four-digit industries in general were not sampled with enough frequency to assume that the sample that was drawn was representative. The decision rules detailed in the methodology section above formed the sole basis for qualifying industries to the list of highly interesting industries.

The second principal limitation upon the interpretation of the results is more mechanical than statistical. The NOHS data was described in terms of 1967 SIC codes. The Dun & Bradstreet file uses the 1972 version of the same publication. (4) There were some industry classification changes between the two versions of the publication. The changes were minor in nature. The major problem involved in the methodology above is the great "leap of faith" that was made in assuming that an industry as delineated by a four-digit SIC code in 1972 is essentially the same as the industry typified by the same SIC code in 1979. No attempt was made to account for possible changes in technology, methods of production, changes in regulations, or geographic shifts in industry in the years between 1972 and 1979.

The maps simply represent the distribution of industries that qualified as being of "high interest" through the methodology above at a single point in time.

Asbestos was chosen only as a first attempt to map chemical exposures. The Hazard Section is continuing to develop this technique, and will map other industrial materials in response to the Institute's Surveillance needs.

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WHICH INDUSTRIES?

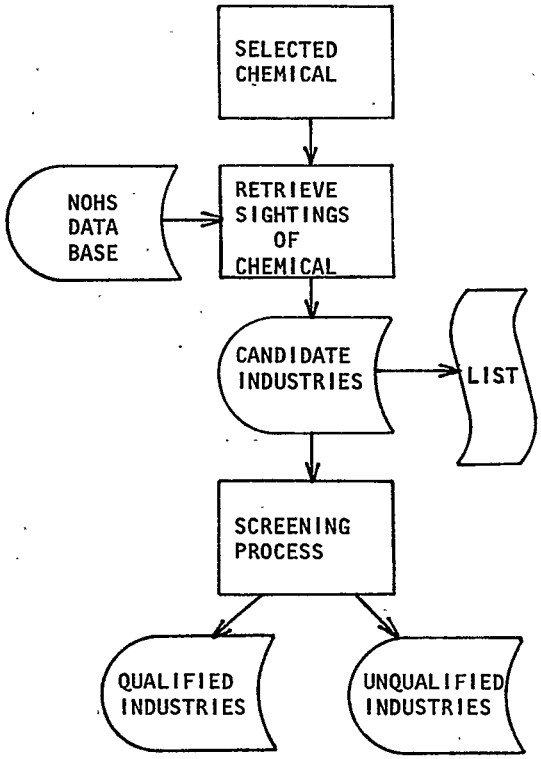


Figure 1

WHERE ARE THESE INDUSTRIES LOCATED?

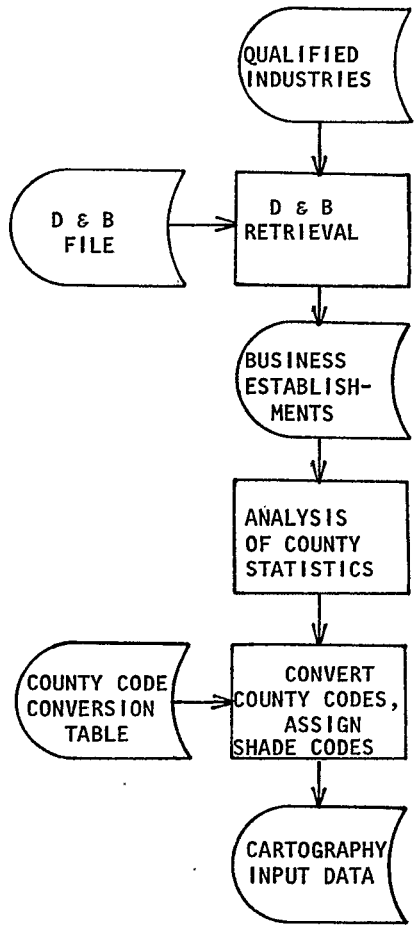


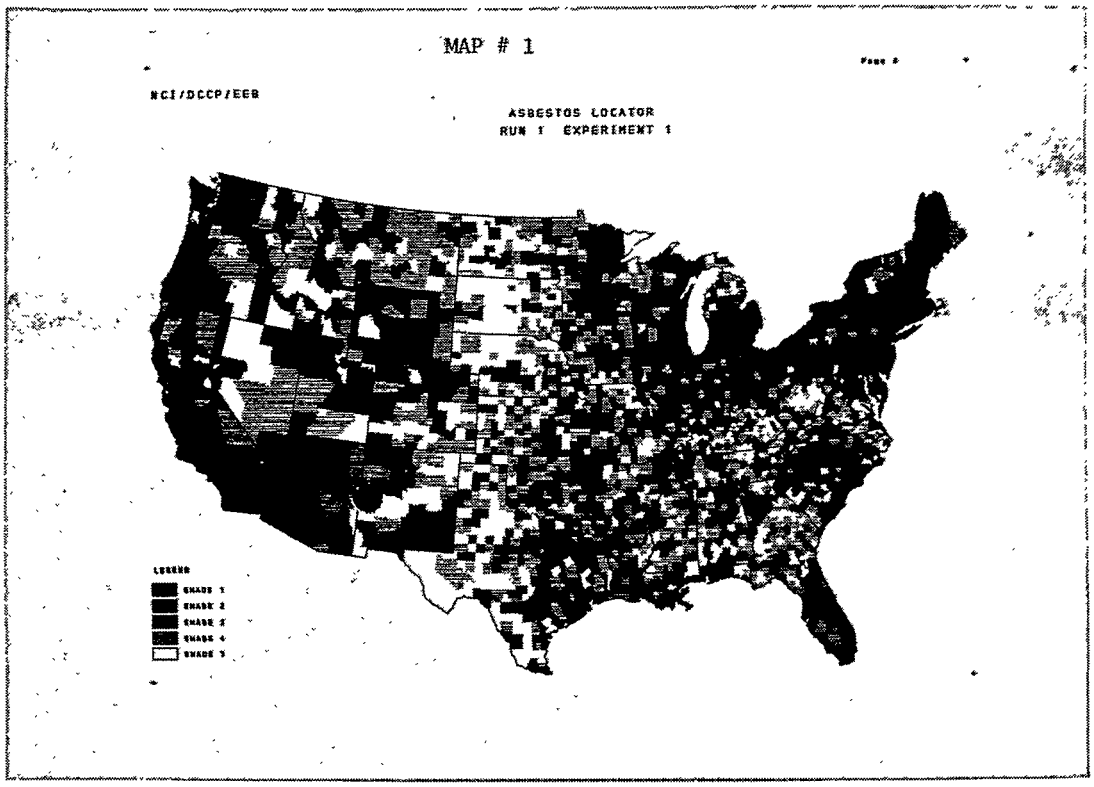
Figure 2

TABLE 1

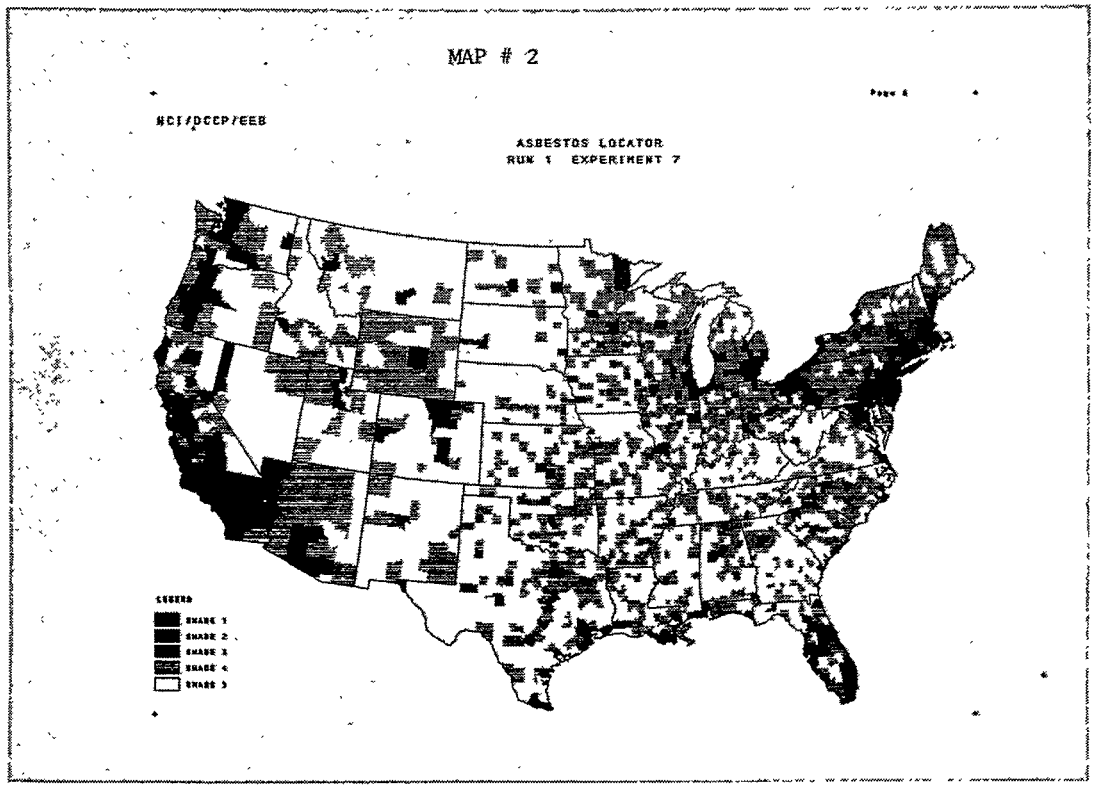
STANDARD INDUSTRIAL CLASSIFICATION CODES OF
INDUSTRIES CONSIDERED "FULLY QUALIFIED"

1967 SIC CODE	INDUSTRY DESCRIPTION
1742	Plastering, Drywall, and Insulation
1752	Floor Laying & Floor Work N.E.C.
1761	Roofing and Sheetmetal Work
2011	Meat Packing Plants
2821	Plastics Materials and Resins
2851	Paints and Allied Products
2911	Petroleum Refining
2952	Asphalt Felts and Coatings
3241	Cement, Hydraulic
3291	Abrasive Products
3292	Asbestos Products
3312	Blast Furnaces and Steel Mills
3352	Aluminum Rolling & Drawing
3433	Heating Equipment, Except Electric
3443	Fabricated Platework (Boiler Shops)
3519	Internal Combustion Engines, N.E.C.
3661	Telephone and Telegraph Apparatus
3711	Motor Vehicles and Car Bodies
3713	Truck and Bus Bodies
3721	Aircraft
3731	Ship Building and Repairing
3742	Railroad Equipment
3791	Trailer Coaches
3843	Dental Equipment and Supplies
3996	Hard Surface Floor Coverings

MAP # 1


NCI/DCCP/EEB
ASBESTOS LOCATOR
RUN 1 EXPERIMENT 1
LEGEND
SHADE 1
SHADE 2
SHADE 3
SHADE 4
SHADE 5

MAP # 2


NCI/DCCP/EEB
ASBESTOS LOCATOR
RUN 1 EXPERIMENT 7
LEGEND
SHADE 1
SHADE 2
SHADE 3
SHADE 4
SHADE 5

THE USE OF HOSPITAL DISCHARGE RECORDS FOR OCCUPATIONAL HEALTH SURVEILLANCE

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INTRODUCTION

A survey of the existence and availability of occupationally related injury and illness data in agriculture[1] showed the need for another data source which could be used to identify potential health problems in agriculture. The Farm Accident Survey of the National Safety Council and the Workmen's Compensation System in California provide information on farm related accidents and a few acute illnesses, such as pesticide poisonings, but there are little data collected on diseases of a longer term etiology. A study at Roswell Park Memorial Institute in Buffalo, N.Y.[2] successfully used hospital records and complete occupational histories in a retrospective study of the relationships between occupation and cancer. In contrast, it was proposed to investigate the use of all routinely collected hospital data with brief occupational histories as a surveillance technique for identifying possible agricultural health problems.

METHODS

The Commission on Professional and Hospital Activities (CPHA) in Ann Arbor, Michigan, was identified as an independent agency involved in the standardized abstracting and collection of hospital records through its Professional Activity Study (PAS). Relevant data routinely collected by the PAS system include demographic information, dates and description of hospitalization, diagnoses and procedures. The diagnoses were coded by the Hospital Adaptation of the International Classification of Diseases, H-ICDA[3].

Since information on place of residence and occupation was not available from PAS, a brief questionnaire to be administered in the hospitals was designed to collect these data. For effective use as a surveillance tool, the questionnaire had to be brief, easily understood, and precoded so it could be administered and processed by hospital personnel with a minimum of time and error. The questionnaire collected data on county of residence, smoking history, current occupation, and years worked in agricultural occupations.

An area in rural west central Minnesota was chosen for study due, in part, to a large concentration of PAS hospitals. The two largest hospitals were basically population-based, since each was the only hospital in the county and each was centrally located and well equipped. Four smaller hospitals, which could not be tied to a well defined service area, were also included in the study to reduce any bias due to hospital size such as cost or distance to the hospital.

DATA COLLECTION

Questionnaires were administered by hospital admissions personnel for a one year period to all patients 18 years of age and older. Only place of residence was recorded for patients under 18. Hospital medical records personnel added the precoded questionnaire responses to predetermined, previously unused fields on the PAS abstracting form. CPHA then provided data tapes of the required medical and demographic items plus the questionnaire responses. For the last three months of the study, one hospital changed from the PAS system to the MED-ART system of Diversified Computer Applications, Palo Alto, California; however, the changeover did not affect data collection, indicating the compatibility of abstracting systems.

From April 1, 1976, through March 31, 1977, 16,598 discharge cases were collected from six hospitals. Patients over 18 years of age accounted for 13,004 of these cases. For these patients, 96 percent answered all of the questions and 98 percent answered the question related to living on a farm.

Two techniques for analysis of the occupational data were used. By obtaining information on place of residence, data from the two population-based hospitals were combined with population estimates, and diagnosis-specific hospital discharge rates were calculated. The ratios of rates for farm residents compared to non-farm residents were computed. Since not all of each county's hospitalized cases were captured, the rates are underestimated, but by examining the characteristics of county residents going to out-of-county hospitals, it was determined that these rate-ratios showed little, if any, bias.

Because of the difficulty in obtaining complete hospital coverage of the county populations, the lack of precise population estimates, and to make maximum use of the data collected, a case-control type approach was also utilized. Data from all six hospitals were used and comparisons between patients with and without an agricultural work history were compared, with adjustments made for age, smoking, and years of agricultural exposure. The main difficulty in this approach is the selection of in-hospital controls, a group of patients whose diagnoses are not related to the exposure under question; however, the population-based analysis was expected to provide information on diagnostic categories for which farm and non-farm residents were at equal risk, and hence which would be suitable for use as control diagnoses.

In addition to the analyses mentioned above, a variety of hospitalization statistics were calculated for the farm and non-farm groups. These included diagnosis-specific lengths of stay, age and sex distributions, and birth statistics. Mortality statistics are not necessarily valid in this study since hospital mortality is likely to be related to distance to the hospital

(greater for farmers), and since many patients dying in the hospital would have incomplete questionnaires.

County population estimates by age and sex for farm and non-farm residents were available only from the 1970 U.S. Census, so it was necessary to estimate the 1976 figures. The Minnesota State Planning Agency, the official census designate in Minnesota, makes yearly estimates and projections by county, age, and sex. Using these 1976 figures, the 1976 estimates of the populations of the two cities in the population-based counties, and the 1970 census figures, current 1976 farm/non-farm breakdowns by age and sex were obtained.

ANALYSIS BY PLACE OF RESIDENCE

Patient origin studies, as conducted by Minnesota Hospital Research and Educational Trust, were used to test the adequacy of the assumption that most of the hospital experience of residents of the two principal counties was captured. Ninety four percent of study county residents admitted to a hospital in the immediate area went to one of the study hospitals. County residents not captured in the immediate area went primarily to large referral hospitals in the Twin Cities, Rochester, and St. Cloud.

Primary diagnoses were tabulated by sex for current farm and non-farm residents and age-adjusted discharge rates were calculated. Cases were counted using major disease classifications, subclassifications, and three digit codes from H-ICDA. Only a patient's first admission in the disease class, subclass, or individual code under study was used. Since the rates are underestimated, the ratio of the rates, or relative risks, are presented.

Table 1 summarizes the primary diagnoses for which farm residents show increased relative risks. The relative risk of farm to non-farm residents for all diagnoses (one discharge per patient) was 0.8 for patients less than 65 years old. For patients over 65, the relative risk was 1.3. This result may indicate health problems in this group but also might indicate problems with identifying farm residence in retired farmers whose farm might not be classified as a farm by the census.

Table 1.

Diagnostic Categories with Increased Relative Risks for Farm Residents

Age	Diagnostic Category	H-ICDA Code	No. of Cases: Farm	No. of Cases: Non-farm	Relative Risk
Male					
< 25	Appendicitis	540-543	13	17	1.9
	Laceration & Open Wounds	870-897	9	9	2.6*
25-64	Diseases of the Blood & Blood Forming Organs	280-289	2	1	4.4
	Diseases of the Liver, Gallbladder & Pancreas	570-577	16	19	2.0*
≥ 65	Infective & Parasitic Diseases	001-136	5	9	2.0
	Endocrine, Nutritional & Metabolic Diseases	240-279	7	17	2.3
	Diseases of the Blood & Blood Forming Organs	280-289	4	6	3.5
	Diseases of the Eye	370-378	7	20	1.9
	Acute Upper Respiratory Infections	460-470	2	3	4.3
	Pneumonia	480-486	17	35	2.3*
	Hernia of the Abdominal Cavity	550-553	17	24	2.7*
	Diseases of the Urinary System	580-599	18	46	1.6
	Benign Prostatic Hypertrophy	600	19	49	1.8*
	Osteomyelitis & Other Diseases of Bone & Joint	720-729	6	7	3.0
Female					
< 25	Diseases of the Gallbladder	575	3	6	2.2
25-64	Diseases of the Eye	370-378	5	5	3.3
	Diseases of Arteries, Arterioles & Capillaries	440-448	2	3	2.6
	Appendicitis	540-543	4	8	1.8
	Uterovaginal Prolapse	623	8	13	1.7
	Diseases of Skin & Subcutaneous Tissue	680-709	7	10	2.1
≥ 65	Cerebrovascular Disease	430-438	8	40	1.9
	Diseases of Veins, Lymphatics & Other Circulatory Diseases	450-458	5	26	1.7
	Diseases of the Gallbladder	575	11	17	5.1**
	Uterovaginal Prolapse	623	3	14	1.7

*,**Statistically significantly greater than one, $p < .05$, $p < .01$

Of special interest are the relative risks for injuries and adverse effects which are given in Table 2. Since farm and non-farm residents are at relatively equal risk for this category, patients with these diagnoses might form an appropriate control group for a case-control comparison.

Table 2.

Relative Risks of Farm to Non-farm Residents for Injuries and Adverse Effects (H-ICDA Codes 800-999)

Age	Relative Risk: Males	Relative Risk: Females
< 25	1.2	1.0
25-64	0.9	1.1
≥ 65	1.1	1.0

CASE-CONTROL ANALYSIS

Because of potential problems in the accurate estimation of populations at risk and in the collection of all or an unbiased portion of hospital experience, a case-control type analysis was performed. The consistency of relative risks near one for farm residents in the previous analysis suggest that the diagnosis classification Injuries and Adverse Effects (H-ICDA codes 800-999) can be used as a control group. This classification, composed of a large variety of infrequently occurring acute conditions, is also suitable for comparison purposes because the independent variable under consideration is years of farm exposure, which is not necessarily related to acute conditions due to the high proportion of ex-farmers or retired farmers in the analysis.

Years of farm exposure were divided into three categories: none, one to nineteen, and twenty years and over. Relative risks were obtained by calculating Mantel-Haenszel[4] summary relative risks from each farming-diagnosis breakdown, stratified by age and smoking history. As in the population-based analysis, only a patient's first discharge in a diagnosis category was used and only primary diagnoses were considered.

Table 3 summarizes the diagnoses for which patients with farming exposure showed increased, but not necessarily statistically significant, relative risks when compared to the population of persons with no farming exposure. Over all diagnoses, for patients between 25 and 64 years of age, patients with farming exposure showed relative risks near or slightly less than one. Males over 65 years with farming exposure had an overall relative risk of 0.7 while females with the same exposure had a relative risk of 1.3.

ADDITIONAL STATISTICS

For all discharges, patients with an agricultural history and those without had identical mean lengths of stay (7.3 days for males and 6.5 days for females). Both female groups reported a case mortality rate of 1.9 percent, while males with any agricultural history had a case mortality rate of 4.8 percent compared to 5.6 percent for the males with no agricultural history.

A comparison of pregnancy and newborn statistics for female farm and non-farm workers and housewives showed similar percentages of complications, stillborn, congenital anomalies, and newborn diseases. The proportion of spontaneous abortions was slightly higher for the farm workers and housewives (4.5 percent to 3.1 percent), but the difference was not statistically significant.

DISCUSSION

The method of administering occupational questionnaires to hospitalized patients and then using such data in conjunction with abstracted hospital data available from abstracting services such as CPHA, can work efficiently to identify potential occupational health problems. In this study, hospitalizations to both farm residents and past and present farm workers were evaluated, since it is hard to separate those "working" and "living" on a farm.

The health of farmers and non-farmers in the rural midwestern setting of this study are not radically different when hospital records are the basis of comparison. Overall, patients with an agricultural background were slightly healthier than patients with no agricultural history. Nevertheless, several diagnoses consistently showed increased risks for subjects with farm backgrounds. These are shown in Table 4.

ADDITIONAL STUDIES

To further investigate the use of hospital records for occupational health surveillance, a new study is currently being performed in Southern Oregon to study workers in three industries: the sawmill, millwork, and lumber industries. Approximately 10,000 discharges for males 18 years of age and older will be evaluated in a one-year study using data from four hospitals. Patient origin studies and employment statistics indicated the study area to be ideal with regard to autonomy of medical services and large concentrations of workers in the industries of interest. Cooperation could not be obtained from three of the seven hospitals; however, so a population-based analysis will only be possible for one county which will include about one third of the discharges. The questionnaire being used addresses length of time at current residence, smoking history, current and usual occupation, and years worked in the three target industries.

Table 3.

Diagnoses with High Relative Risks Associated with an Agricultural Occupational History

Diagnostic Category	H-ICDA Codes	Relative Risk (No. of Cases) 1-19 Yrs. in Ag.		≥ 20 Yrs. in Ag.	
Males, Ages 25-64					
Diseases of the Blood & Blood Forming Organs	280-289	0.0	(0)	3.5	(4)
Psychoses not Attributable to Physical Conditions	306-309	1.7	(6)	3.1	(6)
Heart Failure	427	2.9	(1)	5.1	(5)
Phlebitis & Thrombophlebitis	451	1.8	(3)	2.1	(6)
Hemorrhoids	455	1.3	(5)	2.1	(11)
Bronchitis, Emphysema, Asthma	489-496	0.9	(3)	2.2	(14)
Inguinal Hernia	550	1.5	(30)	1.6	(43)
Biliary Calculus	574	2.4	(3)	1.7	(4)
Other Bladder Disease	596	1.9	(1)	4.9	(5)
Benign Prostatic Hypertrophy	600	1.0	(6)	2.2*	(29)
Osteoarthritis & Allied Conditions	713	5.2	(4)	5.9*	(11)
Females, Ages 25-64					
Cancer of Large Intestine	153	0.0	(0)	2.5	(4)
Diabetes Mellitus	250	0.6	(3)	2.2	(12)
Diseases & Conditions of the Eye	360-379	2.0*	(10)	0.6	(4)
Acute Myocardial Infarction	410	1.3	(3)	8.0**	(9)
Cerebrovascular Disease	430-438	3.0	(4)	2.3	(3)
Diseases of Arteries, Arterioles, Capillaries	440-448	0.5	(1)	2.0	(5)
Ulcer of Duodenum	532	4.8*	(6)	1.4	(3)
Intestinal Obstruction	560	0.3	(1)	2.1	(3)
Diverticular Disease of Intestine	562	0.8	(2)	2.1	(5)
Other Diseases of Urinary Tract	599	5.9**	(7)	3.2	(4)
Endometriosis	619	2.2	(10)	1.4	(5)
Uterovaginal Prolapse	623	0.5	(4)	3.2**	(27)
Diseases of Skin & Subcutaneous Tissue	680-709	0.9	(6)	3.3	(12)
Osteoarthritis & Allied Conditions	713	2.1	(4)	1.3	(5)
Males, Ages ≥ 65					
Psychoses not Attributable to Physical Conditions	306-309	--	--	2.0	(5)
Diseases of Veins, Lymphatics, & Other Circulatory Diseases	450-458	--	--	2.3	(24)
Diseases of the Gallbladder	575	--	--	1.6	(31)
Other Symptoms Referable to Cardiovascular & Lymphatic System	775	--	--	2.0	(7)
Females, Ages ≥ 65					
Primary Malignant Neoplasms	140-195	--	--	1.6*	(60)
Secondary Malignant Neoplasms	196-199	--	--	2.0	(14)
Diseases of the Blood & Blood Forming Organs	280-289	--	--	2.1	(9)
Diseases of Veins, Lymphatics, & Other Circulatory Diseases	450-458	--	--	1.9*	(39)
Pneumonia	480-486	--	--	1.8	(28)
Other Diseases of the Respiratory System	500-519	--	--	2.5	(11)
Diseases of the Esophagus, Stomach, Duodenum	530-537	--	--	1.8*	(38)
Hernia of Abdominal Cavity	550-553	--	--	2.0	(14)
Biliary Calculus	574	--	--	1.9	(14)
Diseases of Gallbladder	575	--	--	1.9*	(36)
Diseases of Genitourinary System	580-629	--	--	1.8*	(73)
Diseases of the Breast	610-611	--	--	2.7	(9)
Uterovaginal Prolapse	623	--	--	3.1**	(25)
Infections of the Skin & Subcutaneous Tissue	680-686	--	--	2.7	(9)
Osteoarthritis & Allied Conditions	713	--	--	2.3**	(53)

*,**Relative risk statistically significantly greater than one, $p < .05$, $p < .01$

Table 4.

Possible Problem Health Areas for Persons Engaged in Agriculture

Diagnostic Category	
Diseases of the Blood and Blood Forming Organs Osteoarthritis and Allied Conditions Diseases of the Gallbladder Hernia of the Abdominal Cavity Diseases of the Veins, Lymphatics and Other Circulatory Diseases Diseases and Conditions of the Eye	MALES AND FEMALES
Uterovaginal Prolapse Neoplasms Cerebrovascular Disease Diseases of the Skin and Subcutaneous Tissue	FEMALES
Benign Prostatic Hypertrophy	MALES

GENERAL COMMENTS

Hospital discharge records have considerable potential for use in occupational health surveillance. Imagine the possibilities for research if all of the available computerized hospital discharge abstracts included even a simple single question on occupation; however, the problem of constructing and obtaining consistent coding for a single relevant occupational classification system would be formidable.

To focus on specific occupational groups or specific geographical areas, patient origin studies and published census and employment statistics are very useful. Patient burden is of utmost concern, so questionnaires need to be concise and simple. A good working relationship with hospital personnel who collect and abstract the data is essential. Population based studies are best suited to evaluate current workers but need to be carried out by organizations who can ensure or require participation by all of the appropriate hospitals. Case-control type studies can make optimum use of hospital abstracts by not being limited to currently employed populations.

In summary, Tables 5 and 6 present the major disadvantages and advantages of using hospital discharge records for occupational health surveillance.

Table 5.

Disadvantages of Using Hospital Discharge Records for Occupational Health Surveillance

1. Hospital data has certain biases such as selectivity of patient population and the exclusion of outpatient data and mortality occurring outside the hospital.
2. The data may vary in quality or reliability for different hospitals or within a hospital since many people are involved.
3. Cooperation from the hospitals may be difficult to obtain due to the burden to employees and to anticipated burden to the patient.
4. Missing data may be a problem due to the hospital's logistics in obtaining the required information. Patients with short stays, patients who die or are incapable of responding, psychiatric cases, and uncooperative patients are the usual ones who may be missed.
5. The population at risk usually cannot be precisely defined. Often it is necessary to combine data from different sources, which even may not be available to the degree desired.
6. When population-based analyses are not possible in-hospital control or comparison groups may be difficult to determine.
7. These types of studies are only meant to provide clues, not serve as examples of cause and effect relationships.

Table 6.

Advantages of Using Hospital Discharge Records for Occupational Health Surveillance

1. Availability of a large number of cases of varying diagnoses, including those which can be used as controls.
2. The medical and demographic data is usually available in a computerized form using a standardized coding system.
3. Occupational information can be easily collected and added to the data processing system.
4. Data collection can be designed to evaluate specific populations of interest (i.e., current or previous workers, selected industries) and the potential exists to adjust for other variables of interest, such as smoking.
5. For the quantity of information available, time and cost considerations are small.

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ACUTE HAZARDS VIEWED THROUGH THE EMERGENCY ROOM

Kenneth Haase, Consumer Product Safety Commission

I. INTRODUCTION

Good Morning. It is a pleasure to have the opportunity to speak to you this morning about the Consumer Product Safety Commission, some of our unique data needs and how we respond to these needs by using hospital emergency room data.

The first two speakers this morning discussed efforts designed to address the need for better chronic hazard data. My presentation will deal with acute hazards and, in particular, accidental injury. Within the public health community in recent years there has been increased emphasis on viewing the environment in terms of its impact on long term chronic illness. Certainly the impact of both outdoor and indoor pollution on our way of life must continue to receive the attention of the research community. However, research funds for chronic hazards are often obtained at the expense of accidental injury. It was, therefore, refreshing to hear Dr. McGinnes point out at our Second Plenary Session, that accidental injury is still a major public health problem which will receive special attention from the Department of Health and Human Resources during the 1980's.

II. CPSC AND ITS MISSION

The Consumer Product Safety Commission (CPSC) is an independant regulatory agency, established under the Consumer Product Safety Act of 1972 and activated in May, 1973. The mission of the Commission is to:

1. Protect the public against unreasonable risk of injury or illness associated with consumer products;
2. Assist consumers in evaluating the comparative safety of consumer products;
3. Develop uniform safety standards for consumer products and to minimize conflicting state and local regulations;
4. Promote research and investigation into causes and prevention of product-related deaths, illnesses and injuries.

CPSC is concerned with the design, manufacture, packaging and labeling of consumer products. In carrying out its mission CPSC has a number of recourses. The three most prominent options available include establishment of mandatory standards, encouragement of voluntary standards, and ban and recall of products posing an unreasonable risk of injury. Commission actions touch the lives of all Americans. Notable examples of mandated standards developed by CPSC include the crib standard and the bicycle standard. The crib standard is designed to reduce the potential for crib strangulation. Better reflection, braking and stronger structural design are some of the features of the CPSC bicycle standard. The Commission is also responsible for the enforcement of the Poison Prevention Packaging Act. While many of us have cursed those child resistant containers which sometimes seem to be designed to keep us from a much needed aspirin after a big night out on the town, the reduction of childhood fatality and injury due to poisoning has been dramatic as a result of these safety caps.

When an industry has the capability and the interest in developing sound voluntary standards, CPSC encourages and assists in such efforts. Two notable examples of efforts currently underway are the voluntary standards being developed for chain saws and ladders.

Over the last two years the Commission has determined on 822 different occasions that a particular product posed a substantial enough hazard to require that it be recalled. Two of the more recently publicized product recalls were the recalls of hair dryers and coffee pots.

CPSC's jurisdiction is extremely wide covering over 10,000 different products. The coverage excludes some broad product categories such as motor vehicles, food, pesticides, tobacco, occupationally related injuries and other such areas that were already under the jurisdiction of other Federal agencies at the birth of the Commission. However, even with these exclusions the number of products of concern to CPSC is enormous; its scope has sometimes been vividly depicted as encompassing almost all of the items in a Sears Catalog.

The large number of products that fall under CPSC's jurisdiction make the data needs of our agency rather difficult. While total product related injury and fatality are a significant part of the Nation's public health problem, the number of injuries or deaths associated with a specific product is often a statistically rare event. Therefore, we must turn to sources of data which provide large numbers of product related injury cases. The hospital emergency room obviously meets this requirement. However, before discussing our data systems let's look at the specific data needs of the Commission.

III. DATA NEEDS

CPSC needs several levels of acute hazard data in order to carry out its mission. These different levels of data not only reflect different needs but also different types of data.

Level 1: Need to be able to measure the scope of injury problem and reflect both frequency and severity. At a minimum the data must identify the problem(s) associated with a particular product. All of our gainful efforts must begin with problem identification. Even effective scratching must first start by locating the itch. In addition, data at this level should assist in establishing priorities among the multitude of competing products. It should be noted that the degree of statistical precision required at this level is generally less than at the next two levels.

Level 2: Need epidemiological data to identify the causal factors associated with injuries. At the first level we looked at product involvement; at the second level we need to know why the accidents occurred so that, in conjunction with engineering and health science knowledge, we can attempt to eliminate or reduce the problem identified at this level.

Generally, very detailed information is required, usually attempting to show the relationship between the host (victim), the agent (product) and the environment.

Level 3: Evaluation data to determine whether the corrective action taken impacted upon the problem. In addition to requiring some of the same detail as level 2, evaluative data usually requires much more statistical precision than that required for level 1. Crude estimates often suffice in reflecting the general magnitude of the problem. However, the same estimates probably would not be adequate for trend analysis.

IV. DATA COLLECTION SYSTEMS

CPSC turns to a number of data sources to meet its data needs, including the National Center for Health Statistics, U.S. Fire Administration and the Census Bureau. However, because our data needs are so very specific, the majority of these needs can be met only through our own data collection efforts. The systems developed by CPSC include the following:

Death Certificate Project: CPSC has entered into contractual arrangements with all 50 States, New York City, District of Columbia, Puerto Rico and the Virgin Islands to obtain death certificates for a selected set of External Causes of Death (E-Codes). Those death certificates which indicate some specific consumer product involvement become part of a Commission file which includes numerical codes for cause of death, product involvement, a limited amount of demographic information, and a narrative description of the cause of the accident. This data base plays an important role in supporting CPSC's hazard identification function, e.g.: (1) Provides independent, lower bound estimates for specific product related fatalities; (2) Through a ratio adjustment procedure using NCHS mortality statistics, provides more precise estimates of product related fatalities and (3) Provides anecdotal and causal information.

Medical Examiners and Coroners Alert Project (MECAP): Because there is a fairly long time lag between death and our receipt of the death certificate, we have also developed a more timely death reporting system. Medical Examiners and Coroners are asked to report to us voluntarily, using a toll-free telephone hotline, when they encounter a death in which a consumer product played a significant role. While this project is not intended to provide statistical estimates, it does alert the Commission to potential, emerging hazards.

Other non-statistical systems which CPSC employs to identify consumer hazards include newspaper clipping services and consumer complaints. While not designed to provide statistical estimates, these informational sources help capture rare statistical events which may, because of their severity, be of public health consequence.

CPSC periodically conducts ad-hoc studies--using personal, telephone or mail interviews--to address specific data needs. In addition, we have been fortunate in having the National Center for Health Statistics include consumer product related injury supplements in the National Health Interview Survey and the National Ambulatory Medical Care Survey.

However, our primary source of injury data is the National Electronic Injury Surveillance System (NEISS). This is a bilevel system, designed and maintained as an intelligence-gathering system which provides data so that decisions can be made. The first level of this system, surveillance, is comprised of a statistical sample of hospital emergency rooms throughout the Nation.

NEISS Surviellance: NEISS became operational in 1972, administered by the Bureau of Product Safety of the Food and Drug Administration. When this FDA group became the nucleus of the Consumer Product Safety Commission in May of 1973, NEISS was also transferred to this new independent agency.

Sample: The initial NEISS sample consisted of 119 hospital emergency rooms representing the contiguous United States. Under contractual arrangements, the NEISS sample was recently redesigned to eliminate some of the bias, increase efficiency and reduce overall data collection costs. The redesigned sample consists of 74 hospital emergency rooms representing all 50 States and U.S. Territories. The sample design is composed of five strata, four strata based on hospital size as measured by the annual number of emergency room visits, and a fifth stratum including those hospitals with some type of specialized burn care unit.

In order to ensure reasonable geographic distribution in the selection process, the hospitals were ordered by zip code within each stratum of the hospital frame. As of today, 61 hospitals have been recruited and are now part of this network.

Each hospital participating in the system is expected to report all injuries treated within its emergency room that involved a consumer product in any way. It is the usual procedure in most emergency rooms to provide a brief description of the accident scenario within the medical record; i.e., "amputated finger on lawn mower." However, the emergency room staff of each participating hospital is urged to provide an adequate description of the product. Daily, all ER records are reviewed and a coded record is generated for those cases involving a consumer product. This record includes the following data elements:

- Age of Victim
- Sex of Victim
- Up to Two Products Involved in the Accident
- Whether a Third Product was Involved in the Accident
- Type of Injury - This is a simple 31 element coding scheme in which the injury is described in broad lay terms; i.e., laceration, fracture, etc.
- Body Part Injured
- Disposition of the patient after ER treatment; i.e., hospitalized, treated and released, etc.

- Accident Locale
- Fire/Motor Vehicle Involvement
- Comments - there is space on the record to provide a brief narrative description of the accident or other pertinent information such as product brand name. The comment section is a relatively new addition to the NEISS record and has proved to be very useful in providing important clues in identifying emerging hazards.
- Other supplementary data - a section of the record has been set aside to allow for coding specific information for defined accident types. This section has been used to collect information for the National Highway Traffic Safety Administration, the Environmental Protection Agency and the Food and Drug Administration, which I will discuss in more detail later. This section is also used for special studies of interest to CPSC. Recent studies in which structured information was entered into this section included, skateboards, poisoning to children, roller skates, ingestion of small parts by young children and fireworks.

Transmittal of data: At the end of each day's coding, the coded data is typed into a teletypewriter installed for this purpose. While typing, a perforated paper tape is automatically punched with complete data on each case. This perforated tape is then loaded in a special "reader" on the machine.

During late night hours of low telephone traffic, a special switching device attached to the headquarters computer in Rockville, Maryland, automatically polls each of the hospital-based terminals. This device turns on each remote teletype machine and reads the perforated paper tape at high speed, edits the data for accuracy and completeness and records the data in the computer. The central computer then prepares a daily summary register and detailed case printouts for headquarters review each morning. The computer also selects cases for follow-up assignment based on pre-established criteria. This leads up to the second level of the system - investigation.

Investigation: So far I have only described a system designed to reflect product involvement not product causation. CPSC has developed both through contractual arrangements and in-house staff cadre of trained accident investigators.

Accident investigations are based on personal contact (on-site or telephone interviews) and provide information on the accident sequence, ways in which the product is being used, environmental circumstances related to the accident, and behavior of the person or persons involved. Whenever possible, they document the product brand name, indicate the involvement of the product or its component parts in the accident, and include photographs and diagrams. Police, fire and coroners' reports may be included as supplemental data. Abbreviated cases, generally conducted by telephone, contain most but not all of these items. None of the investigations include identifying information on the victims or other respondents.

These investigations are used by CPSC to provide detailed information on products and the victim's involvement in product-related injuries and potential injury situations. The majority of the cases assigned for investigation are selected to provide data for directing regulatory action, for monitoring existing standards, or for providing a basis for response to petitions to CPSC. Others are selected if they are likely to provide information about defective products relating to the various Acts administered by CPSC. When possible, an attempt is made to select cases representative of the NEISS surveillance data.

All investigations are forwarded to CPSC headquarters in Washington, D.C. where they are coded for computer input and filed in the Clearinghouse by year and NEISS product code. These files are available to the public at the Clearinghouse in either paper copy or on microfilm. CPSC analyses of hazard patterns exhibited in the accident investigations are available for selected products.

Limitations of the System: Beyond the sampling error associated with any probability survey, NEISS has a unique set of problems.

One of the first concerns would be the adequacy of an emergency room reporting system to serve as a surrogate of all injuries. This is to ask,"If you only look at injuries treated in emergency rooms, what is it that you miss?" Obviously,those injuries for which medical care can be delayed are less likely proportionately to be seen in the ER.

Deaths are also undercounted for several reasons. First, deaths that occur after treatment in the ER and transferred to another hospital department are not recorded as fatalities. Dead on arrival cases may not have an ER medical record prepared and therefore, not captured in NEISS. It is for these reasons that CPSC has established separate reporting systems on fatalities which I discussed earlier.

The non-sampling error associated with a hospital reporting system can be significant. Certainly recording information in an emergency room setting must lie within the shadow of patient treatment. Any of us who have sought emergency room treatment know that, as patients, we don't want to respond to questions that don't appear relevant to the treatment of our particular ailment. Therefore, at the surveillance level NEISS is designed to capture a very limited amount of data - that which is generally collected as part of patient care. We leave the collection of epidemiologic information to the investigator.

The cost of NEISS, in terms of contracts and in-house resources directed at the collection of the data, is approximately two-million dollars annually. This amount relative to some other federally funded data collection systems may not appear large. However, since the entire CPSC budget approximates $40 million, this amount is relatively large for one data collection system. For this reason we have solicited other Federal Agencies to share in the data as well as the cost associated with NEISS.

NEISS data sharing with other agencies: Currently, CPSC has ongoing data collection agreements with three Federal Agencies. These

agencies contribute funds to share part of the system's fixed costs as well as pay for the operating costs associated with their data. These interagency agreements provide for the collection of motor vehicle related injury data for the National Highway Traffic Safety Administration, the collection of pesticide related injury information for the Environmental Protection Agency and the collection of drug, cosmetic and medical device injury information for the Food and Drug Administration. We have recently signed an interagency agreement with the National Institute of Occupational Safety and Health to test the feasibility of collecting occupationally related injury data through NEISS.

Environmental Health Data

Concurrent Session K

ENVIRONMENTAL HEALTH DATA PROGRAMS & RESOURCES: FOUNDATIONS AND NEW DIRECTIONS

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Environmental Improvement Division

The question of the future and the alternative directions we may go to solve present and future environmental health problems is being addressed at the global, national, state, and in many areas, local level. The prognosis seems to be one of imminent doom or technological salvation, depending on which reports one may read. In all cases, however, there is a call for greater cooperation among the various entities involved in environmental health problems and their solutions.

Certainly, cooperation is important, but what other resources are available for commitment to such an undertaking? Certainly we have the human resources of our organizations and, generally, at least moderate financial resources from the public coffers. These financial resources permit us to purchase or lease the equipment and external services we need and to contract for special projects or consultation. If we are fortunate, we have the intangible resources of public support of our endeavors and the full commitment of the human resources comprising our organization staff.

In the environmental health arena, there are a number of disciplines playing various roles and contributing the resource of their knowledge. In my own organization, there are scientists with backgrounds in biology, chemistry, health physics, industrial hygiene, safety, geohydrology, meteorology, epidemiology, and engineering, to name just a few. There are planners, technicians, field generalists, attorneys and statisticians, in addition to those in management. The work of all is important, yet it is meaningless unless progress is made in ultimately solving environmental health problems. The question then becomes one of how to coordinate the knowledge and abilities of these disciplines into problem-solving efforts.

The first step is to identify the environmental health problems needing solution. This may sound obvious and relatively simple, but it is not. While it is easy to state that air or water quality is a problem, it is not so easy to quantify that problem and determine its full extent. It is, therefore, necessary to design sampling networks for the collection of data, to perform the sample collection and laboratory analyses, and to collect the resulting data in such a manner as to be useful. Statistical analyses must be performed to not only determine the present state of the environment, but to develop models for forecasting future problems, if present conditions persist. Of course, we do not live in a static world and it is, therefore, necessary to continue to collect monitoring data and update these forecasts. In spite of reams of data, there remains the persistent belief that there is not quite enough to fully define the problem, as there quite often is not.

However, at some point in time it is necessary to analyze the data and projections and develop alternative solutions to problems thus quantified. At this point, it is also necessary to determine the resources required to implement the various alternatives. Organization management can then prioritize problems, propose solutions, and determine a course of action for implementation. Later, the implementation programs must be evaluated to determine the progress made in solving or ameliorating the problems, thus requiring more data and analysis, and usually, modification of programs.

What I have just described is, of course, a planning process. While it may be considered the nemesis of many who would prefer not to take time away from their data collection or regulatory enforcement activities, it can be one of the primary resources available to an environmental health organization. How can it be considered a resource when it is the product of the other resources of manpower and financial support? Simply, because it provides a quantified basis for requesting those other resources from funding entities, as well as a guide for what we will do with those resources.

In the Environmental Improvement Division, staff have been compiling data and statistical analyses, and developing annual problem assessments, goals and objectives, and program evaluations since the inception of the agency ten years ago. There are both simple and sophisticated data collection and analysis programs in use. The air quality program collects data on ambient air and individual point sources in its efforts to quantify problems and perform modelling analyses for control efforts. The water quality personnel collect chemical and bacteriological data on surface and ground water to determine quality of the resource, the long-range effects of various discharges, and whether or not dischargers are meeting requirements. Radiological data is collected on background radon levels in uranium producing areas to determine health effects of long-term exposure to low-level radiation and devise protection programs. Data is collected on the state of the work environment and analyzed by industrial hygienists and safety experts to determine methods of reducing environmental health risks to workers. Staff in the individual liquid waste disposal program are collecting data in an attempt to quantify the problems resulting from the increasing use of septic and alternative liquid waste disposal systems. Additionally, data collection and reduction programs exist for the food quality, vector control, and solid and hazardous waste programs. Yet, all of this effort is to no avail unless it is used to develop programs, and the manpower exists to implement those programs for problem-solving. To that end, this past year a five-year plan was developed on the basis of the data and projections

compiled over the past ten years and a resource needs analysis was completed to outline the various resources needed to achieve specified problem reductions five years hence. The resource needs analysis includes information on laboratory support needs, legislative needs, data processing needs, equipment needs and, of course, manpower needs.

The provision of adequate manpower is a never-ending problem to those who would solve environmental health problems. As operants in the public sector, we must justify manpower increases to a public weary of big government and, more specifically, to the elected officials holding the purse strings. With a quantified, detailed plan, it is possible to demonstrate to the public and public officials not only what the problems are, but what the solutions may be, what resources are needed to achieve them, and how we will use those resources.

However, it is not enough to state that we need manpower increases. We must demonstrate why we need them. In this regard, another data collection and analysis program of the Division finds its use. That program is one for collecting information on time devoted by staff to particular objectives and their activities. This time report system provides not only the audit trail necessary for continuation of federal funding for some environmental health programs, but it also provides management with a tool to assure the most efficient and effective use of manpower. When correlated with numbers of known facilities, it also provides a means of estimating workload per person. This workload per person figure can then be applied to the identified problem solutions and future required manpower can be determined.

Thus, there are two major processes at work. One is the process of quantifying the present status of the environment, implementing present programs, and determining the present utilization of available resources in meeting problems. The second process is the utilization of presently known facts to develop projections of future environmental conditions, develop programs to address those situations, and locate the resources needed to implement them. The planning process and the time report system provide the means to unify present situations and future projections.

Because manpower and its maximum utilization are instrumental in solving environmental health problems, let us dwell on that a moment. The EID time report system yields the data concerning present utilization of manpower. It tells us how much time is devoted to individual programs and to each objective in that program. Additionally, it tells us whether the time was devoted to such things as enforcement, education, or sampling activities. The report for each individual details the time devoted to various objectives and activities and the percentage of time this represents of his total time. Thus, from the time report, it is possible to determine present manpower allocation at the program, objective, and individual level.

In the evaluation of programs, the time report can be used as an aid to determine, for instance, whether enforcement or education activities are most efficient in achieving objectives. It is then possible to redirect manpower such that an increased amount of manpower is devoted to particular activities or objectives. In this manner, the most efficient and effective utilization of available manpower is achieved.

Knowing that manpower is being used to its maximum potential, and knowing the number of facilities being adequately or inadequately addressed, it is possible to determine present shortfalls in the available manpower, and the number of facilities which may be optimally addressed. It is then possible to tie this information into the resource needs analysis of the planning process and develop projections for future manpower needs.

Thus, when developing budgets or presenting requests for additional manpower, it is possible for management staff to refer to the resource needs analysis, knowing that present manpower allocation has been documented and requests for additional personnel have a solid basis. The time report system, when used as a means of reallocation of available manpower and as a means of projecting future needs, then becomes another resource available to management staff of environmental and environmental health programs.

As discussed previously, then, it can be concluded that in addition to the external resources of cooperation among agencies and nations, public support and a commitment to solving problems at least a portion of the resources needed to solve environmental and environmental health problems must be developed within the organization itself. Given the initial resources of limited manpower and finances, it is possible to develop a foundation for future programs using the systems of data collection and analysis, program planning, program evaluation and monitoring of manpower allocation. This documented, quantified foundation provides the means to develop projections, define new directions and, ultimately, direct programs to the solution of environmental and environmental health problems. Along with this, of course, must exist a continuation of data collection, evaluation, planning, and redirection of manpower. Neither the foundation, the resources, nor the directions are static, but all must be continually re-evaluated and re-directed.

RESOURCES AND ORGANIZATIONS FOR ASSESSING ENVIRONMENTAL HEALTH RISKS

Janet T. Eyster, Michigan Department of Public Health

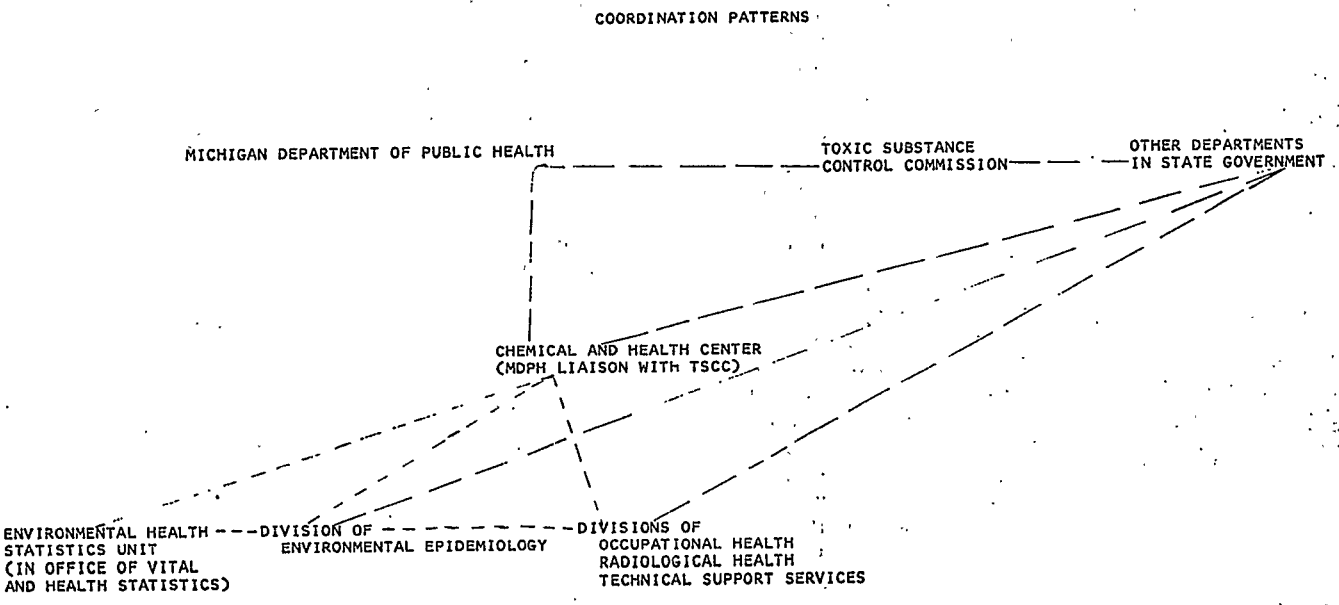
The Michigan Department of Public Health (MDPH) has traditionally been involved in environmental and occupational health and safety programs. These programs have expanded during the last decade as federal and state environmental protection laws and OSHA regulations have been implemented by the state. Assessment of the health risk of exposure to toxic substances began at MDPH in 1965. The early investigations included the study of the effects of pesticide exposure on the health of rural populations, polychlorinated biphenyls (PCB) exposure on the health of fishermen and polybrominated biphenyls (PBB) exposure on the health of a cohort of Michigan farm families. Current studies range from evaluating the long-term health effects of PBB and PCB exposure on cohorts of Michigan citizens to estimating the health risks of other toxic substances introduced into the environment through industrial pollution and inadequate chemical disposal.

Toxic substance control programs in other departments in the state government also expanded during the last decade as stronger environmental protection and food and drug laws were passed. In 1978 the governor established the Toxic Substance Control Commission to evaluate the extent of environmental contamination in Michigan, to recommend clean-up or containment actions to state and local governmental units and to coordinate the toxic substance control activities of the Departments of Natural Resources, Agriculture and Public Health.

Within the Department of Public Health the responsibilities in several units of the Department were expanded during the 1970's to include toxic substance control and health risk assessment. The Divisions of Occupational Health, Radiological Health and Technical Support Services in the Bureau of Environmental and Occupational Health are responsible for regulating and monitoring occupational safety and toxic substance exposure levels in the work place. The Division of Environmental Epidemiology, in the Bureau of Laboratory Services and Disease Control, is responsible for determining the short and long-term health effects of the exposure among workers and other cohorts of highly exposed persons. The staff in the Division of Environmental Epidemiology also collaborate with staff in the Departments of Natural Resources and Agriculture to determine the magnitude of environmental contamination by toxic substances and to assess the potential human health risk. The Environmental Health Statistics Unit in the Office of Vital and Health Statistics is the statistical arm of the environmental health programs in the Department. Staff in this unit work with Environmental Epidemiology staff on two long-term health risk assessment projects. They also work with Occupational Health and Environmental Epidemiology staff on other toxic substance exposure and risk assessment studies. The Chemical and Health Center, in the Bureau of Environmental and Occupational Health, coordinates some of the work of these units in the Department with the activities of other state Departments and the Toxic Substance Control Commission.

Consolidating the statistical staff working on environmental health projects into a single unit within a centralized vital and health statistics unit may be unique in the country since normally statisticians are hired to work within the programs on specific projects. The current structure has developed during the last decade because the advantages of the single separate unit as discussed below outweighed the disadvantages.

The staff in these units devoted to health



risk assessment and toxic substance control have a variety of training. The Chemical and Health Center has five staff consisting of an administrator, lab scientist, resource specialist, geologist and a secretary. The twenty-seven Environmental Epidemiology staff include four administrators, a physician, a toxicologist, four chemists and biochemists, seven lab technicians, four field representatives and six clericals. The Environmental Health Statistics Unit has six statisticians and biometricians, two statistical technicians, a calculation clerk and a secretary. From a staff of up to 138 persons in the Divisions of Occupational Health, Radiological Health and Technical Support Services, selected members will be temporarily assigned to risk assessment activities in addition to their regulatory activities in toxic substance control. The staff in the Divisions are primarily engineers, physicists, chemists, industrial hygenists, occupational health specialists, technicians and clericals. Over forty staff are OSHA and chemical compliance officers.

To coordinate some of the work of the statistical unit and the other Divisions of the Department with the activities of the Toxic Substance Control Commission, the Chemical and Health Center staff hold frequent meetings with staff in other areas of the Department, other Departments in the state government and the Commission. The coordination of the research activities for the epidemiological studies of the long-term health risks of PBB and PCB is facilitated by biweekly meetings of staff in the Division of Environmental Epidemiology, the Office of Vital and Health Statistics and the Environmental Health Statistics Unit.

In spite of the frequent meetings, a disadvantage of having a separate Environmental Health Statistics Unit is the reduced level of communication and coordination between statistical and program staff. This can result in reduced statistical input during planning and implementation stages of the projects because program staff sometimes fail to invite statistical staff to important meetings. Physical separation of the program and statistical staff impedes spontaneous exchange of ideas and isolates statistical staff from the day to day decisions by program administrators and field staff. Analyzing data and interpreting results are more difficult because the statistical staff are sometimes unaware of the complexity of some of the information they are receiving. Also, feedback of the statistical findings to program staff is slower and more formalized.

The physical distance between the program and statistical staff also reduces use of the statisticians. Program staff hesitate to contact a statistician when they need data tabulated and analyzed immediately. When they do make the request statistical staff are less prepared to respond quickly because they have less insight into the program issues. Because the program staff do not routinely see the statistical staff working, they have difficulty judging the time involved in completing the statistical assignments. Finally, when statistical staff have completed the analyses requested by the program staff, the statisticians will tend to work in areas which are of more interest to them but which may be of lower priority to the program.

One of the major advantages of having the Environmental Health Statistics Unit in the centralized statistical service rather than having the staff assigned directly to each project in the environmental health area is that the statistical staff have a more objective view of the statistical issues. Their recommendations are less influenced by the emotional, political and economic issues usually associated with assessing the magnitude of environmental contamination. The staff can evaluate the need for and probable value of a health study, can suggest improvements in the study or can recommend that no study be conducted based solely on scientific merit and statistical validity. The statisticians also are more objective when they are analyzing the study data and interpreting the results because they are more isolated from the external pressures to "prove" a particular point of view.

A second advantage is that in the centralized service there is strong statistical peer review by senior level statisticians. This review usually cannot be provided by project administrators who have strong scientific backgrounds but limited statistical knowledge. Staff in the Environmental Health Statistics Unit can also collaborate daily with other statistical staff in the central unit with indepth training in sampling and survey methods, analysis of variance, regression analysis, categorical data analysis, mathematical modeling and vital statistics analysis. Staff within the centralized unit also have training and experience in a variety of other scientific areas: environmental psychology, education, agriculture, microbiology, zoology, allied medical specialities, physiology, natural resources, medical data coding and chronic disease epidemiology. The combination of available statistical expertise, varied scientific backgrounds and the strong peer review in the centralized statistical service enhances the quality of the data analysis, interpretation of the results and statistical reports.

Access to statistical experts in other agencies and universities is facilitated for both junior and senior statistical staff because someone in the central unit often knows the experts personally or at least knows who are the best people to contact. Conversely outside experts are more responsive when they are contacted because the staff are representatives of a larger statistical organization.

Another major advantage is the availability of diverse health and vital statistics data in the Office. Birth and death statistics, Medicaid data, data from a statewide health and health habits survey, medical data from the state employees health screening service, data from four health surveys designed to assess health risks associated with toxic substance exposure are available in the Office. Also with program consent, data from other diverse public health programs such as Hypertension and Diabetes Control, Immunization, Family Planning, WIC Nutritional program and the Maternal-Infant-

Children prenatal program are also available through other staff in the central unit.

Training staff to utilize the computer systems and to interface with data processing is more efficient in the central unit. Continuity of statistical support is enhanced by low staff turnover and backup staff. Even when a staff member receives an advancement by working as the statistician for another program in the Department, they are in the same office and available to assist their replacement when questions arise later on. When the Environmental Health Statistics Unit needs additional statistical support for a short period of time, other staff not assigned to a specific program can assist them. The additional staff can quickly contribute to the work because they are generally familiar with the projects, have worked with the staff on other assignments and have common training.

Overall the unit is less expensive because the environmental health projects can share statistical technicians and statisticians rather than hiring individual professional staff. Our experience has been that a statistician and statistical technician team assigned to several projects is as effective as assigning two statisticians to the projects. The technician can free the statistician from data management tasks and allow him or her to concentrate more on consulting, statistical analysis and report preparation. We have also found that both members of the team are more satisfied with their jobs than the individual statisticians working in the program setting were in the past.

The experience at the Michigan Department of Public Health is that an Environmental Health Statistics Unit in a central vital and health statistics unit can work effectively with environmental and occupational health staff in other parts of the Department. The statistical staff can contribute a level of objectivity and expertise to the environmental health programs rarely achieved by individual statisticians working in the program setting.

ENVIRONMENTAL DATA REPORTING AND USE

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Abstract

Programs in environmental health generate a great deal of data that are potentially quite useful for many reasons other than their originally intended use. Evaluation or planning of programs, or risk assessment activities are reasonable uses of such data. Better understanding of what environmental health data bases are available, and how they are developed, is necessary to obtain maximum benefits from such data sources.

At least three distinct types of environmental health data are routinely collected within state agencies. These include: (1) data to check compliance with existing regulations; (2) data collected to monitor the quality of the environment; and (3) management data, or data on manpower, budgets, and information such as licenses issued, or numbers of inspections. These data have specific uses within the sections collecting the data, but also offer potential uses between sections or agencies that could improve the services offered by the agencies. Some examples of how each of these types of data can be used to generate new information are discussed, along with the importance of communication between sections and agencies as to what data are available.

Introduction

Environmental health programs generate a great deal of data that are potentially quite useful for many reasons other than what was originally intended. Program planning, program evaluation, and health risk assessment are all appropriate uses of these data. Extensive secondary use of environmental health data often does not occur because they are gathered by numerous local, state, and federal agencies; this diversity of sources makes data acquisition by secondary users difficult. In addition, there is lack of general knowledge by potential users of what data are included in these agency files.

Environmental health data are collected for various reasons, and their usefulness for other purposes depends somewhat on an understanding of why and how the data of concern were generated. For example, data obtained from general background monitoring of air quality at a given location should be interpreted differently from data obtained for stack sampling of an industry in the same vicinity.

Although organization of Minnesota state environmental agencies may be somewhat unique, by showing some of the types and sources of environmental health data that we gather, it is suspected that you will be able to translate this information to your own circumstances. To help accomplish this translation, existing and potential uses for the information already collected are described.

Types of Data and Sources

State agencies collect several types of data which, for the sake of discussion, we have categorized by purpose of collection (Table I). It is recognized that clear-cut differences between groupings is not always evident; however, our intention is to provide a useful framework for multidisciplinary sharing of information.

Table I
Data Forms

I. Compliance
   - A. Direct Observation
   - B. Reporting of Data
   - C. Data from Local Agencies (obtained by either direct observation or reporting)

II. Monitoring Data
   - A. Permanent Sites
   - B. Mobile or Rotating Sites

III. Supporting Data
   - A. Physical Environment
   - B. Management

Compliance Data

The first category is compliance, or enforcement, data. This is data collected to ensure that state regulations and statutes are followed. Agencies employ a variety of collection systems, or a combination of systems, depending on such factors as resources available for collection, regulatory approach (direct observation vs. reporting of data), importance of data in relation to compliance, etc.

A major source of enforcement data is that obtained by direct observation (inspections) conducted by state agency personnel. In the process of determining compliance with sanitation regulations, sanitarians from the Minnesota Department of Health's (MDH) Division of Environmental Health Field Services collect inspection data on food, beverage, and lodging establishments throughout the state. Also included in this Section's duties are inspections of camping areas, mobile home parks, public water supplies, and swimming pools. The Radiation Section of MDH inspects all electrically powered generators of ionizing radiation for compliance with state and federal regulations. The Occupational Health Section depends almost exclusively on data obtained by inspections to assure that industry provides a safe working environment. Tables II and III list some of the programs for which these data are collected.

Table II
Data Sources - MDH

Radiation
- Radiation Monitoring
- Equipment Inspections

Risk Assessment
- Special Studies (surveys)

Analytical Laboratory
- Sample Analyses

Occupational Health
- Work Site Inspections

Water Supply
- Water Supply Inspections
- Well Logs
- Plumber and Driller Licenses

Table III
Data Sources - MDH

Environmental Field Services
- Recreation Site Inspections
- Food and Lodging Inspections
- Community Water Supply Inspections
- Mobile Home Park Inspections
- Food-Borne Illness Reports
- Swimming Pool Inspections
- Licenses
- Surveys of Local Agencies
- Emergency Situation Reports
- Mosquito Trapping Results

The Minnesota Pollution Control Agency (MPCA) depends on inspections to a lesser degree in fulfilling its mission as the enforcement agency for air and water pollution control, solid and hazardous waste disposal, and noise pollution control. The MPCA utilizes another system for gathering data on compliance, that of regular reporting by permit holders. All major point sources of air and water pollution are required to obtain permits from the MPCA, and are required to file regular reports on the levels of pollutants in stack emissions, or the characteristics of wastewater discharges. This method has been successful in most cases, and requires only occasional spot checks of permit holders by MPCA staff. Table IV shows some of these programs for which data are collected in MPCA.

Table IV
Data Sources - MPCA

Division of Air Quality
- Air Quality Monitoring
- Surveys
- Emission Reports
- Emission Permits

Division of Water Quality
- Water Quality Monitoring
- Surveys
- Discharge Reports
- Discharge Permits

Division of Solid Waste
- Hazardous Waste Licenses
- Landfill Inspections
- Spill Manifest
- Disposal Facilities Permits

The Ground Water Quality Control Unit in the Environmental Health Division of MDH also utilizes this data-reporting approach for accumulating well log[1] data. Complete well log data, including geology, water quality and quantity, and construction methods, are reported to this unit (as well as to the Department of Natural Resources and the Minnesota Geological Survey) to (a) ensure compliance with regulations on well construction, (b) provide information relating to appropriation of waters, and (c) add to the general hydrogeological information base for Minnesota.

Enforcement data are gathered by local agencies where responsibility for environmental programs is delegated to them by the state. In Minnesota, about 40 counties and cities have their own health departments; some assume responsibility for food, beverage and lodging inspections; others have developed programs relating to private and noncommunity water supplies; and a few inspect landfills by authority of the MPCA. Table V shows what categories of services (at least in Minnesota) one would most likely expect offered by local governments. This program category listing illustrates types of data available from local agencies.

Table V
State and Local
Environmental Health Functions[2]

Local Government

Primary Provider*
- Food Protection
- Water Supply Sanitation
- Sewage Disposal Control
- Solid Waste Management
- Vector Control
- Recreational Sanitation
- Housing Safety and Sanitation
- General Nuisance Control

State Government

Primary Provider**
- Hazardous Product Safety
- Occupational Safety and Health
- Radiation Control
- Water Supply Sanitation (municipal supplies only)

Shared Responsibility
- Hazardous Waste Management
- Water Pollution Control
- Air Pollution Control
- Noise Pollution Control
- Institutional Sanitation

*The term "primary" includes the following activities: monitoring, permits issuance, plan review, inspection, enforcement, technical assistance/consultation, planning, training and public education. Where local government is the primary provider, state support services would include: state policy development, technical assistance, standard setting, evaluation, public education, training.

**Where the state is the primary provider, local government support would include: reconnaissance, reporting, and local planning.

Compliance data, wherever collected, are used to detect violations of state laws or regulations. If no violations are detected, it may be that these data are examined no further. However, there are some analyses of compliance data which can be useful for evaluating programs and determining trends for noncompliance items. For example, one interpretation of increased noncompliance may be that there has been deterioration of control measures. Another explanation may be that inspection has become more stringent.

Monitoring Data

The second major category of data is that used to assess environmental quality by direct monitoring of one or more environmental parameters. Data collection sites may be located to establish general background data or, possibly more often, located in sites for detection of suspected violations of standards. These monitoring programs can be established on a permanent basis, such as has been done by the Radiation Section of MDH, where there is a permanent system to monitor radiation levels across the state. This system is used to detect general

trends in environmental radiation, with strategic location of sampling points to be particularly helpful if there is accidental release of radioactive materials from a nuclear power plant. Similarly, the MPCA utilizes a series of permanent stations throughout the state to monitor air quality, assuring early detection of any degradation of clean air areas.

Another system for collecting monitoring data involves a more flexible approach: choosing sites to be monitored based on a need for information, or a suspicion of contamination, instead of a network of permanent stations. Since water quality may vary more than air quality from site to site and there are many more potential sites for monitoring, the MPCA utilizes this flexible system for its surface water quality program.

A third form of monitoring is accomplished by specific location, and time-limited surveys. This is a widely used approach in environmental health, collecting samples first to determine if a problem exists, and second, to help define alternative solutions to the problem. If the solution to the problem does not involve continued monitoring, then no further data are collected. In our Division of Environmental Health the Health Risk Assessment Section most often becomes involved with these types of studies.

Supporting Data

The preceding two types of data can be directly related to health; that is, compliance and monitoring efforts generally are designed to detect factors that are known to be associated with health. For example, inadequate food handling, or pollutants in air or water can be shown to have adverse effects on health. However, to fully analyze an environmental health problem, one needs data about the physical environment which relates human exposure to the contaminant. Some amount of supporting data is required to estimate severity and magnitude of exposure potential. An example of how one might use specific supporting data is presented in the following comments.

In the Karst regions (fissured and channeled limestone) of southeastern Minnesota, high nitrates and coliforms have been detected in many wells used for drinking water supplies. In order to study the extent and possible sources of the problem, information was obtained from the Minnesota Geological Survey and the U. S. Geological Survey concerning the hydrogeology of the area; health effects were investigated in a study done by the University of Minnesota College of Veterinary Medicine. Also, abandoned well locations were sought by the Health Department by contracting with a private surveyor. Although this study was done to identify a health problem, the data that were generated proved useful to other agencies as well. It was recommended that the data supplied on the hydrogeology of the area be added to the Minnesota Land Management Information Service (MLMIS) data files, providing an integrated source of health, water and land-use data. Tables VI and VII list some types of data presently collected by the MLMIS.

The MLMIS, a part of the Land Management Information Center within the State Planning Agency, has large amounts of data stored in computer files concerning land use, land ownership, water cover and other categories appropriate to land management. Consequently, the MLMIS is a valuable potential source of supporting data for environmental health programs, a source of which should improve as the Center further develops its system.

Table VI
MLMIS Data

- Geographic Identifiers
  - Townships
  - School Districts
- Resource Data
  - Land Use/Land Cover
  - Forest Cover
  - Water Orientation
  - Watersheds
  - Water Source for Irrigation
- Land Ownership Data
  - Recommended Use
  - Administering Agency
  - Acreage

Table VII
MLMIS Data

- State Comprehensive Outdoor Recreation Plan Data
  - Resorts
  - Campgrounds
  - Water Access
  - Swimming Beaches
  - Swimming Pools
- Derived Data
  - Soil Productivity
  - Cropland Productivity
  - Interpretations of Soil Atlas Data
    - Available Water to Five Feet
    - Substratum Permeability Rate
    - Depth to Bedrock

Our Health Risk Assessment Section in the Division of Environmental Health often uses supporting data in carrying out its mission. Background information on the substance or condition of concern is usually required to determine if a potential hazard does exist. Information from toxicologic, epidemiologic or clinical sources can be used to help determine if a risk exists, and if it does, how great that risk is. Further, decisions on health risk require demographic estimates of population at risk. Additional steps may be taken to develop a risk comparison, or benefit risk analysis.

A current example of how supporting data are used in risk assessment is illustrated by a groundwater problem in the Minneapolis-St. Paul Metropolitan Area. Phenols, and subsequently, PAH,[3] have been detected in the municipal water of a western suburban area. The initial step in risk assessment was a literature search of toxicological information regarding the presence and health effects of PAH in drinking water. Estimates of PAH levels in the water were initially made by correlating their presumed presence to phenol concentrations. When a method for detecting PAH was developed, direct measurements were made and the MDH recommended that four wells be closed due to the possible health risks associated with the presence of these compounds. Illustrative of the use of supporting data,

mathematical models of water flow in aquifers are being developed by the U. S. Geological Survey to help in determining flow patterns and placement of barrier wells. Before this problem can be completely rectified, further knowledge on groundwater flow, soil characteristics, and barrier well construction methods will be required.

Finally, another type of supporting data is what we have called management data. This includes all data pertinent to the operation of an environmental health program or agency. It includes, but is not limited to, numbers of license or permit holders, available manpower, budgets, time allocation by staff, and other clerical and administrative information. These data, which are often generated as a result of gathering other types of data (such as compliance or monitoring data), are often necessary to assist in allocating effort and for evaluating programs. They can be gathered from such sources as license and permit applications, agency budgets, or office records. Recognizing the potential usefulness of these types of data, the Environmental Field Services Section within the Environmental Health Division has placed much of their management data in computer files to facilitate recovery and analysis.

Data Integration

In conclusion, I would like to discuss attempts which are being made in Minnesota to integrate environmental data sources to make them more useful. One of the primary thrusts was mentioned earlier, involving the integration of water quality and water well data into the MLMIS. This has not been done as of yet; however, the MLMIS plans to place some of the Minnesota Geological Survey's data in their files in the near future in an attempt to begin the integration of these data bases.

The integration of geological, hydrological, and environmental contaminant information into the MLMIS would enable such tasks as modeling areas to identify those environmentally sensitive, and could provide assessments of situations so that appropriate land use practices could be followed in a given location. Integration of these sources of data would also provide a single source of data for many environmental problems, and would aid in identifying relationships that might exist for the above sources of information.

Also in regard to data integration, states do take advantage of federal program offerings as far as air and water quality are concerned. One can take advantage of the national computer systems (SAROAD and STORET)[4] which contain quality, discharge and other information relating to water and air pollution.

In our health department (possibly there are similar programs in your agencies), the Center for Health Statistics provides a service which helps with the development of new data sources and better utilization of our existing sources. The Center is presently working on plans for profiles of health data in each of the state's 87 counties. It is being proposed that these profiles be used to show some basic features of environmental health services across the state. This should help to identify areas of need by including such statistics as number of water supply systems and population served, food or lodging establishments, wastewater treatment facilities, landfill sites, etc. This list could be expanded if there were sufficient interest and input, and hopefully, provide a program planning and analysis service for local elected officials, health agencies and boards, and professional staff.

The Center for Health Statistics has worked in cooperation with the Radiation Control Section of MDH's Environmental Health Division to develop an information set for radiation control. The information required by MDH was determined so that a minimum data set was developed; this was then assembled into data collection forms and code sheets. Output from the system will incorporate as many of the reports that must be generated within the Radiation Control Section (such as radiological facilities inventory, inspection activities, etc.) as possible. Other output will aid with evaluation of programs, allocation of staff, and handling of emergency spills. Prior to the development of this system, obtaining this information required a manual search of files.

Another example of MCHS involvement in environmental health programs is our recent grant proposal to NIOSH for an occupational health surveillance system. Vital statistics, which are a data component of interest to this surveillance system, already fall under the realm of the Center for Health Statistics. The MCHS was instrumental in the development of experimental design for the program and will be an important resource for statistical analysis and application of software and analytical methods for interpretation of results. Consequently, the MCHS role is envisioned as being an active participant in developing a functioning information system, in addition to their substantive role as a consultant on statistical analysis.

Conclusion

We have provided you with a classification of the major types of environmental health data, and have presented some examples of sources of these data types within the State of Minnesota. Hopefully, this information will convince you that data for environmental health programs come from many diverse sources, not all of which appear to be related to environmental health. You should also realize by now that data need not be gathered for a single purpose, but can be potentially valuable for other uses. However, future use of any data source requires several considerations. These include an objective for collection and use in broad terms, knowledge of how such data can be processed and utilized to be made accessible for other uses, as well as active integration of sources by various agencies.

Data should not be collected indiscriminately, in hopes of some future potential usefulness. When gathered with broad objectives and made accessible, environmental data can prove to be valuable for making health risk assessments, and for evaluating and planning of effective environmental health programs.

1 Well logs give a vertical profile of geologic formation, data which are useful for making judgments about water availability and quality

assessments.

2 Table from the Final Report of the Environmental Health Policy Study Advisory Committee, A Joint Project of the Minnesota Department of Health and the Association of Minnesota Counties, March 12, 1980.

3 PAH - Polynuclear aromatic hydrocarbons include a large number of organic compounds, some of which are known carcinogens in very low concentrations.

4 SAROAD - EPA's national data system for air quality information.
STORET - EPA's national data system for water quality information.

Health-Related Economic Costs of Environmental Hazards

Concurrent Session L

HEALTH-RELATED ECONOMIC COSTS OF THE THREE-MILE ISLAND ACCIDENT

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I. Introduction

On March 28, 1979, a nuclear power station at Three-Mile Island (TMI) near Harrisburg, PA, had a major breakdown. A melt-down and subsequent radioactive discharge from the nuclear plant would have had catastrophic consequences on the lives and properties of individuals in the surrounding area. During the two-week period of the accident, many residences were vacated for safety and health reasons. Many industrial and business establishments were also closed. This accident had various effects on local communities, as well as the country as a whole. The nationwide impact on the energy industry has been widely publicized and is well known; however, perhaps the most important effects of the accident were on the residents of the area surrounding TMI. Possible effects included an escalation in the cost of electricity, changes in agricultural production, business activities, the housing market, the tourism industry, and the physical and mental health status of the people in the area.

The Governor's Office of the Commonwealth of Pennsylvania has issued a report which examines the socioeconomic impact of the accident (Governor's Office, Harrisburg, 1980). This report estimated a monetary loss of $7.7 million in the value of production in manufacturing industries, $74.2 million in business sales in nonmanufacturing industries, and $.25 to $.50 million in the agricultural sector for a total monetary loss to industry of about $82 million. The effects on the housing market were negligible (Nelson, 1980). The household economic costs of evacuation were estimated at $6 million, excluding the $1.2 million insurance reimbursement (Hu, 1980). These cost estimates do not include the possible costs relating to changes in the physical and mental health status of the people in the TMI area. The focus of the current study is to estimate the health-related economic costs of the accident. All these costs are estimated from survey data sources.

In this study, health-related economic costs are defined as the economic costs incurred by individuals or communities as a result of a change in physical or mental health status and/or change in health care services due to the TMI accident. Although changes in agricultural production, business activities, the housing market, and tourism may have direct economic consequences to their communities. These latter economic consequences are: (1) the possible increase in demand for health care services which may increase health care expenditures and utilization of health care resources, (2) the possible increase in morbidity which may increase a worker's absenteeism or other forms of loss of worker's productivity, and (3) the possible increase in consumption of alcohol, cigarettes, sleeping pills, and other tranquilizers during and after the accident. Estimation of these costs will provide policymakers with needed information regarding household responses and the related economic cost of these adjustments in the local communities.

In Section II, the data sources used in the study will be described. Section II will provide an analysis of the effects of the TMI accident on physician visits, work days lost, and alcohol and cigarette consumption. Concluding remarks are contained in Section IV.

II. Data Description

Two separate data collections were made in July 1979 by the Chilton Research Services of Radnor, PA, under separate contracts from The Pennsylvania State University and the Nuclear Regulatory Commission. A telephone survey using random digit dialing was employed, with no overlapping of respondents between the two surveys.

The Pennsylvania State University (PSU) data contain 691 households; 5 percent of households within the 5-mile radius of TMI were randomly selected (there are 14,300 households in the 5-mile ring). Obviously, this was the most intensely affected area within the TMI region. The data include responses to extensive questions about the social and psychological effects of the accident, the costs of evacuation, and health care utilization patterns during the two-week period of the accident and a two-week period in July 1979. The data contain respondents' files as well as information on the individuals within the respondents' households. A follow-up survey of 400 households within the PSU data set was conducted in January 1980.

The Nuclear Regulatory Commission (NRC) data contain 1,503 households covering an area 0 to 55 miles from TMI, with heavier sampling within the 15-mile ring than beyond the 15-mile ring. These data include responses concerning the evacuation decision, evacuation costs, views on nuclear power plant installation, social and psychological effects of the accident, but no information on health care utilization. The importance of these data is the cross-sectional information (variations in distance away from TMI) which allows comparisons to be made in terms of the evacuation decision, costs of evacuation, and effects of the TMI accident on mental and psychological behaviors. A detailed discussion of the sampling design and weighting procedures is presented in a report prepared by the Social Impact Research, Inc. (Flynn, 1979).

These two data sources are comparable, since they are both randomly selected from the area. The average household size is about three persons. During the two-week TMI accident period, a little over 4 percent of the households in the area included pregnant women. The mean education of

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the heads of households is about high-school level. In these two samples, about 20 percent of the households have an income of less than $10,000. About 40 percent of the households have an income between $10,000 and $20,000, while about 20-25 percent of the households have an income between $20,000 and $30,000. The characteristics of marital status and age of the heads of households are also very similar in these two samples.

III. Household Economic Costs of Health-Related Behavior

Regardless of whether a household decided to evacuate or not to evacuate during the TMI accident, household members in the TMI area may have felt tension, confusion, or stress due to the TMI accident. Not all households experienced these mental phenomena, and even if they did, the stresses may not have led to physical or behavioral responses. However, some household members may have experienced physical symptoms or behaved differently as a result of the TMI accident. Physical symptoms included stomach trouble, headache, abdominal pain, diarrhea, etc. Behavioral symptoms included insomnia, excessive sweating, loss of appetite, irritability, etc.

The basic analytical framework for estimating the health-related economic costs of the TMI accident is illustrated in Figure 1. As shown in Figure 1, the TMI accident as well as a set of socioeconomic and demographic factors may have affected the stress level of individuals in the TMI area. The change in stress level together with a set of socioeconomic and demographic factors may, in turn, have influenced (1) the demand for health care services (number of physician visits), (2) the change in productivity (work days lost and slower pace of work), and (3) the changes in consumption of alcohol, cigarettes, and tranquilizers. The resources expended for these three types of effects constitute the health-related economic costs of the TMI accident.

1. Relationships between TMI and Stress

To measure and test these possible effects of the TMI accident, one has to first establish the linkage between the effects of the TMI accident and the stress level of area residents. Once the effects of TMI on stress is certain, a statistical model will be used to examine the resultant stress on three types of health-related behavior.

As discussed earlier, the NRC data cover an area 0 to 55 miles from the TMI facility. Distance from TMI is used as a control variable to test whether the accident increased the tension and stress of the TMI area residents. Two forms of dependent variables are measured--the number of psychosomatic symptoms a respondent reported having during the two-week interview period and a dummy variable for those who had any one of the behavioral symptoms. Two time-periods are used. One is the two-week period after the accident (March 28, 1979) and the other is a two-week period three months after the accident (July 1979). In addition to the TMI accident itself, the independent variables that may affect a person's psychosomatic and behavioral symptoms are: age, sex, education, marital status, occupation, income, and pregnancy status. Few nonwhite residents are in the sample so the race variable is not included.

Since the dependent variables are expressed in either discrete numbers or dichotomous (0 or 1) form, tobit and probit techniques should be used to obtain the maximum likelihood estimation. This study used the ordinary least squares for it is easy to estimate and the coefficient is easy to interpret. The drawbacks of the ordinary least-squares technique are minimized because of the relatively large sample size and sufficient non-zeros in the dependent variable.

Table 1 shows that during the TMI period the distance variable had the most statistically significant effect on residents' psychosomatic and behavioral symptoms. The deleted distance category is 15-miles beyond the TMI area. Residents within the 15-mile ring were about 20 percent more likely to have behavioral symptoms than those beyond the 15-mile ring. The effects on psychosomatic symptoms are very similar. The effects of TMI were still apparent during the July period but to a lesser degree. Residents within the 5-mile ring and those in the 10-15 mile ring showed stronger stress symptoms than the residents in the 5-10 mile ring. Examination of other sociodemographic

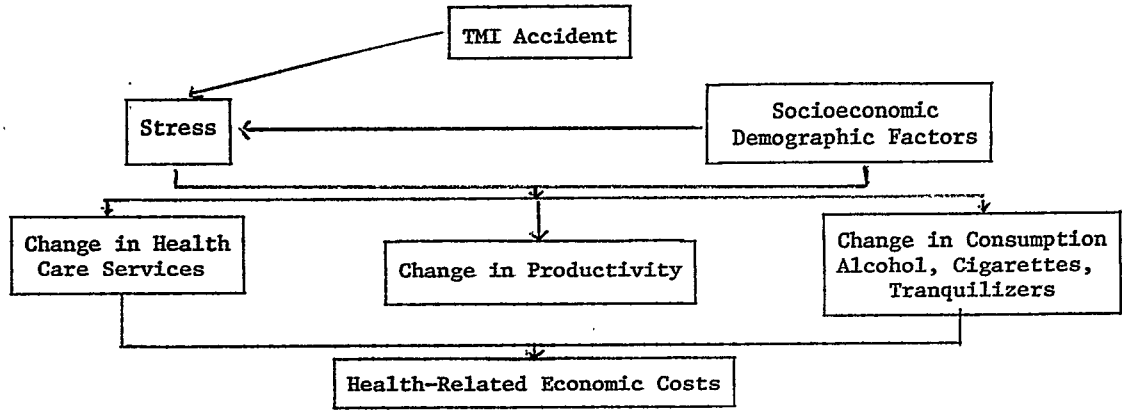

FIGURE 1

Framework for Estimating Health-Related Economic Costs of the TMI Accident

TABLE 1

Relationships between TMI Accident and Stress Levels[a]

Variables	March		July	
	Psychosomatic	Behavioral	Psychosomatic	Behavioral
intercept	.264*** (.115)	.148*** (.064)	.965*** (.169)	.354*** (.065)
0-5 miles	.225*** (.061)	.185*** (.034)	.218*** (.089)	.115*** (.034)
6-10 miles	.179*** (.055)	.201*** (.031)	.099 (.080)	.036 (.030)
11-15 miles	.270*** (.054)	.197*** (.030)	.248*** (.080)	.068*** (.030)
R^2	.038	.066	.038	.031
F statistic	4.06	7.31	4.07	3.34

Note: Values in the parentheses are standard errors of coefficients.

[a]Other sociodemographic variables included in the equations are not presented in this table.

***Indicates the 1% level of significance (one-tailed test).

variables suggest that the higher the level of education, the less the degree of stress, that males felt less stress than females, and that pregnant women had higher levels of stress.

2. Relationships between Stress and Physician Visits

The NRC survey data did not collect physician visit information. Therefore, the analysis of the effect of stress on physician visits rely solely on the PSU data.

Residents in the TMI area may have sought medical help during the TMI accident for two possible reasons. (1) Psychological and stress emotional tension may have led people to consult with a doctor or health professional in order to reduce their anxiety or to gain medical opinions about the possible effects of radiation. In the PSU survey, 73 out of 692 respondents indicated that they did consult with doctors and health professionals to make them less tense during the two-week period of the accident. (2) Physicial discomfort resulting from psychological and emotional disturbances during the TMI accident may have prompted a physician visit. It is difficult to make accurate judgments as to which visits to physicians were due to the TMI accident even from the patient's point of view. Therefore, a model of the demand for physician services is used to measure the effects of stress on physician visits between the TMI accident and January 1980. Since few respondents in the survey were admitted to the hospital, only the physician visits will be used as dependent variables. In reality, people who are under mental stress are rarely admitted to the hospital; more often they seek help from a physician. A demand function for physician visits usually includes income, price of a visit, insurance coverage, and a set of sociodemographic variables. In this study, information on the price of physician visits was not available. However, this is a relatively small geographic area and there are only a few physicians in the area. A separate physician fee survey indicated that in this area fees for a routine visit range from $12 to $14, a rather narrow variation. Insurance coverage is approximated by the occupation of the respondent. In addition to age, sex, educational level, and marital status, both psychosomatic and behavioral symptoms are included in the equation. A self-valued health status of the respondent and the existence of chronic ailments are included as state of health variables. In the survey, a question was asked about whether a respondent will usually consult with a physician when discomfort occurs. This variable is included to reflect the preference for a doctor visit.

Table 2 presents the regression results of the demand for physician visits. They show that stress has a statistically significant positive effect on the demand for physician visits. Individuals who report suffering from the most psychosomatic symptoms also visited physicians more often. For the most part the other variables that significantly affect the demand for physician visits are those related to the healthiness of the individuals. Individuals that report themselves in better health visit physicians less often. It also appears that people with any one or more of the chronic ailments have a greater demand for physician visits. Also, as expected, pregnant women and older persons visit physicians more often than everyone else.

3. Relationship between Stress and Work Days Lost

In the January 1980 survey, respondents were asked about the number of work days lost for health reasons for the period from Labor Day 1979 to January 1980. On the average, individuals lost 3.2 work days.

TABLE 2

Relationship between Stress and Physician Visits and Work Days Lost

Variables	Physician Visits (TMI-January 1980)	Work Days Lost (September-January 1980)
intercept	2.454***	-2.317
	(.836)	(5.972)
health status	-.567***	-1.433
	(.140)	(1.004)
preference for doctor visits	.908***	2.177***
	(.122)	(.871)
male	-.350*	-2.050
	(.207)	(1.480)
age	.196***	.178
	(.079)	(.567)
married	-.286	1.319
	(.385)	(2.753)
separated, divorced, widowed	-.609	-1.524
	(.440)	(3.140)
family size	-.099	-.229
	(.068)	(.485)
education	-.090	.110
	(.137)	(.979
income	.047	.613
	(.123)	(.881)
chronic ailments	.512***	.778
	(.206)	(1.471)
pregnant	4.259***	21.090***
	(.711)	(5.084)
behavioral symptoms	.801***	1.215
	(.215)	(1.535)
psychosomatic symptoms	.092**	.951***
	(.041)	(.290)
farmer, homemaker, unemployed, retired, other	.156	---
	(.236)	
market worker	---	5.443***
		(1.686)
sample size	379	379
R^2	.411	.150
F. statistic	18.15	4.59

Note: Values in the parentheses are standard errors of coefficients.
***Indicates the 1% level of significance (one-tailed test).
**Indicates the 5% level of significance (one-tailed test).
*Indicates the 10% level of significance (one-tailed test).

The factors that affect the number of work days lost include the status of health of the respondent, age, education, sex, marital status, pregnancy status, preference for doctor visits, and status of labor market participation. For the purpose of this investigation, behavioral and psychosomatic symptoms were also included in the analysis. The regression analysis will be able to introduce these confounding variables as well as the stress variables, measured during and after the TMI accident. Thus, indirectly, the effect of stress may measure the effect of the TMI accident on work days lost, holding other sociodemographic variables the same.

Table 2 also shows the regression results for the number of work days lost. That stress has a statistically significant positive effect on the number of work days lost. Additionally, the pregnancy variable had a greater effect on the number of work days lost.

An interesting result of this analysis is that people who have a preference for visiting a physician when they are ill also have a larger demand for time off work. This suggests that time

off work and physician visits are complements in the production of health. The alternative explanation would be that physician visits and time must be combined in fixed proportions in order to produce health. Thus, a certain amount of time must be used in conjunction with a physician visit to produce health.

Finally, individuals who work in the labor market have more work days lost than individuals who do not work in the labor market. There are two possible explanations. One is that individuals who do not work in the labor market may always report zero days lost from work for health reasons. Alternatively, individuals who work in the market may have fringe benefits that compensate them for their work days lost so that there is no incentive to take time off for health reasons.

4. Relationship between Stress and Alcohol and Cigarette Consumption

There is a tendency for people under stress or anxiety to increase their consumption of alcohol or cigarettes or to take tranquilizers or sleeping pills. According to the PSU survey, 63 respondents indicated they drank more alcoholic beverages than usual during the accident period. This represents about 13.4 percent of the 469 regular consumers of alcoholic beverages. On the average, the regulars had four additional servings a day in any one day during the period. In general, 55 percent of the people drank beer, 15 percent drank wine, and 30 percent drank liquor. In the January 1980 follow-up interview, however, only 7 out of 404 respondents indicated that they increased their consumption of alcoholic beverages in relation to the TMI accident.

Within the 5-mile radius, 43 percent of the respondents were regular smokers, consuming about one pack (20 cigarettes) a day. Thirty-two percent of regular smokers indicated that they increased their smoking during the two-week TMI accident. These respondents smoked an additional ten cigarettes each day during the accident period. In the January 1980 follow-up interview, 32 out of 404 respondents indicated that they increased smoking in relation to the TMI accident.

During the two-week period of the TMI accident, 51 respondents took sleeping pills compared to 24 respondents who took sleeping pills during the questionnaire interview time (July). Similarly, there were 60 respondents who took tranquilizers during the TMI accident compared to 32 respondents who took them during the questionnaire interview period. These figures indicate that about twice as many people took sleeping pills or tranquilizers during the TMI accident as at other times. The consumption of sleeping pills and tranquilizers in January 1980 was about 22 and 31 out of 404 respondents, respectively.

Table 3 provides the regression results for the relationship between the consumption of sleeping pills, tranquilizers, alcohol, and cigarettes and the stress levels of the TMI residents, during January 1980. Other sociodemographic variables are also included in the three equations. Table 3 indicates that both psychosomatic and behavioral symptoms have statistically significant positive effects on the taking of sleeping pills and smoking cigarettes after the accident. In addition, the psychosomatic symptoms have significant positive effects on the taking of tranquilizers, while the alcohol consumption was not significantly affected by the stress level during the January 1980 period.

TABLE 3
Relationship between Stress and Consumption of Sleeping Pills, Tranquilizers, Alcohol, and Cigarettes, January 1980[a]

Variables	Sleeping Pills (Dummy Variable)	Tranquilizers (Dummy Variable)	Alcohol (# of Servings)	Cigarettes (# Packs)
intercept	-.114*	-.114	-.024	.132
	(.069)	(.08)	(.037)	(.084)
behavioral symptoms	.051***	.037	.01	.079***
	(.026)	(.029)	(.013)	(.031)
psychosomatic symptoms	.017***	.019***	.003	.014***
	(.005)	(.005)	(.003)	(.006)
sample size	379	379	379	379
R^2	.112	.094	.024	.112
F statistic	3.85	3.15	0.76	3.86

Note: Values in the parentheses are standard errors of coefficients.

[a]Other sociodemographic variables included in the equation are not presented in this table.

***Indicates the 1% level of significance (one-tailed test).

*Indicates the 10% level of significance (one-tailed test).

5. Estimates of Health-Related Economic Costs

Empirical estimations of the effects of the TMI accident on stress and the effects of stress on health-related behaviors have been established in the previous four sections. The estimation of economic costs of these behaviors will rely on the magnitude of these changes. The procedure used to estimate these costs is as follows:

> (Δ Stress level due to TMI) x (Δ Health-related behavior due to stress) x (size of the population in a given area) x (unit cost of the health-related behavior).

Changes in stress level due to the TMI accident can be obtained from regression coefficients in Table 1. Changes in health-related behavior due to stress can be obtained from regression coefficients in Table 3. Given the size of the population for the 0-5 mile ring (Hu, 1980) and the unit costs of the health related behaviors (obtained from prevailing fees in the local market), costs can be estimated for the changes in health-related behavior due to the TMI accident within the 5-mile ring.

Table 4 indicates that the largest health-related cost item due to the TMI accident is work days lost, followed by the increase in physician visits. The costs of increased consumption of sleeping pills, tranquilizers, and cigarettes are minimal. Among them, cigarettes took the largest share of the costs. The results also indicate that the tension and stress caused by the TMI accident still persist as of January 1980. An estimation of the total health-related costs of the accident between March 1979 and January 1980 is about a half-million dollars for the residents within the 5-mile ring.

IV. Concluding Remarks

This study has hypothesized that the accident at TMI affected area residents' mental status, if not their physical status. Mental status refers to increased stress and psychosomatic symptoms of people in the area. This study examines three types of health-related economic costs of the TMI accident: (1) the increase in health care services, (2) the increase in work days lost, and (3) the increase in consumption of sleeping pills, tranquilizers, alcohol, and cigarettes. Two data sets are used to examine these effects--the NRC data and the study survey (PSU data).

The findings indicate that stress symptoms caused by the TMI accident did affect the health-related behaviors of area residents. Based on regression analysis, it is estimated that the cost of the changes in health-related behaviors was about $.52 million for a ten-month period within a 5-mile ring of TMI. Of the costs examined, the economic costs of work days lost and physician visits are the largest cost items. The results also show that the effects of the stress still existed eight months after the accident.

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TABLE 4

Changes in Health-Related Behavior Due to TMI, 0-5 Mile Ring between the TMI Accident and January 1980 (additional quantities)

	Quantity[a]	Costs[b]
physician visits	235	$ 3,525
work days lost (days)	17,194	514,200
sleeping pills (tablets)	1,530	180
tranquilizers (tablets)	1,710	120
cigarettes (packs)	17,530	8,760
Total		$526,785

Notes: [a]The quantities are derived from the product of the three distance regression coefficient in Table 1 (March) in relation to psychosomatic stress and the regression coefficients in Tables 2 and 3.

[b]The unit costs were $15 for each physician visit, $30 for each work day lost, $.12 for each sleeping pill or tranquilizer, and $.50 for one pack of cigarettes.

ESTIMATING HEALTH AND ECONOMIC BENEFITS: THE CASE OF OCCUPATIONAL SAFETY REGULATIONS

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There has been an increasing realization in recent years that improvements in safety and environmental quality are not costless. The costs of regulation are both direct and indirect. They include direct outlays to comply with Federal regulations and indirect reductions in productivity. Studies such as those done at the Commerce Department's Bureau of Economic Analysis have shown that both types of costs are important.[1]

Benefits as well as costs result from regulation, although measurement of the benefits may be more problematic. This paper presents estimates of the impacts of safety regulations on accident rates and, using the estimated impacts, measures the economic values or benefits of the regulations. Its primary findings are:

- Little evidence was found of a direct, or immediate, impact of regulations on work accident rates.
- Regulations may have a significant indirect impact on fatality rates via changes in the safety characteristics of new machinery and equipment.
- Acquisition of newer and safer capital over the period 1972-77 may have saved the lives of 1,000 workers in 1977.
- Rough quantification of these gains suggest significant economic benefits to safety regulations.

Safety regulations: Background

Central responsibility for worker safety at the Federal level is located in the Department of Labor. The Occupational Safety and Health Administration (OSHA) is responsible for assuring safe working conditions for all workers engaged in interstate commerce, as provided for by the Occupational Safety and Health Act of 1970. The Mine Safety and Health Administration (MSHA) is responsible for metal, nonmetal, and coal mine safety under the Federal Mine Safety and Health Amendments Act of 1977.

The Occupational Safety and Health Act of 1970 was passed as a result of concern over what was perceived to be a large and growing occupational safety problem. At the time, over 100,000 person years of production were lost annually because of work injuries. Over the period 1958-70, the work injury rate in manufacturing rose from 11.4 to 15.2 disabling injuries per million person hours worked. Concern over the special problems in mining, highlighted by a series of mine explosions, resulted in the Federal Metal and Nonmetallic Mine Safety Acts of 1966 and 1969, followed by the Federal Mine Safety and Health Amendments Act of 1977.

Safety standards.--Although education, research, and other functions are mandated under the various Federal safety acts, the major Federal regulatory activities are the establishment and enforcement of national safety standards. These are discussed in turn. There are two general types of safety standards: (1) specification standards, which specify design and construction requirements for machinery and equipment, and (2) performance standards, which define work procedures that allow a job to be performed safely. Most safety standards are of the specification type.

Specification standards apply to permanent capital equipment and machinery. Enforcement of such standards is easier than enforcement of performance standards since specifications relating to the design, construction, and existence of particular types of capital equipment can be checked in a single inspection. Performance standards relating to work procedures, on the other hand, may require continuous or intermittent monitoring.

Enforcement.--Inspections, and to a lesser extent financial penalties, are the main devices for insuring compliance with safety standards; closure orders are also employed in mining and for the correction of imminent danger situations under the OSHA Act. An attempt is made to target inspections to serious accidents. OSHA's stated inspection priorities are as follows: (1) evidence of imminent danger; (2) catastrophies or fatal accidents; (3) complaints by employees or their representatives; (4) workplaces in the special programs category; and (5) random inspections of all covered workplaces.

The Economic Processes of Accident Prevention

There are four avenues through which direct regulation by safety standards can have an impact on work accident rates. (1) If the regulations are enacted as law, some firms may comply simply because it is the law. (2) Some firms may balance the costs of compliance against the expected costs of non-compliance (the probability they will be inspected and found in violation times the average penalty for non-compliance), acting to reduce accident rates when the latter exceed the former. (3) Employees may become better informed as to the causation and, therefore, prevention of work accidents as a result of the production and dissemination of regulations. (4) Manufacturers of capital equipment will have an incentive to produce equipment that complies with legal safety standards as a result of product liability laws and impacts on product marketability; as firms replace obsolescent machinery and equipment, they will over time come into compliance with the law.

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Balancing costs of compliance and noncompliance

Costs to firms of noncompliance appear to be relatively low. For most firms, the probability of inspection is less than two percent. When they are inspected, not all violations are discovered or cited, and even when cited, the average penalties are small--$188 per citation in 1976.[2]

Costs of compliance, on the other hand, may be sizable and significantly in excess of expected penalties, although available data are limited and should perhaps be viewed with some skepticism. The National Association of Manufacturers surveyed its members in 1974 and found mean estimates ranging from $35,000 for the smallest firms to $4.7 million for the largest firms.[3] A Business Roundtable Study of the direct costs incurred by 48 large companies found an average capital cost of $1.4 million in 1977.[4] The sole estimates of costs from other than industry sources, a survey by the Small Business Administration of loans for compliance with OSHA regulations, found an average loan of $200,000; an amount in excess of the mean cost estimates for small firms reported by the National Association of Manufacturers.[5]

The difference between the expected costs of compliance, especially capital costs and the incentives for immediate, across-the-board compliance--expected penalties--suggests that the only significant immediate effect of inspections and penalties will be on relatively low cost, easily correctable violations.[6]

Studies that have looked at the effects of direct regulation have found little or no impact of inspections or penalties on total injury rates or lost workday rates.[7]

Safety improvements in capital equipment

Because low inspection rates and small penalties give firms little incentive for immediate across-the-board compliance, most firms will prefer to wait until existing equipment is replaced. This tendency to wait rather than retrofit or scrap and replace existing equipment is reinforced by the cost advantage of embodied safety equipment. As the President's Interagency Task Force on Workplace Safety and Health has observed, retrofitting is expensive relative to "the large savings and the increased worker protection which may be produced by imposing engineering requirements as capital is replaced rather than across the board."[8] If, for reasons of marketability and product liability, manufacturers of capital produce equipment that complies with legal safety standards, over time as firms purchase new equipment, there should be an observable reduction in serious work accident rates.

Product liability may be a very important indirect effect of regulation. Prior to the introduction of Federal safety regulations, it was difficult for an employee injured in an accident involving capital equipment to sue the equipment manufacturer. Workers' compensation laws are designed to eliminate the concept of negligence and fault; any injury to an employee arising "out of and in the course of" their employment is compensable, and accidents involving unsafe equipment do not result in a judgment against the employer establishing fault, which might later be used in a product liability suit against the equipment manufacturer. Under Federal regulations, serious accidents involving equipment that fails to meet standards result in a citation and penalty against the employer. Although the regulatory agency cannot fine the manufacturer, a citation against an employer for violation of Federal safety standards increases the probability of a successful product liability suit against the equipment manufacturer by an injured employee.

Estimating Model

A model to estimate the impact of safety regulations on accident rates can be developed from the profit-maximizing behavior of employers and the avenues through which regulations affect safety. The estimating model used here is similar to the standard models employed in other analyses of safety in the workplace. Although such models are loosely based on the minimization of the sum of safety costs, most of the variables are control variables for industry specific work accident risk factors. The basic differences between this and other models are: first, the inclusion of an index of safety capital to measure the indirect effect of regulation on accident rates and, second, the use of fatality rates as a dependent variable rather than injury rates. Using fatality rates, it is:

$$\log (FR_{i,t}) = b_0 + b_1 \log (NH_{i,t}) + b_2 \log (PRODW/TW_{i,t}) + b_3 \log (W_{i,t}) + b_4 \log (SAFETYK_{i,t}) + b_5 \log (REG_{i,t}) + b_6 \log (REG_{i,t-1}) + b_7 \log (REG_{i,t-2}) + E_{i,t}$$

where

t = period

i = industry

$FR_{i,t}$ = fatality rate

$NH_{i,t}$ = new hire rate

$(PRODW/TW)_{i,t}$ = proportion of total workers who are production workers

$W_{i,t}$ = average hourly wage rate

$SAFETYK_{i,t}$ = safety capital index which is

$$\left(\sum_{n=72}^{n=t} INV_{i,n} \right) / STOCK_{i,t}$$

INV_t is investment in new machinery and equipment (in 1972 dollars) and $STOCK_{i,t}$ is the stock of machinery and equipment in 1971 (in 1972 dollars)

REG_t = regulatory variable, alternatively INSPL = inspections per laborer or PENL = penalties per laborer

E_t = error term.

The double log form is based on the assumption that the underlying production function for safety exhibits diminishing marginal productivity. That is, it takes greater amounts of safety inputs to achieve a given decrease in fatality rates as such rates decline to lower levels. An additional advantage of this functional form is that the estimated coefficients have a simple interpretation as elasticities, which represent the percentage change in the dependent variable (fatality rates) associated with a one percent change in an independent variable; for example, inspections per laborer.

The variables may be grouped into three classes: (1) the dependent variable which measures work accident rates; (2) the independent variables associated with differences in the probabilities of work accidents across industries; and (3) the independent variables used to measure the impacts of regulation. These are discussed in turn.

Work accident rates.--The Bureau of Labor Statistics produces a number of series on work accident rates, including total injury rates, lost workday rates, and fatality rates. Most statistical analyses of safety regulations have looked at the impact of inspections and penalties on total injury rates and lost workday rates, finding little or no impact.

Department of Labor officials, in response to these studies, point to significant reductions in the rate of fatal work accidents and to problems with total injury rates and lost workday rates which, they argue, are poor measures of changes in worker safety.

Mortality is an objective event, whereas the reporting of injuries and lost workdays is dependent on attitudinal factors. For example, the perception of what constitutes an accident, or the number of days taken off from work due to an accident, may be expected to vary with the degree of attention paid to employee safety and health, the existence and amount of paid sick leave (including workers compensation), and employer attitudes towards absenteeism following work accidents. The introduction of OSHA and MSHA and increases in paid sick leave and benefit payments under workers' compensation should cause one to seriously question conclusions based solely on the behavior of total injury rates or lost workday rates over the period of increased Federal safety regulation.[9]

A second reason for emphasizing fatality rates is that regulatory procedures in their emphasis on specification standards probably focus on physical hazards which may be more closely associated with more serious accidents and fatalities. Although the evidence is fragmentary, the view that the majority of serious accidents are related to physical hazards has significant support within the safety profession.[10] A third reason is that economic costs associated with fatalities are very large. Premature death and permanent disability deprives society of the productive contribution of individuals not only in the current year, but for all their future productive years. Injuries that do not result in mortality or permanent disability lead to costs that are usually short lived. These costs differences can be significant; 63 percent of all work accidents involve no lost workdays. Nonserious cases account for over 90 percent of work accidents, yet they account for less than 25 percent of the economic costs of work accidents. Nonserious accidents account for less than 10 percent of all work accidents, yet they account for over 75 percent of total costs (table 1).

Work accident risks.--Studies of the causes of work accidents have found that many of the variables that affect work accident rates are outside of the direct control of government regulators. Among the most important of these are variables associated with the business cycle. As the pace of business activity rises, newly hired workers are employed in factories operating dangerously close to capacity. Overtime hours rise while worker responses and attention to detail tend to fall. All of these factors contributed to an increase in work accident rates.

Production workers have accident rates significantly higher than office workers. Production workers as a proportion of total workers in each industry is introduced as a control for the inherent risk in each industry.

The wage rate may be regarded as a measure of industry risk. In a perfectly competitive market (ceteris paribus), one should observe a positive correlation between risk and wage rates. However, to the extent other factors affecting wage rate (e.g., training, education, and unionization) vary positively with risk level, the relationship will be in the opposite direction. Employers of highly skilled workers may have a large investment in their workers and therefore a greater incentive than other employers to invest in accident prevention.

Regulatory variables.--The regulatory variables conventionally used in statistical analyses of safety are inspections or penalties. Since for some firms threat of citation for a violation may be sufficient to assure compliance, both inspections and penalties are included in the model. However, due to obvious difficulties with multicollinearity, if both variables are included in the same equation, inspections and penalties are included in separate equations. The regulatory variables are measured for either the current year or for the current and preceding two years. The lagged regulatory variables are also estimated with a second order polynomial distributed lag.[11]

Employer responses to regulation should depend on the likelihood of a serious violation being found, and this likelihood will vary with the number, intensity, and completeness of inspections. A measure of the intensity of inspections is important since, according to Smith, "there is substantial evidence that inspectors do not discover or cite all violations in the plants they inspect."[12] In this analysis, inspections and penalties are expressed on a per laborer basis to control for industry size and to allow for number and intensity of inspections.

Table 1. Work Accidents: Incidence and Costs, 1975.

Work Accidents	Average Cost 1/ Per Case (Medical care and lost worktime)	Number of Cases 2/ (thousands)*	(percent)*	Total Economic Cost 3/ (Millions of dollars)*	(percent)*
Total cases	$1,550	4,828.0	100.00%	$7,484	100.00%
Nonserious cases	408	4,386.7	90.85	1,791	23.93
Without lost workdays	12	3,050.5	63.18	37	0.49
With lost workdays	1,313	1,336.2	27.67	1,754	23.43
Serious cases	12,908	441.0	9.13	5,693	76.06
Permanent disability	10,585	436.1	9.03	4,616	61.67
Minor partial	4,858	332.4	6.88	1,615	21.57
Major partial	26,135	100.2	2.07	2,619	34.99
Total	109,280	3.5	0.07	382	5.10
Fatalities	219,706	4.9	0.10	1,077	14.39

1/ Source: See table 3 below.

2/ Total Cases, Nonserious Cases without Lost Workdays, Total Lost Workday Cases (Nonserious and Serious), and Fatalities, from Bureau of Labor Statistics, Occupational Injuries and Illness in the United States, 1976 (Washington, D.C.: U.S. Government Printing Office, April 1979), p. 74; Nonserious Lost Workday Cases, Permanent Total Disability Cases, Permanent Major Partial Disabilities, and Permanent Minor Partial Disabilities estimated from unpublished data on the distribution of compensable cases obtained from the Council on Compensation Insurance.

3/ Product of raw data for column 2 and column 3.

* Totals may not add due to rounding.

An index of safety capital is included to capture the indirect effects of regulation as described above. The proportion of the total stock of machinery and equipment purchased after 1971 is used as a proxy for the stock of safer equipment resulting from regulations.[13]

Findings

The estimating model was applied to data for 27 mining and manufacturing industries over a 6-year period (1972-77)--a pooled cross-section time series analysis. The results of the various regression equations are presented in table 2.[14] (Data on nonfatal serious accidents is not available in the detail required for this analysis.)

The coefficients for the new hire and production worker variables in the equations are statistically significant and positive, conforming to a priori expectations. The coefficients for the wage rate variable, which a priori could be positive or negative, are positive and significant.

Little evidence was found to support a significant direct effect of regulations, as measured by inspection and penalty rates, on accident rates. Although a little over one-half of the coefficients are statistically significant, many of these have a positive rather than negative sign. The unexpected, positive signs reflect: first, the intertemporal instability in the impact of the regulatory variables because of correlation between the simple distributed lag variables, and, second, the focus by regulators on the more dangerous industries.

Although this analysis revealed no direct effect of regulation, a significant indirect effect was found. The index of safety capital showed a significant inverse relationship with fatality rates.

These results should be interpreted with care. In addition to the effect of regulation on safety capital, increases in relative wages, medical care costs, and other costs of work accidents also provide incentives for the adoption of safer capital.[15] Moreover, although the fatality rate regression coefficients for the index of safety capital are robust in sign and significance, the size of the coefficients is quite sensitive to the length and structure of the lagged regulatory variables. There appears to be multicollinearity between the distributed lag inspection and penalty variables and the index of safety capital.

These are interesting results, in that they suggest a beneficial indirect impact of regulation on work accident rates in mining and manufacturing, contrary to earlier investigations. While a finding that regulation may be statistically significant in explaining changes in accident rates is important, an equally important issue is the magnitude of the regulatory impact.

Valuing Gains From Safety Regulation

Reductions in accidents.--The indirect gains from safety regulation appear to be significant for the industrial sectors analyzed here. However, the exact magnitude of the effect is difficult to determine. A 1 percent change in the index of safety capital induces anywhere from a .2 percent to a 1.0 percent change in fatality rates. Due to the instability in the coefficients, it is perhaps best to err on the conservative side, using the lowest coefficient. Combining .2 as a conservative estimate of the elasticity coefficient for the index of safety capital and the change in the index of safety capital over the period 1972-77 produces an estimated 26 percent reduction in the 1977 fatality rate as a result of safety regulation for this group of industries. In other words, had the index of

Table 2. Fatality Rate Regression Results. Coefficients and T Statistics

	Ordinary Least Squares (OLSQ)			Polynomial Distributed Lags (PDL)		
Independent Variables	1	2	3	4	5	6
Constant (b_0)	-20.846	-24.448	-22.547	-26.604	-13.138	-14.626
	(9.96)	(10.62)***	(10.27)***	(12.36)***	(9.46)***	(10.23)***
Wage (W)	4.523	5.399	4.857	6.045	4.441	5.393
	(8.12)***	(8.14)***	(7.85)***	(9.23)***	(6.87)***	(7.21)***
New Hire (NH)	1.227	1.339	1.567	1.686	1.370	1.535
	(5.35)***	(5.19)***	(6.27)***	(6.62)***	(5.64)***	(5.97)***
Prod. Empl. (ProDW/TW)	.921	1.445	1.249	2.743	1.835	2.961
	(1.54)*	(2.02)**	(1.43)*	(3.16)***	(2.24)**	(3.52)***
Safety Capital (SafetyK)	-0.294	-0.197	-1.046	-0.943	-0.303	-0.318
	(2.50)***	(1.35)*	(2.35)**	(2.54)***	(2.90)***	(2.78)***
$INSPL_t$	0.335		0.74		0.295	
	(6.41)***		(0.24)		(1.09)	
$INSPL_{t-1}$			-0.342		-0.244	
			(0.91)		(0.66)	
$INSPL_{t-2}$			0.574		0.195	
			(2.69)***		(1.34)*	
$PENL_t$		0.152		-0.261		-0.029
		(2.04)**		(1.35)*		(0.17)
$PENL_{t-1}$				-0.317		-0.270
				(1.54)*		(1.30)*
$PENL_{t-2}$				0.690		0.364
				(4.01)***		(2.83)**
S (std error)	.85	.96	.75	.78	.74	.77
R^2 (adjusted)	.59	.48	.68	.66	.69	.66

Significance level: * = 10 percent; ** = 5 percent; *** = 1 percent

safety capital remained at its 1972 level, the 1977 fatality rate would have been 18.9 per 100,000 workers rather than 14.0 per 100,000 workers. Based on the 1977 annual employment for these industries, this difference in fatality rates meant a gain of 998 lives in 1977 as a result of increases in the index of safety capital over the period 1972-77.

Valuing gains from the saving of life.--Methods for estimating the economic costs of fatalities (or the saving of lives) have a long history and are widely employed. A recent bibliography in health economics counts over 500 studies employing what may be called the human capital approach to valuing the costs of death (or of illness and disability).[16] By this methodology, gains from reductions in the risk of fatal accidents are valued in terms of the savings in resources used to treat the fatal injury--direct costs plus increases in production attributable to reductions in fatal accidents--indirect costs.[17] These costs, which are common to all fatalities, are often supplemented by costs to business-related accidents.[18]

In general, studies employing this methodology classify the costs as follows:

1. Direct Costs

Medical Costs: Expenditures on diagnosis and treatment, including outlays for hospital and nursing home care, physicians' and nurses' services, and drugs.

Nonmedical Costs: Costs of insurance administration and property damage. Insurance administration costs include operating costs of private carriers (investigation and adjustment of claims, administration, and a return to invested capital carriers), and the administrative costs of the Federal and state agencies that supervise the workers' compensation programs.[19] Property damage costs include damage to equipment and the wastage of raw materials.

2. Indirect Costs

Earnings Loss: Individuals who die prematurely represent a loss in potential GNP and social well-being. These losses are normally calculated as the product of deaths and the discounted expected future earnings of these workers by age and sex. Expected future earnings for each age and sex group are a function of expected years of life remaining, expected future labor force participation, and future earnings. This approach to valuing life leaves much unmeasured. Productivity losses are confined to the market, excluding household production. Other dimensions of the loss of life, such as pain, suffering, and the simple value of living, are ignored.[20]

Production Losses and Administrative Costs of the Employer: The National Safety Council defines these costs as "the money value of time lost by workers other than the injured worker. It includes the time lost in investigating accidents, writing reports, retraining workers to replace lost personnel, and disruptions of production schedules." The National Safety Council estimates these costs to be at least as large as the sum of all the other costs of work accidents.

Table 3 presents rough estimates of the per case costs of work accidents. Serious and total accidents have significantly higher costs than other accidents. Unfortunately, with the exception of medical care costs and productivity losses due to disability and premature death, good data for estimating the costs of work accidents are extremely difficult to obtain. Many important cost categories have been left out simply because reliable cost estimates by accident severity could not be obtained. Even the productivity numbers are subject to some uncertainty regarding the appropriate real rate of discount for calculating the present value of future earnings to the household; a discount rate of 4 percent has been used which is an estimate of the real return to households on financial investments and investments in housing over a 30-year period 1948-78.

Estimated economic benefits of safety regulation.--Order of magnitude estimates of the economic benefits of safety regulation for the 27 industries included in this analysis are derived from the direct medical and indirect costs shown for fatalities in table 3, adjusted to 1977 prices. Even though several cost items have been omitted and a conservative estimate of lives saved in 1977 (998 lives) was used in making these estimates, the economic benefits of safety regulation were $261 million.

Table 3. Economic Costs 1/ and Distribution of Work Accidents by Severity, 1975.

Accident Severity	Direct Medical Costs	Indirect Costs (Earnings Loss)	Total Costs
Nonserious cases	$ 143	$ 256	$ 408 2/
Without lost workdays	--	--	12 3/
With lost workdays	471	842	1,313
Serious cases	2,679	10,229	12,908
Permanent disability 4/	2,688	7,897	10,585
Minor partial disability	1,605	3,253	4,858
Major partial disability	5,649	20,486	26,135
Total disability	20,731	88,549	109,280
Fatalities	1,952	217,754	219,706

1/ Lost Worktime and Medical Care Costs, Nonserious Cases Without Lost Workdays—medical costs of first aid not covered by insurance and time lost (less than a full workday) by the injured worker, from J. V. Grimaldi and R. V. Simonds, Safety Management (Homewood, Ill.: Richard D. Irwin, 1975), pp. 614-617; Nonserious Cases With Lost Workdays—estimated from data on average lost workdays per lost workday case, average wage per worker with work loss days, and medical care expenditures per temporary total disability case. Sources: Bureau of Labor Statistics (Occupational Injuries); S. J. Mushkin, Biomedical Research: Costs and Benefits (Cambridge, Mass.: Ballinger Publishing Co., 1979), p. 302; and unpublished data from the Council on Compensation Insurance; Serious Permanent Disabilities—estimated from data on indemnity compensation for work loss and medical care cost per case by type of disability. Sources: Unpublished data from the Council on Compensation Insurance; Fatalities—estimated from data on the present value of future earnings (discounted at a real rate of 4 percent), the distribution of accident deaths at work sites, and medical care cost per case for fatalities. Sources: unpublished data from the National Center for Health Statistics and the Council on Compensation Insurance.

2/ Total Cost includes the medical and earnings loss costs for Nonserious cases without lost workdays.

3/ Medical and earnings loss costs are only available in aggregate.

4/ Lacking good data on actual work loss for permanent disabilities, indemnity compensation for work loss was employed. It is not clear how these data relate to actual work loss. Dishonesty may bias these numbers up, while waiting periods and ceilings will bias these numbers down.

References

1. See J. E. Cremeans, "Conceptual and Statistical Issues in Developing Environmental Measures-Recent U.S. Experience," The Review of Income and Wealth (June 1977); and E. F. Denison, "Effects of Selected Changes in the Institutional and Human Environment Upon Output Per Unit of Input," Survey of Current Business (January 1978).

2. A. L. Nichols and R. Zeckhauser, "Government Comes to the Workplace: An Assessment of OSHA," The Public Interest (Fall 1977), p. 53.

3. "What It's Costing Industry to Comply with OSHA," Occupational Hazards (Fall 1974), pp. 8-9.

4. Arthur Andersen and Co., Cost of Government Regulation Study for the Business Roundtable (New York: Arthur Andersen and Co., March 1979).

5. R. S. Smith, The Occupational Safety and Health Act (San Francisco: American Enterprise Institute, 1976), p. 62.

6. Even for firms found in violation and directed to make capital expenditures, the time required for most capital projects would introduce a significant time lag between inspections/penalties and changes in serious accident rates.

7. See R. S. Smith, "Intertemporal Changes in Work Injury Rates," Proceedings of the Industrial Relations Research Association (1972); R. S. Smith, The Occupational Safety and Health Act (San Francisco: American Enterprise Institute, 1976); J. R. Chelius, "The Control of Industrial Accidents, Economic Theory and Empirical Evidence," Law and Contemporary Problems (Summer/Autumn 1974); R. S. Smith, "The Impact of OSHA Inspections on Manufacturing Industry Rates," The Journal of Human Resources (Spring 1969); and J. Mendeloff, "An Evaluation of the OSHA Program's Effect on Work-Place Injury Rates: Evidence From California Through 1974," Report prepared for the Office of the Assistant Secretary for Policy, Evaluation, and Research (Washington, D.C.: U.S. Department of Labor, 1976); and W. Kip Viscusi, "The Impact of Occupational Safety and Health Regulation," The Bell Journal of Economics (Spring 1979). (Mendeloff did, however, find a statistically significant decline in the subcategory of machine-related injuries and fatalities using data for California.)

8. Interagency Task Force on Workplace Safety and Health, "Making Prevention Pay" (Rosslyn, Va.: Interagency Task Force on Workplace Safety and Health, 1978).

9. The divergence between objective and subjective measures of health is exemplified by the difference in the path of mortality and morbidity rates since 1930. Over the period 1930 to 1975, advances in medicine, improvements in public health and in the general standard of living produced a 40 percent drop in age adjusted death rates while over the same period, reported morbidity (restricted-activity-days due to illness) rose from 14 days per person to 18 days per person.

10. See N. A. Ashford, Crisis in the Workplace (Cambridge, Mass.: The MIT Press, 1976), pp. 112-115.

11. While the distributed lag is theoretically preferable to use of the current period, such lags often increase problems of multicollinearity. Thus, the current-period regulatory variables provide an alternative estimate of the short-run impact of inspections and penalties, which might affect easily correctable violations not requiring capital investment.

12. R. S. Smith (1976), p. 63.

13. Given the lag between legislation and its impact on industry, it is difficult to pick up an exact year in which federal safety regulation began to affect capital equipment; 1972 is chosen here.

14. Regressions were also performed using work loss days and total injuries. There seemed to be a significant negative relationship between the index of safety capital and total injury rates. The signs and significance in the lost workday rate regressions, however, were too unstable to infer any causal effect. Lost workdays may be more affected by institutional factors, such as increases in sick leave and disability benefits, than are injury rates. (An increase in disability days per case could offset a decline in the number of cases over the period being analyzed so that there would be no clear effect on lost workdays.)

15. To the extent these costs are imposed on employers by workers' compensation programs, the effect can still be attributed to government intervention, although not to regulation.

16. Selma J. Mushkin, et al., Bibliography on the Cost of Illness (Bethesda, Md.: National Institutes of Health, 1980).

17. The empirical application of this tradition was effectively codified in Dorothy Rice, Estimating the Costs of Illness (Washington, D.C.: U.S. DHEW, May 1966).

18. See, for example, R. H. Simonds and J. V. Grimaldi, Safety Management (Homewood, Ill.: Richard D. Irwin, 1963), pp. 79-140.

19. In the short-run, reductions in fatalities would not reduce all of these costs because many are fixed costs that could not be reduced immediately.

20. Recent studies have shown that the capitalized value of future earnings is the appropriate implied value of life for individuals' "willingness to pay" for reductions in the probability of their own death when their objective functions are the maximization of lifetime earnings under conditions of zero risk aversion. The existence of risk aversion premiums, premiums for the avoidance of pain and suffering, and the fact that individuals maximize total utility, not total earnings, serve to raise the value per statistical life above discounted future earnings. Thus, the value of future earnings represents a lower bound on the value of life. (M. J. Bailey, "Safety Decisions and Insurance," American Economic Review (May 1978, pp. 295-298; B. C. Conley, "The Value of Human Life in the Demand for Safety," American Economic Review (March 1976), pp. 45-55; Dan Usher, "An Imputation to the Measure of Economic Growth for Changes in Life Expectancy," in M. Moss (ed.), Measurement of Economic and Social Performance (New York: National Bureau of Economic Research, 1973); and J. Hirschleifer, T. Bergstrom, and E. Rappoport, A General Evaluation Approach to Risk Benefit for Large Technological Systems and its Application to Nuclear Power (Los Angeles, Calif." Department of Economics and Engineering, UCIA, 1974). Alternative estimates of individuals' "willingness to pay" for the saving of statistical lives using survey and revealed preference methods (which should encompass aversion to pain, etc.) have been employed by various authors. The resulting range of estimates is extremely large, from $42,000 to $9,200,000 per life. Although valuable work is being done in the area, as the Public Health Service Task Force on Cost of Illness Studies has observed, the techniques are too "experimental" for governmental cost-benefit analysis at this time. For a survey of the subject, see J. S. Landefeld, "Estimating Life Values: Linking Theory to Practice" (Washington, D.C.: Bureau of Economic Analysis, 1980).

Vital Records, Health Promotion, and Life-Style Factors

Concurrent Session M

THE RELATIONSHIP OF LIFESTYLE CHARACTERISTICS TO MORTALITY AMONG CALIFORNIA SEVENTH-DAY ADVENTISTS

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In 1958, researchers at Loma Linda University began a study to investigate the lifestyle characteristics of the Seventh-day Adventist (SDA) population in California. By Church proscription, virtually all SDAs abstain from the use of tobacco and alcohol, and a large majority adhere to one or more of the recommendations of the Church regarding other habits and practices which are advocated primarily for their established or supposed health-promoting effects. Presently about 54 percent of SDAs follow a lacto-ovo vegetarian diet and 41 percent rarely or never use caffeine-containing beverages. They also tend toward sparing use of sweets, other highly refined foods, hot condiments, and spices. Regularity in vigorous exercise, adequate rest, and rather conservative social mores are strongly encouraged.

METHODS

In 1960, the American Cancer Society (ACS) collected a four-page self-administered questionnaire from one million subjects throughout the United States (1). Researchers at Loma Linda saw the potential of this as a comparison group and administered the same ACS questionnaire to their study population.

This report is limited solely to the responses of white subjects aged 35 or over in 1960 who lived in California and who completed the ACS Questionnaire. Of those, 22,940 were SDAs and 112,726 were nonSDAs. Table 1 shows the age-sex distribution of the white California respondents to the ACS questionnaire.

One can see that there is a preponderance of women among both the SDAs and nonSDAs, and there is a greater proportion of persons 75 and over among SDAs. In view of this we have chosen to report mortality data as age adjusted mortality ratios for each of the sex groups.

Previously published data (2) indicate that SDA and nonSDA participants in the ACS study are comparable in that they are both of better educational and occupational status than U.S. whites. Also, both groups tend to have fewer single, divorced, and separated persons, particularly among males.

It would appear that the nonSDAs of the ACS study would be a more appropriate comparison group for the SDAs than would the U.S. white population.

In contradistinction to the demographic and socioeconomic comparability between SDAs and nonSDAs, Table 2 shows marked differences in lifestyle traits between the two groups in the use of cigarettes, meat, and coffee.

The procedures used to enroll and trace persons in the SDA and nonSDA groups were similar but differed in some respects. For the SDA subjects, volunteer research assistants were identified in each congregation. They were responsible for obtaining completed ACS questionnaires from a list of 10-20 individual adult members (age 30+) of their congregations. These volunteers also agreed to report annually on the living/dead status and whereabouts of each person on their list who completed the ACS questionnaire.

For the nonSDA subjects, volunteers were recruited by local ACS officers. They were asked to enroll at least ten families whom they knew well and could expect to be in touch with over a period of years. Some recruited only one or two families; others, 20 to 30 families. The average was 16.

Volunteers, working under supervision, served as the primary method of death ascertainment for the SDA population during 1960-65 and for the nonSDA population during 1960-71. In both groups, special efforts were exerted to trace subjects whose living/dead status was not clearly determined by the volunteers. The proportion of subjects lost to followup was 1.7% among the SDAs and 3.8% among the nonSDAs.

Previously published data (3,4) regarding the risk of cancer deaths among California SDAs indicate a significantly lower risk for SDAs as compared to the general California population.

Since several of the causes of death had relatively small numbers, it was the desire of current researchers at Loma Linda to extend the follow-up in order to gain more cases. To do this, the computerized California State death certificate files were obtained for the years 1960-76, and a computer program was developed to match the SDA subjects to the State death certificate tapes.

Both files were sorted alphabetically and comparisons made only between pairs that matched on sex and the first four letters of the last name. A matching score was calculated for each linkage that passed this first sieve.

The following variables were used in the scoring of the record linkage program: 1) pos. 5-8 of last name, 2) pos. 9-11 of last name, 3) pos. 1 of first name, 4) pos. 2-5 of first name, 5) pos. 6-8 of first name, 6) middle initial, 7) month of birth, 8) day of birth, 9) year of birth ($\pm$ 5 years), 10) first letter of state of birth. One point was given for each variable that matched exactly. A half-point was given if either record had data missing for that particular variable. The program was developed so as not to penalize individuals with very short names.

The record linkage program classified the linkages into three groups: 1) definite matches (i.e. score of 10), 2) possible matches (i.e., scores 6.5-9.5), and 3) definite non-matches (i.e., scores 0.0-6.0). The cutpoint of 6.5 was determined experimentally. (Cutpoints below 6.5 markedly increased the clerical work, with no apparent increase in the number of successful matches.)

The possible matches were displayed on a computer terminal for a clerical decision. The clerk compared all ten fields and decided whether the linkage was a probable match, "go to file", or not a match. A printed copy of the terminal display was made for each of the "go to file" decisions. The clerk then looked at the paper documents (e.g., original questionnaires, death certificates) that would aid in making a final decision.

As a means of assessing the validity of this record linkage procedure, it was implemented for the years 1960-65, allowing a one-to-one comparison between deaths ascertained by the record linkage procedure and deaths that were previously ascertained by the traditional follow-up methods described above. For 1960-65, the record linkage procedure ascertained

93.2 percent of the 2,011 previously ascertained deaths in the SDA group (Table 3). Fifty-four previously ascertained deaths had occurred outside of California and were unable to be reascertained by record linkage with the California death certificate tapes. However, record linkage ascertained 29 deaths that had been previously missed by the traditional follow-up methods. It is noteworthy that only seven subjects were falsely labeled as dead by the record linkage procedure. These false linkages were detected by a meticulous comparison of the original questionnaire data with the death certificate for each death that was ascertained exclusively by record linkage.

The proportion of deaths missed by record linkage does not show substantial variation by sex, age, or time period. The pattern for cancer deaths is very similar to that for all deaths. Furthermore, the previously ascertained deaths which occurred in California during 1960-65 did not differ substantially from the deaths which occurred outside California by sex, age, education, marital status, smoking history, age at baptism, or cause of death. It therefore seems reasonable to assume that the nonCalifornia deaths during 1966-76 which were missed by the record linkage process do not differ substantially from the deaths ascertained by record linkage.

Death certificate records for the years 1960-69 were combined into one file. For each year of the period 1970-76, there was a separate input file. Table 4 shows the total number of records on the death certificate files, and the number of linkages by score.

To account for the underascertainment of deaths by record linkage, the counts of SDA deaths used to obtain cause specific mortality rates were adjusted upward for the 1966-76 period. This adjustment accounted for the 6.8 percent of deaths that had been missed by the record linkage process, together with an estimate of the non-California deaths.

An estimate of the proportion of deaths expected to occur among SDA study subjects who emigrated from California was made by assuming that the proportion of deaths occuring out of the state would be the same among both SDA and nonSDA subjects who completed the ACS questionnaire while residing in California. A linear regression analysis and a graphical plot of the proportion of total nonSDA deaths which occurred out of California for each year during 1960-71 revealed that an average of 4.9% of the deaths occurred out of California. The expected proportion of out-of-state deaths increased with time from 3.02% in 1961 to 5.68% in 1971 with an average linear increase of 0.37% per year. Thus, the number of SDA deaths was adjusted upward by a factor of 0.37% per year during 1966-76.

RESULTS

The Mantel-Haenszel procedure (5) was used to produce age-adjusted sex-specific mortality ratios for SDAs versus nonSDAs and SDAs versus U.S. whites. From the first two columns of Table 5 one can compare the risk of dying from selected major cancers and cardiovascular diseases in terms of age-adjusted mortality ratios. The mortality of nonSDAs as compared to U.S. whites is considerably lower especially since all but one of the mortality ratios are below one. Ten of the 13 mortality ratios are statistically significantly lower for the ACS nonSDAs; this is true both for males and females. In comparing the ACS SDAs with the ACS nonSDAs we can see that 10 out of 13 male mortality ratios are significantly lower with the 3 lowest mortality ratios (for both males and females) being for the following causes of death: lung cancer, other smoking related cancers, and colon-rectal cancer. For all causes of death the SDAs have a significantly lower mortality than the ACS nonSDAs who in turn had a lower mortality than the general population. However, the all-cause mortality for males was considerably lower than for females.

To determine what the mortality ratios would have been if smoking were removed from the population, SDAs who had never smoked were compared with the nonSDA nonsmokers. Even with this further comparison the age adjusted mortality ratios were still significantly lower for 4 of the 13 causes of death among males (coronary heart disease, cerebrovascular disease, other circulatory disease, and all causes of death) and 7 of the 13 causes of death among females (all cancer, lung cancer, colon-rectal cancer, breast cancer, cerebrovascular disease, other circulatory disease, and all causes of death).

In comparison to U.S. whites, the nonSDAs in the California segment of the ACS study are somewhat of a low-risk group for cancer and cardiovascular disease, which makes any low SDA/nonSDA ratio even more meaningful (2,6).

Although there is considerable variation in dietary habits among SDAs, the typical diet of a sizable proportion of SDAs would tend to be lower in saturated fat and cholesterol and higher in dietary fiber than that of the general population. Sufficient variation in the SDA diet to produce a biologic effect is strongly suggested by a previous report which shows a three-fold greater risk of fatal coronary heart disease among young SDA nonvegetarian men as compared to vegetarian men (7). This difference in risk persisted after adjustment for several major risk factors for coronary heart disease.

Although the ACS questionnaire was not designed to assess all the various components of the SDA lifestyle, it contained questions on 18 characteristics that could be considered representative of the typical SDA lifestyle. Using a score of 1, 2, or 3 to indicate degree of adherence to each of these 18 habits (good adherence = 3, poor adherence = 1), a Health Habit Index (HHI) was constructed to serve as an approximate indicator of degree of adherence to the lifestyle recommended by the SDA Church. Smoking history was not included as part of this index. The specific lifestyle characteristics used to make up this index are as follows: 1) breast feeding, 2) exercise, 3) hours of sleep, 4) use of tranquilizers, laxatives, antiacid medicines, 5) use of salt, 6) use of pepper, 7) use of catsup, mustard, spices, 8) use of meat or poultry, 9) use of fish, 10) use of eggs, 11) use of cheese, 12) use of sweet desserts, 13) use of candy, 14) use of fried foods, 15) use of ham or pork, 16) use of beer, wine, hard liquor, 17) use of coffee or tea, 18) use of soft drinks.

Table 6 illustrates the mortality ratios for SDAs whose HHI falls in the upper, middle, and lower thirds of the sex specific HHI distribution for the total SDA population. The denominator used for each mortality ratio is the mortality risk of SDA subjects in the upper third of the distribution. Cancer of the lung and stomach in both sexes and colon-rectal cancer in males were the only cancer sites that showed any noticable relationship to HHI.

The risk of fatal lung and colon-rectal cancer is inversely related to the HHI, such that subjects with poor adherence (lower third) to the SDA lifestyle have

approximately twice the risk of those with good adherence (upper third). The risk of fatal coronary heart disease and "other circulatory disease" among males is strongly related to the HHI in younger subjects (relative risk of 2 to 2.4), with the strength of the relationship decreasing with age. In younger men and women, the HHI is strongly related to the risk of dying from nonmalignant-noncirculatory disease, with the strength of the relationship also decreasing with age.

Among males, the clear relationship between the Health Habit Index and risk of fatal colon-rectal cancer, coronary heart disease, "other circulatory disease," and nonmalignant-noncirculatory disease strongly suggests that one or more components of the typical SDA lifestyle are protective for these diseases. One might suspect that the crudeness of this index would be likely to mask relationships rather that revealing them. Thus, the observed relationships are even more striking.

Several hypotheses could be set forward to explain the observed low risk of cancer deaths among SDAs. A selection hypothesis would state that there is some set of selective factors that characterize the proportion of the general population who choose to join the SDA Church. There is another set of selective factors associated with willingness to fill out a questionnaire.

Alternatively, a lifestyle hypothesis suggests that one or more components of the SDA lifestyle primarily account for their low risk of cancer death.

A survival hypothesis would suggest that some or all of the lower cancer mortality may be reflective of better cancer survival rates among SDAs as compared to the general population. Because of the strong health orientation of the SDA Church, members may tend regularly to seek preventive health services. Thus, it is likely that their cancers may tend to be diagnosed and treated at an earlier stage than those of the general population. The current ongoing study on California Adventists is looking at incidence and mortality data to help answer this question.

Clearly, all of these hypotheses may be partially true.

In summary, the following observations favor the lifestyle hypothesis as the primary explanation for the low risk of colon-rectal cancer and nonmalignant disease among SDA males in comparison with nonSDA males, and a partial explanation for the low lung cancer risk among SDAs of both sexes.

1. The low SDA risk persists when nonsmoking SDAs are compared to non-smoking nonSDAs.
2. There is a gradient of increasing risk with decreasing adherence to the SDA lifestyle even among SDAs who have never smoked.
3. The risk among SDAs with poor adherence to the SDA lifestyle is slightly less or statistically equal to the risk in comparable non-smoking nonSDAs (except for nonmalignant-noncirculatory disease).

Thus, for these causes, the weight of evidence favors the hypothesis that the protective effect of the characteristics of the SDA lifestyle outweighs the possible effect of selective factors as to who becomes a Seventh-day Adventist. However, this conclusion is partially dependent on a rather crude and nonspecific Health Habit Index. Any conclusions would therefore be considered preliminary until confirmed by a demonstrated relationship between incidence and mortality from these diseases and individual components of the Health Habit Index, which is the emphasis of the current study of California Adventists funded by NCI which began in 1974.

TABLE 1

NUMBER OF WHITE CALIFORNIA PARTICIPANTS IN THE ACS STUDY BY AGE AND RELIGION, 1960

AGE GROUP	SDA				NONSDA			
	MALE		FEMALE		MALE		FEMALE	
	N	%	N	%	N	%	N	%
35 - 44	2,254	27.8	3,569	24.1	4,764	9.7	11,876	18.7
45 - 54	2,015	24.8	3,443	23.2	23,015	46.6	25,499	40.2
55 - 64	1,497	18.4	3,131	21.1	13,599	27.6	15,177	24.0
65 - 74	1,369	16.9	2,848	19.2	6,248	12.7	8,156	12.9
75 - 84	812	10.0	1,500	10.1	1,582	3.2	2,347	3.7
85+	169	2.1	333	2.3	137	0.2	326	0.5
All Ages	8,116	100.0	14,824	100.0	49,345	100.0	63,381	100.0

TABLE 2

PERCENT OF WHITE CALIFORNIA SEVENTH-DAY ADVENTISTS (SDAs) AND NONSDAs WITH VARIOUS LIFESTYLE CHARACTERISTICS, AGE 35 AND OVER, 1960

CHARACTERISTIC	CALIFORNIA AMERICAN CANCER SOCIETY STUDY PARTICIPANTS			
	SDAs		NONSDAs	
	MALE: % (N = 8,116)	FEMALE: % (N = 14,824)	MALE: % (N = 49,345)	FEMALE: % (N = 63,381)
CIGARETTE SMOKING:				
Never smoked	63.4	92.5	24.7	60.0
Ex-smoker	34.9	7.0	23.9	7.9
Current smoker	1.7	0.5	51.4	32.0
CURRENT USE OF MEAT AND/OR POULTRY:				
<1 time/wk	55.9	54.0	2.5	2.0
1-3 times/wk	26.6	25.7	10.5	7.8
4-6 times/wk	12.5	14.0	45.1	45.2
≥7 times/wk	5.0	6.2	41.9	45.0
CURRENT USE OF COFFEE:				
<1 cup/day	72.7	73.2	10.4	11.2
1-2 cups/day	16.9	18.3	29.1	29.8
3-4 cups/day	7.2	6.7	32.6	33.3
≥5 cups/day	3.2	1.9	27.8	25.7

TABLE 3

NUMBER OF DEATHS AND AVERAGE ANNUAL MORTALITY FOR ALL CAUSES AND ALL CANCER AMONG WHITE CALIFORNIA SDAs, AGE 35 AND OVER BY METHOD OF DEATH ASCERTAINMENT

PRIMARY CAUSE OF DEATH BY AGE, YEAR OF DEATH, AND SEX	SDA CALIFORNIA ACS STUDY PARTICIPANTS--1960-65									
	ALL CAUSES					ALL CANCER				
	NUMBER OF CALIFORNIA DEATHS				(5) PERCENT OF PREVIOUSLY ASCERTAINED DEATHS REASCERTAINED BY RECORD LINKAGE 1/(1+2)	NUMBER OF CALIFORNIA DEATHS				(5) PERCENT OF PREVIOUSLY ASCERTAINED DEATHS REASCERTAINED BY RECORD LINKAGE 1/(1+2)
	PREVIOUSLY ASCERTAINED[a]		ASCERTAINED ONLY BY RECORD LINKAGE[b]			PREVIOUSLY ASCERTAINED[a]		ASCERTAINED ONLY BY RECORD LINKAGE[b]		
	(1) REASCERTAINED BY RECORD LINKAGE	(2) MISSED BY RECORD LINKAGE	(3) TRUE LINKAGES[c]	(4) FALSE LINKAGES[c]		(1) REASCERTAINED BY RECORD LINKAGE	(2) MISSED BY RECORD LINKAGE	(3) TRUE LINKAGES[c]	(4) FALSE LINKAGES[c]	
MALE	782	40	9	4	95.1	124	5	2	0	96.1
FEMALES	1,093	96	20	3	91.9	205	13	2	0	94.0
BOTH SEXES										
35-44	49	4	1	1	92.5	14	0	0	0	100.0
45-54	113	4	2	0	96.6	43	1	0	0	97.7
55-64	191	12	5	1	94.1	57	2	2	0	96.6
65-74	472	46	6	1	91.1	103	4	1	0	96.3
75+	1,050	70	15	4	93.8	112	11	1	0	91.1
All Ages	1,875	136	29	7	93.2	329	18	4	0	94.8
1960-61	494	39	2	2	92.7	103	3	0	0	97.2
1962-63	680	41	6	2	94.3	106	6	0	0	94.6
1964-65	701	56	21	3	92.6	120	9	4	0	93.0

[a] *Deaths were identified by quarterly reports from the clerk of each SDA Church congregation, as well as annual mail or person contact of each participant. These clerks' reports listed all deaths which the clerk was aware of that occured during the previous quarter.*

[b] *Deaths were ascertained by a computer assisted linkage of the SDA study population to the 1960-65 death certificate file for the entire State of California.*

[c] *True linkages are deaths on the State death certificate file which were perfect (or almost perfect) linkages on all linkage variables. These were confirmed by comparison of the subject's death certificate to the original questionnaire. The false linkages are deaths where comparison of the death certificate to the original questionnaire clearly indicated that the two records were for different persons.*

TABLE 4

DISTRIBUTION OF RECORD LINKAGE SCORES BY YEAR OF DEATH BASED ON LINKAGES BETWEEN THE SDA-ACS STUDY AND THE CALIFORNIA STATE DEATH CERTIFICATE TAPES

YEAR OF DEATH	NUMBER OF RECORDS ON TAPE	NUMBER OF LINKAGES BY SCORE[a]								TOTAL NUMBER OF LINKAGES
		6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	
60 - 69	1,580,219	11,980	7,862	2,086	1,025	524	653	1,356	1,015	26,501
70	168,711	1,778	940	256	107	31	64	58	182	3,416
71	171,631	1,804	948	215	123	35	67	47	195	3,434
72	172,408	1,873	928	276	124	39	62	37	202	3,541
73	175,301	2,168	1,120	264	117	52	78	50	217	4,066
74	172,747	1,765	935	223	131	38	54	44	216	3,406
75	173,183	1,868	1,013	254	108	30	47	55	239	3,614
76	173,563	1,844	874	260	116	34	68	63	232	3,511
TOTAL	2,787,763	25,080	14,640	3,834	1,851	783	1,093	1,710	2,498	51,489

[a]Record linkage program used approx. 9 min. CPU time per tape on a 370/158.

TABLE 5

NUMBER OF DEATHS AND MORTALITY RATIOS[b] FOR SELECTED CAUSES OF DEATH AMONG WHITE, MALE[d] CALIFORNIA SEVENTH-DAY ADVENTISTS (SDAs) (1960-1976), AMERICAN CANCER SOCIETY STUDY (ACS) NONSDAs (1960-1971), AND ALL US WHITES (1960-1975), AGE 35 AND OVER, BY SEX AND HISTORY OF CIGARETTE SMOKING

CAUSE OF DEATH	AGE-ADJUSTED MORTALITY RATIOS[b]			NO. OF DEATHS			
	ACS NONSDAs + ALL US WHITES	ACS SDAs + ACS NONSDAs	SDA NONSMOKERS + NONSDA NONSMOKERS	NEVER SMOKED		TOTAL	
				SDA	NONSDA	SDA	NONSDA
ALL CANCER	0.78†	0.60††	0.85	230	334	388	1,963
LUNG CANCER	0.91*	0.18††	0.67	10	23	24	542
OTHER SMOKING-RELATED CANCER[c]	0.63†	0.59††	1.28	31	29	47	265
COLON-RECTAL CANCER	0.85†	0.62††	0.67	37	71	59	277
PROSTATE CANCER	0.89	0.92	0.93	50	59	78	201
STOMACH CANCER	0.66††	1.41	1.02	23	31	42	100
LYMPHOMA AND LEUKEMIA	0.96	0.86	0.93	38	55	55	215
ALL OTHER CANCER[a]	0.61†	0.74**	0.79	41	66	83	363
CORONARY HEART DISEASE	0.70††	0.66†	0.76††	504	773	901	3,678
CEREBROVASCULAR DISEASE	0.72†	0.72††	0.76††	186	232	293	832
OTHER CIRCULATORY DISEASE	0.97	0.64†	0.65††	174	267	304	1,158
OTHER CAUSES	0.60††	0.79††	1.01	313	354	514	1,756
ALL CAUSES OF DEATH	0.71†	0.66†	0.79††	1,407	1,960	2,400	9,387

* and ** $p < 0.05$ based on χ^2 (associative). The single asterisk indicates that the hypothesis of uniform relative risk for the various strata was rejected--$p < 0.05$ based on χ^2 (homogeneous).

† and †† $p < 0.01$ based on χ^2 (associative). The single dagger indicates that the hypothesis of uniform relative risk for the various strata was rejected--$p < 0.05$ based on χ^2 (homogeneous).

[a] All cancer sites not specifically shown in the table.

[b] Adjusted by the Mantel-Haenszel procedure.

[c] Includes mouth and pharynx, esophagus, larynx, bladder and other urinary organs, and pancreas.

[d] Data on females can be found in reference # 2.

TABLE 6
NUMBER OF DEATHS AND MORTALITY RATIOS FOR SELECTED CAUSES OF DEATH AMONG WHITE CALIFORNIA SDAs (1960-76) BY SEX, AGE, AND HEALTH HABIT INDEX‖ AND NONSMOKING WHITE CALIFORNIA NONSDAs (1960-71) BY SEX AND AGE

CAUSE OF DEATH	SEX AND AGE	AGE-ADJUSTED MORTALITY RATIO§				NUMBER OF SDA DEATHS		
		ALL SDA						
		HEALTH HABIT INDEX‖			NONSDA NEVER SMOKED			
		UPPER THIRD	MIDDLE THIRD	LOWER THIRD		UPPER THIRD	MIDDLE THIRD	LOWER THIRD
ALL CANCER	MALE	1.00	1.20	1.02	1.18	157	151	95
	FEMALE	1.00	0.95	1.13	1.31†	258	230	190
LUNG CANCER	BOTH	1.00	0.74	1.78	1.85*	14	10	18
OTHER SMOKING-RELATED CANCER	MALE	1.00	0.79	1.05	0.67	21	13	13
	FEMALE	1.00	0.98	1.08	1.12	22	20	15
STOMACH CANCER	BOTH	1.00	0.86	0.77	0.89	34	25	15
LYMPHOMA AND LEUKEMIA	MALE	1.00	1.56	1.15	1.43	18	25	14
	FEMALE	1.00	1.07	1.05	1.07	31	29	19
PROSTATE CANCER	MALE	1.00	1.10	0.87	1.15	36	30	17
BREAST CANCER	FEMALE	1.00	0.90	1.07	1.29	57	54	52
COLON-RECTAL CANCER	MALE	1.00	2.02*	1.87	2.09†	17	28	18
	FEMALE	1.00	0.97	0.90	1.68†	41	33	21
ALL OTHER CANCER‡	MALE	1.00	1.19	0.75	1.02	35	34	17
	FEMALE	1.00	0.94	1.13	1.13	89	80	66
CORONARY HEART DISEASE	MALE							
	35-64	1.00	1.79*	2.43†	2.31†	21	43	61
	65-79	1.00	1.58†	1.59†	1.57†	112	146	108
	80+	1.00	1.14	1.30*	1.20	208	155	88
	FEMALE							
	35-69	1.00	1.21	1.08	1.03	38	52	45
	70-79	1.00	1.29	1.54	1.32†	105	118	86
	80+	1.00	1.06	1.14	1.00	403	301	159
CEREBROVASCULAR DISEASE	MALE	1.00	1.41†	1.19	1.51†	124	124	64
	FEMALE	1.00	1.01	1.06	1.29†	285	219	126
OTHER CIRCULATORY DISEASE	MALE							
	35-69	1.00	1.47	2.01	1.32	9	16	22
	70-79	1.00	1.31	1.86*	2.10†	24	25	25
	80+	1.00	1.07	1.53*	1.44*	89	62	44
	FEMALE							
	35-69	1.00	0.46†	0.62	0.53*	30	18	26
	70-79	1.00	0.90	1.03	1.10	55	43	30
	80+	1.00	1.03	0.99	1.08	194	143	67
OTHER CAUSES	MALE							
	35-59	1.00	1.24	2.09*	1.32	15	24	45
	60-79	1.00	1.42*	1.63†	1.05	64	78	70
	80+	1.00	0.82	0.96	1.04	128	68	40
	FEMALE							
	35-59	1.00	1.63	2.42†	1.44	11	27	53
	60-79	1.00	1.33*	1.33	1.07	86	109	79
	80+	1.00	0.96	0.96	0.88	194	132	64
ALL CAUSES	MALE	1.00	1.27⊛	1.42†	1.37†	951	892	662
	FEMALE	1.00	1.05	1.15†	1.14†	1,659	1,392	925

*(†) *p < 0.05 (<0.01) based on Chi² (associative). A circle around the asterisk or dagger indicates that the hypothesis of uniform relative risk for the various strata was rejected--p < 0.05 based on Chi² (homogeneous).*

‡ *All cancer sites not specifically shown on the table.*

§ *Adjusted by the Mantel-Haenszel procedure.*

‖ *See page 2 for discussion of Health Habit Index components.*

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NUMBER OF PRENATAL VISITS AND LOW BIRTHWEIGHT IN THE FULL-TERM INFANT

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Infants born at full-term weighing as little as 2,500 grams usually are considered to have experienced a less-than-expected intrauterine growth. While intrauterine growth retardation is a less common cause of low birthweight than prematurity, it may provide better opportunities for preventive medical and social intervention.

A number of studies have suggested an association between low birthweight and specific socio-economic and medical factors[1-4]. This relationship has been attributed to maternal undernutrition, drug addiction, obstetric complication, maternal history of reproductive inefficiency (infertility, abortion, stillbirth, prematurity) and inadequate prenatal care. Other associated influences cited include illegitimacy, pregnancy in early adolescence, close spacing of pregnancies, smoking and alcohol consumption. Deficits in mental and physical development have been found in up to 60% of low birthweight infants followed until five years of age[5]. Many low birthweight children later have learning problems at school.

The American College of Obstetricians and Gynecologists in its Standards of Ambulatory Care[6] has stressed the importance of a well-designed program of prenatal medical care for every pregnant woman. It is important that such care begin early in pregnancy. According to the Standards, prenatal care programs should be designed in such a way that every woman during the course of a normal pregnancy should have a medical check-up once every four weeks up to 28 weeks; then bi-weekly until the 32nd week; and thereafter weekly to date of delivery.

Following that regimen, and assuming a first prenatal visit in the third month of gestation, the recommended number of visits is 13 or 14. If a woman requires substantially more attention than that, it may be suspected that there is some complicating maternal or fetal condition.

The purpose of this study was to elicit evidence from existing data to determine whether or not the schedule of visits recommended by ACOG or any alternative schedule is optimal for full-term pregnancies as measured by the incidence of low birthweight. A further objective was to ascertain the extent to which certain maternal demographic and medical characteristics interact with number of prenatal visits in terms of birthweight outcomes. The underlying hypothesis is that early and continuous prenatal care can identify, cure or alleviate those conditions that may be associated with low birthweight and related forms of suboptimal pregnancy outcome.*

* Subject to upper limits, neonatal mortality is correlated inversely with birthweight. Low birthweight infants also are more likely than larger infants to have structural defects.

Materials and Methods

Data collected by the National Center for Health Statistics from Certificates of Live Birth provide information on length of gestation, birthweight, maternal race, age and number of prenatal visits (38 states and D.C.); the presence or absence of previous fetal loss and birth order (37 states and D.C.); and years of schooling completed and marital status (32 states and D.C.). Only full-term live births were included in the study. Premature live births (less than 37 weeks gestation) and live births for which length of gestation was not specified were excluded in order to permit comparisons to be made among pregnancies of about the same duration which varied according to number of visits, social characteristics and history of fetal loss. Of the 3,326,632 live births in the United States in 1977, 2,112,745 that occurred in the 38 states above and D.C. were classified by length of gestation and number of prenatal visits. Of these, 1,505,047 were full-term*.

This population of full-term births first was classified according to number of prenatal visits and the percentages with specified number of visits were computed by race, age, birth order, history of previous fetal loss, marital status and year of schooling completed (Table 1).

Next, the percentages of births weighing 2,500 grams or less were computed for certain cross-classification of these variables (Tables 2, 3 and 4).

Results

Number of Prenatal Visits

As shown in table 1, the mothers of these full-term infants most commonly had 9 to 12 visits (52%) or 5 to 8 visits (20%). Only 13% had the 13 or 14 visits recommended for a normal pregnancy. Another 10%, however, had 15 or more visits. Women with only 1 to 4 visits and with no visits at all accounted for 5.4% and 0.7% of the births, respectively.

These percentage distributions varied sharply by demographic classification. Nearly 14% of the white mothers but only 8% of non-white mothers had 13 or 14 visits. Differences of about the same order were apparent for women in their twenties or thirties (14%) as compared with the youngest adolescents (7%). Even larger variations are evident between married and unmarried women and between those with the lowest and highest educational attainment. Nearly 1 out of 5 women with less than 8 years of schooling had fewer than 5 prenatal visits as compared with 1

* For the 37 and 32 states and D.C., above, the number of full-term live births were 1,457,516 and 1,142,151, respectively.

out of 50 who had more than a high school education. Some of these variations, however, may be attributable to maternal age differences.

Only minor differences in number of prenatal visits were found between women who had and did not have a previous fetal loss. Women having first, second or third births were very much alike in terms of number of visits. Those having fourth or subsequent births, however, tended to have significantly fewer visits.

Figure 1 contrasts the percentages of women at lowest and highest socio-demographic risk who had fewer than five prenatal visits.

Incidence of Low Birthweight

The social factors believed to predispose to suboptimal pregnancy outcome include age, race, marital status, education and birth order. Previous fetal loss also has been identified as a risk factor.

Tables 2, 3 and 4 show the percentage of full-term live-born infants weighing 2,500 grams or less, by number of prenatal visits, further classified by maternal characteristics. Comparisons of the incidence of low birthweight by number of visits between groups of mothers presumed to be at low and high risk with regard to the specific social factors cited above are presented in Figures 2-5.

For the total of full-term births, the low-weight ratio was highest for infants whose mothers had no prenatal visits (8.6%). This rate declined continuously as number of visits increased, to reach a minimum of 2.1% for births to mothers with 13 or 14 visits. A modest increase to 2.5% was observed for infants born to women who had 15 or more visits. The reasons for this secondary increase can only be surmised because the National Center for Health Statistics does not enter on its computer tapes the information in the birth certificate concerning maternal complications.

Essentially the same pattern, at different levels, was found in all but one of the several maternal subgroups. Although the youngest and oldest women most commonly had low-weight infants, this rate varied inversely with number of visits. Indeed the low birthweight ratio for women in their twenties (an optimal childbearing age) who had fewer than 5 visits was almost twice as high as the rate for women aged 17 and younger who had the full series of 13 or 14 visits.

The only women who deviated markedly from this pattern were those aged 40 and over. In this age group, the low birthweight ratio was at a minimum for those with no prenatal visits. The reason for this deviation is not evident form the available data but among the possible explanations are the relatively small number of births to women with no prenatal visits (164) or the higher prevalence of maternal diabetes in this age group.

While racial differences persisted regardless of number of visits, it is clear that non-white women who had 13 or 14 visits were much less likely to have had low-weight infants than those with fewer visits (Table 2). As shown in Table 3, first and fourth or subsequent births experienced a higher incidence of low birthweight than second or third-born infants. The smallest risk of low birthweight -- less than 2% -- was found among second-born infants of women who had 13 or 14 prenatal visits. This advantage was greater for women who did not have a previous fetal loss (1.9%) than for women who had one or more previous fetal losses (2.2%).

Table 4 shows the pattern of low birthweight by educational attainment and marital status. Married women with the most education had the lowest rate of infants weighing 2,500 grams or less (2.1%) while unmarried women with the least education had the highest ratio (6.8%). These two variables undoubtedly are interrelated through maternal age but it is not possible on the basis of the available tabulations to acertain the separate effect of each variable. Nevertheless, the influence of prenatal care is evident for each of the cross classifications.

Conclusions

Insofar as full-term pregnancies are concerned, there is an inverse relationship between number of prenatal visits and risk of low birthweight. This relationship persists continuously up to 14 visits for nearly all the socio-demographic subgroups considered and for women with and without a history of previous fetal loss. A secondary increase in the low-weight ratio occurs in pregnancies with more than 14 visits, presumably the result of an aggregation of complications in these pregnancies.

The majority of pregnant women in the United States do not have as many prenatal visits as appear to be optimal from the foregoing analysis. The deficit is particularly marked for women at highest socio-demographic risk. If all the births in this study had experienced the low-weight ratio of those whose mothers had the full series of 13 or 14 prenatal visits, the incidence of low birthweight in these pregnancies could have been reduced by about 38%. On a national basis it is estimated that this would reduce the annual number of full-term newborn weighing 2,500 grams or less by about 30,000.

References

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Table 1

Percent of full-term live births to women with specified number of prenatal visits, by selected maternal characteristics, 38 reporting states and D.C., 1977.

Maternal Characteristics	Number of prenatal visits					
	0	1-4	5-8	9-12	13-14	15+
Total, all births	.69	4.69	20.35	51.82	12.86	9.59
Race						
White	.47	3.48	18.34	53.85	13.78	10.07
Nonwhite	1.81	10.69	30.33	41.73	8.25	7.19
Age						
17 & under	1.53	10.89	34.03	41.08	6.76	5.71
18-19	1.20	8.30	28.32	45.97	9.05	7.16
20-29	.57	3.92	18.53	53.06	13.77	10.15
30-39	.58	3.54	18.40	53.89	13.54	10.05
40+	1.56	7.78	25.04	47.50	9.64	8.48
Birth order						
1st	.58	3.82	19.34	51.95	13.93	10.38
2nd	.56	4.05	19.43	53.82	13.10	9.04
3rd	.76	5.15	21.16	52.41	12.02	8.50
4th+	1.54	8.89	26.34	46.87	9.22	7.13
Previous fetal loss						
yes	.64	4.24	19.00	51.45	13.61	11.06
no	.70	4.66	20.56	52.27	12.77	9.03
Marital status						
Married	.28	3.44	18.17	54.01	13.77	10.33
Not married	1.69	12.91	34.12	38.86	6.33	6.09
Education						
< 8 years	1.86	17.02	33.89	36.05	5.68	5.50
8-12 years	.57	5.68	22.67	50.58	11.51	8.98
13 + years	.14	1.73	14.16	56.21	16.00	11.76

Table 2

Percent of full-term live births weighing 2,500 grams or less, by specified number of prenatal visits, by maternal age and race, 38 reporting states and D.C., 1977.

Age	Number of prenatal visits						
All births	0	1-4	5-8	9-12	13-14	15+	Total
17 & under	9.68	8.04	5.44	3.72	3.35	3.75	4.89
18-19	8.82	7.60	5.38	3.55	2.64	3.33	4.40
20-29	8.56	6.19	4.45	2.70	1.98	2.31	3.05
30-39	7.44	5.94	4.15	2.68	2.12	2.26	3.03
40 +	3.05	5.37	5.38	4.13	3.84	3.58	4.49
All ages	8.58	6.63	4.62	2.82	2.09	2.52	3.36
White							
17 & under	6.04	6.77	4.31	3.00	2.10	2.73	3.72
18-19	7.98	6.84	4.50	3.00	2.27	2.82	3.59
20-29	6.44	5.19	3.88	2.42	1.79	2.07	2.63
30-39	6.39	5.04	3.67	2.46	1.96	2.55	2.69
40 +	2.17	4.74	4.62	3.84	3.40	3.72	4.01
All ages	6.57	5.74	3.96	2.50	1.87	2.23	2.78
Nonwhite							
17 & under	13.22	9.02	7.26	6.50	5.99	6.63	7.09
18-19	9.93	8.74	7.36	5.81	4.80	5.80	6.80
20-29	11.41	7.82	6.34	4.72	3.61	4.22	5.46
30-39	10.85	7.87	5.94	4.23	3.38	4.17	4.99
40 +	4.17	6.69	7.50	5.51	6.25	3.11	6.06
All ages	11.23	8.25	6.59	4.87	3.85	4.52	5.76

Table 3

Percent of full-term live births weighing 2,500 grams or less, by specified number of prenatal visits, by live birth order and history of previous fetal loss, 37 reporting states and D.C., 1977.

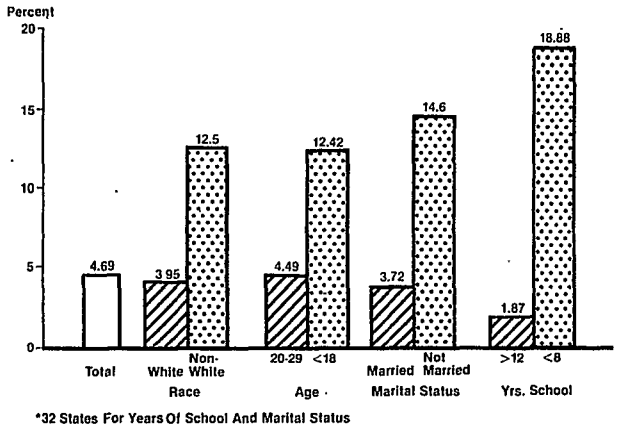
Birth order	Number of prenatal visits						
All births	0	1-4	5-8	9-12	13-14	15+	Total
1st born	7.92	7.30	5.07	3.07	2.11	2.41	3.46
2nd born	9.42	6.27	4.20	2.45	1.94	2.35	2.92
3rd born	8.54	6.29	4.27	2.68	2.09	2.64	3.18
4th+ born	8.94	5.89	4.36	2.92	2.34	3.25	3.63
Total	8.65	6.54	4.55	2.70	2.07	2.51	3.26
No previous fetal loss							
1st born	7.90	7.23	5.00	3.02	2.00	2.36	3.40
2nd born	9.75	6.10	4.69	2.36	1.88	2.27	2.83
3rd born	7.95	5.97	4.07	2.70	2.06	2.58	3.13
4th+ born	8.66	5.69	4.19	2.90	2.23	3.33	3.57
Total	8.55	6.43	4.44	2.59	1.98	2.39	3.19
Previous fetal loss							
1st born	8.23	7.98	5.95	3.62	2.96	3.13	3.99
2nd born	8.22	7.31	5.20	2.87	2.23	3.23	3.37
3rd born	10.36	7.54	5.10	2.65	2.17	2.89	3.35
4th+ born	9.72	6.52	5.05	3.00	2.42	4.31	3.80
Total	9.22	7.22	5.33	3.07	2.51	2.98	3.62

Table 4

Percent of full-term live births weighing 2,500 grams or less, by specified number of prenatal visits, by years of schooling completed and marital status. 32 reporting states and D.C., 1977.

Years of Education	Number of prenatal visits: 0	1-4	5-8	9-12	13-14	15+	Total
All births							
< 8 years	9.63	4.51	5.09	3.69	3.15	3.92	4.40
8-12 years	8.51	6.90	4.91	3.11	2.28	3.94	3.64
> 12 years	4.44	4.65	3.34	2.10	1.68	2.49	2.25
Total	8.32	6.48	4.59	2.78	2.06	2.51	3.23
Married							
< 8 years	9.02	3.67	4.25	3.32	3.19	3.65	3.79
8-12 years	6.77	6.00	4.39	2.84	2.12	2.80	3.18
> 12 years	2.87	3.89	3.13	2.04	1.62	1.95	2.14
Total	6.66	5.53	4.06	2.56	1.94	2.31	2.84
Not married							
< 8 years	11.11	6.96	8.18	5.45	2.96	4.38	6.84
8-12 years	10.42	8.30	6.45	4.95	3.92	4.88	5.94
> 12 years	6.57	7.41	5.40	4.24	4.03	4.07	4.87
Total	10.23	8.15	6.45	4.89	3.93	4.72	5.87

Figure 1. Percent of Full-Term Infants Whose Mothers Had Fewer Than Five Prenatal Visits, by Race, Selected Maternal Ages, Marital Status and Years of School Completed, 38 States* and D.C., 1977



*32 States For Years Of School And Marital Status

Figure 2. Percent of Full-Term Live Births Weighing 2,500 Grams or Less by Number of Prenatal Visits, by Race, 38 States and D.C., 1977

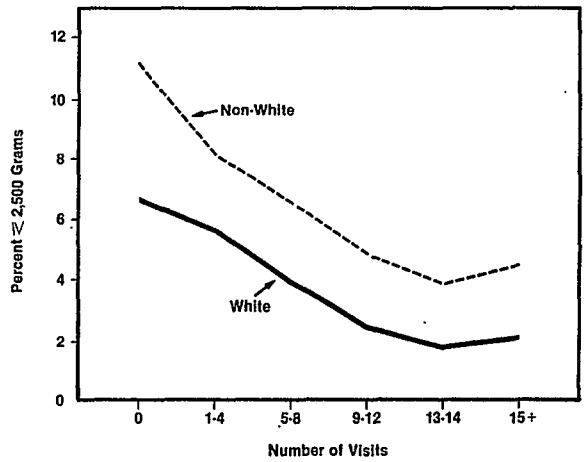


Figure 3. Percent of Full-Term Live Births Weighing 2,500 Grams or Less Whose Mothers Were Under 18 and 20 to 29, by Number of Prenatal Visits, 38 States and D.C., 1977

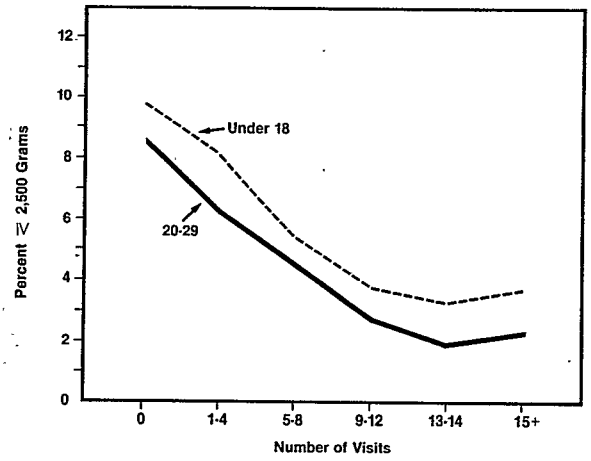


Figure 4. Percent of Full-Term Infants Weighing 2,500 Grams or Less by Number of Prenatal Visits, by Maternal Marital Status, 32 States and D.C., 1977

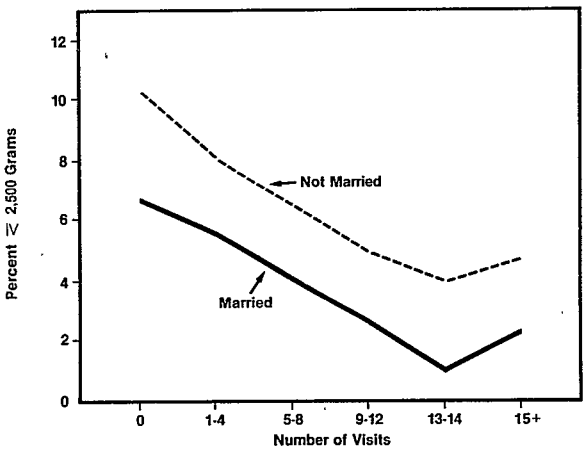
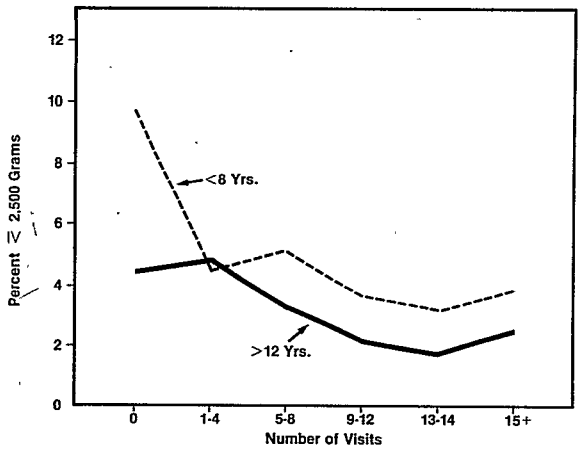


Figure 5. Percent of Full-Term Live Births Weighing 2,500 Grams or Less Whose Mothers Had Less Than 8 and More Than 12 Years of Schooling, by Number of Prenatal Visits, 32 States and D.C., 1977



THE USE OF SENTINEL HEALTH EVENTS IN A MORTALITY SURVEILLANCE SYSTEM

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I. Introduction

The Working Group on Preventable and Manageable diseases has proposed the use of sentinel events as negative indexes of health.[1] These events represent unnecessary diseases, unnecessary disabilities and unnecessary untimely deaths which can be prevented or managed under many circumstances.

This list of sentinel health events has generated much interest since it represents a comprehensive and documented set of potentially preventable or treatable conditions. This could be welcome news to health statisticians, planners and program managers who are often called upon to determine the number of preventable diseases and deaths in their area. It is important, however, to understand the nature of this list when available data are applied against it. Such an application can outline the uses and limits of sentinel health events for analytical and research purposes. Specifically, this report employs Missouri death data to assess the use of sentinel health events in a mortality surveillance system.

II. Limitation of Sentinel Health Events

An inspection of the notation in the Working Group's table indicates that restrictions are placed on several of the listed conditions. The first type of restriction refers to the codes used to identify the sentinel events. These codes come from the Eighth Revision, International Classification of Diseases Adapted for Use in the United States (ICDA-8).[2] Some ICDA-8 codes in the table are followed by the letter "M." This notation is used to indicate that the scope of the condition is not exactly represented by that particular code. Such an example is Wilms' tumor, represented by 189.0M in the Working Group's table. ICDA-8 code 189.0 represents malignant neoplasm of the kidney, except pelvis. Since Wilms' tumor is a special sub-category of this code, the letter "M" is placed after it.

There are other sentinel health events which could not be assigned any code from the ICDA-8 Manual, and these are represented by "NIC" in the table. One such example includes a broad range of man-made diseases induced by toxic agents, physical hazards, artificial environments, accidents and biological hazards. These conditions are not identifiable as such through the ICDA-8 Manual, and are thus designated with an "NIC."

Another type of restriction is listed under the "Notes" in the table's right-hand column. These notes indicate for several conditions that prevention or treatment is limited to certain circumstances or individuals. For example, malignant neoplasm of the trachea, bronchus and lung is noted as a sentinel death, but its prevention is only relevant in cases involving cigarette smoking or occupational exposure.

These various restrictions point to some of the difficulties in applying this list to death data coded with ICDA-8. Since available death data do not allow these restrictions to be made, a tabulation of sentinel deaths from the Working Group's list will result in two types of inaccuracies. On the one hand, it will include cases which do not exactly reflect the specified diseases or which the restrictions are intended to exclude. Alternately, for those conditions represented by an "NIC," the tabulation will omit these health events being addressed.

Additional examination of the Working Group's table reveals that it does not contain several conditions which are felt to be preventable under certain circumstances. For example, the sentinel list does not include coronary heart disease or arteriosclerosis. While not all such deaths can be prevented, the recent declines in these death rates and the personal health habits that have been associated with the risk of dying from such diseases suggest many of these deaths can be prevented or at least postponed.

At the other extreme, the table implies certain prevention goals which may be unrealistic. The table indicates that all deaths under the age of one year, regardless of cause, are to be considered unnecessary untimely deaths. Although this is a laudable goal, it is impractical to simply add up all infant deaths and call them preventable.

Thus the composition of the Working Group's table reveals a series of problems to those wanting to merely sum these sentinel health events and use this total as a firm measure of preventable mortality or as an overall index of untimely deaths.

Turning to the problems associated with actually compiling the relevant data against the sentinel list, one is initially faced with a problem of presentation. Since the list contains 76 different causes of death representing a wide assortment of diseases, it is difficult to present these statistics in a concise and understandable manner.

A useful grouping of the sentinel health events has been developed by the Cooperative Health Information Center of Vermont, Inc.[3] These groupings are based upon perceived etiologic factors and categorize events into four areas. These four areas relate to: 1) failures in primary care; 2) exposures to environmental, occupational and lifestyle risks; 3) lack of proper treatment; and 4) combinations of these factors.

Table 1 presents Missouri sentinel deaths by these groupings. This table shows that sentinel health events account for a sizable proportion of Missouri deaths, and this proportion has increased from 1972 to 1978. In 1972 sentinel events comprised 9.9 percent of all Missouri deaths. By 1978 this figure had grown to 11.2 percent.

The major contributor to sentinel deaths and the primary reason for their overall increase have been events related to environmental, occupational and lifestyle risks. This grouping contains causes of death in which prevention or treatment is relevant only to certain exposures.

Table 2 displays the individual causes comprising this "exposures to risks" category. From this table it appears that smoking is the single

most important exposure. Cancers of the lung and bladder along with chronic bronchitis, emphysema and chronic obstructive lung disease have all been linked with smoking, and these diseases represent over 90 percent of the sentinel deaths related to exposures to risks.

These events, however, demonstrate one of the difficulties associated with the Working Group's list. Not all the deaths from these diseases could be directly linked with smoking. Other factors can be involved in these diseases, and thus only some unknown subset of these deaths can be truly called preventable.

The specific diseases which comprise the sentinel deaths related to failures in primary care are contained in Table 3. This category almost exclusively consists of one group of diseases - certain causes of perinatal mortality.

After smoking-related diseases, these diseases of early infancy represent the other major contributor to the sentinel total. In fact, Table 4 indicates that diseases related to smoking and certain causes of perinatal mortality account for nearly 80 percent of all sentinel deaths. The other 20 percent are scattered among 69 various conditions.

This has important implications to those interested in summing these sentinel events and using them as an overall index to be compared between areas. These comparisons will largely be influenced by these two disease groupings. In other words, those areas having high lung cancer or infant death rates will also be high with respect to the overall sentinel index.

Another characteristic of the Working Group's list is that it is often very specific. This specificity can be viewed as both a strength and a weakness. On the positive side, the specificity eliminates irrelevant cases from consideration. On the negative side, however, it omits relevant cases simply because they lack sufficient detail.

Table 5 contains two examples of this problem. The Working Group's list, for example, is restricted to only certain cancers of the tongue-including the dorsal surface, borders and tip and the ventral surface-but excluding the base. The death data in Table 5, however, demonstrates that virtually all of the tongue cancer deaths in Missouri have the part as being unspecified. These events are excluded from the sentinel total due to their insufficient detail.

Another example refers to meningitis deaths. In the Working Group's list, sentinel meningitis deaths are restricted to those in which a specified organ is noted as the cause. Yet Table 5 shows that 45.1 percent of all meningitis deaths in Missouri have no organism specified as the cause. These examples illustrate that frequently the prevalence of sentinel health events may be more reflective of the quality of medical recording rather than the quality of medical care.

III. Uses of Sentinel Health Events

As noted above, sentinel health events have several limitations which restrict their usefulness as an overall index of untimely deaths or as a firm measure of preventable mortality. These limitations, however, are not criticisms of the sentinel method as proposed by the Working Group. Rather, the limitations should serve as a caution against the misuse of this method. Dr. Rutstein of the Working Group has addressed the problem of inferring preventability from a simple compiling of data. According to Rutstein, there are three steps that are essential to the sentinel method.

The first step is the exploratory analysis of routinely collected data. Based on this analysis, step two involves clinical investigation of relevant cases. This review forms the basis for the third step which is development of appropriate interventions to correct the uncovered problems.

Providing a starting point for these case-by-case reviews is one of the primary uses of sentinel events. This type of review was used successfully in the maternal mortality studies of the New York Academy of Medicine in the 1930s.[4] During these studies, the facts surrounding each maternal death in New York City were reviewed by a group of physicians and the findings were widely circulated. The recommendations produced from these studies can at least be partially credited with the dramatic decline in maternal deaths that followed.

This same model was more recently applied in a study of perinatal mortality in Massachusetts in 1967 and 1968.[5] After case-by-case reviews, it was judged that approximately one-third of these deaths were preventable through medical means. The preventable deaths occurred mainly in hospitals with small obstetrical services. The study led to changes in standards, the closing of small units and regionalization of certain services. After these changes were instituted, the perinatal death rate in Massachusetts dropped from fifteenth lowest to second lowest in the nation.

A study currently underway involves the review of all cervical cancer deaths in Massachusetts. Under the study design, relevant information is abstracted from follow-back records of hospitals and nursing homes. In some cases, the attending physician is interviewed. All of these cases are then reviewed by a committee of expert panelists from the Massachusetts Medical Society. The committee makes a determination as to the preventability of each death.

Another application of the sentinel method appeared in a Massachusetts study which profiled the occupation of young males who died of lung cancer.[6] In the study, the authors found preliminary evidence of an elevated risk for commercial fishermen. Consequently, the authors are now examining 20 years of death records in a major fishing community in Massachusetts.

A second important use of sentinel events is that it can provide a sharp focus to routine monitoring systems. Occupational health surveillance is a good example of this type of use, especially for states currently coding occupation and industry from their death certificates. Many of the sentinel health events are specifically related to occupational exposures. These include silicotuberculosis, lung cancer, cancer of the pleura, myeloid leukemia, aplastic anemia and pulmonary heart disease. Annual summary tables for these deaths can be made by groupings of occupations and industries. This type of routine monitoring can help to identify suspect occupations and industries for specified diseases.

A third use of sentinel events relates to health program planning. Although there are many pitfalls in using total sentinel events as a firm measure of preventable mortality, the comparison of death rates from select causes from the Working Group's list can be helpful in identifying areas in which certain types of preventable problems may be concentrated.

Such an approach has been used in Missouri with respect to smoking-related diseases.[7] This Missouri report analyzes age-adjusted death rates by county. This analysis reveals a concentration of counties with high rates in the southeastern portion of the state. Missouri's urban centers of St. Louis City and Jackson County also exhibit high rates.

These comparisons can be misleading to the extent that the percentage of these deaths directly associated with smoking varies from county to county. Yet in the absence of extensive county-by-county surveying across the state, this method can be a useful way to provide clues to where smoking is prevalent and contributes to serious health problems. This can serve as important guidelines in the planning of prevention programs aimed at these problems.

In conclusion, there are several valuable uses of sentinel events with mortality data. They provide a starting point for clinical reviews, they can sharpen the focus of routine surveillance activities, and they can assist in the planning of health programs. As with all analytical methods and techniques, however, caution must be exercised to insure their proper use.

Footnotes

1. Rutstein DD, et. al.: Measuring the quality of medical care: a clinical method (tables revised, 9/1/77). New England Journal of Medicine 294: 582-588, March 1976. The sentinel health events discussed above are restricted to those in Table A of the Working Group's article. The reader may be interested to know that the Working Group has revised its tables to reflect ICD-9 codes and medical advances since 1977. Reprints of this second revision can be obtained from the Clearinghouse on Health Indexes, National Center for Health Statistics, 3700 East West Highway, Hyattsville, MD. 20782
2. United States Department of Health, Education and Welfare, National Center for Health Statistics: Eighth Revision, International Classification of Diseases (1965 Revision) Adapted for Use in the US (PHS Publication No. 1693) Washington, D.C., Government Printing Office, 1967.
3. Cooperative Health Information Center of Vermont, Inc.: Contract Number 291-77-0004 Deliverable 5.
4. New York Academy of Medicine, Committee on Public Health Relations: Maternal Mortality in New York City: a study of all puerperal deaths 1930-1932. New York, The Commonwealth Fund, 1933, p. 290.
5. Muirhead DM: Report on Perinatal and Infant Mortality in Massachusetts 1967 and 1968. Committee on Perinatal Welfare of the Massachusetts Medical Society, December 1971.
6. Frazier TM, Wegman DH: Exploring the use of death certificates as a component of an occupational health surveillance system. American Journal of Public Health 69: 718-720, July 1979.
7. McEvoy L: Differential Mortality in Missouri implications for prevention efforts. Missouri Center for Health Statistics Publication No. 10.2, April 1980.

TABLE 1

NUMBER OF RESIDENT SENTINEL DEATHS: MISSOURI 1972-1978

RELATED TO:	1972	1973	1974	1975	1976	1977	1978	Total
FAILURES IN PRIMARY CARE.....	785	659	656	617	566	551	583	4,417
EXPOSURES TO RISKS.....	3,410	3,466	3,464	3,550	3,829	3,846	4,089	25,654
LACK OF PROPER TREATMENT.....	758	760	681	689	595	572	628	4,683
PRIMARY CARE/ PROPER TREATMENT.....	88	116	112	111	101	92	93	713
EXPOSURES TO RISKS/ PROPER TREATMENT.....	130	129	131	145	124	124	119	902
TOTAL SENTINEL DEATHS	5,171	5,130	5,044	5,112	5,215	5,185	5,512	36,369
(PERCENT OF ALL MISSOURI DEATHS).....	(9.9)	(9.9)	(10.0)	(10.4)	(10.6)	(10.6)	(11.2)	(10.4)

TABLE 2

SENTINEL DEATHS RELATED TO
ENVIRONMENTAL, OCCUPATIONAL, AND LIFESTYLE RISKS
MISSOURI 1972-1978

CONDITION	NUMBER	PERCENT
MALIGNANT NEOPLASM OF TRACHEA, BRONCHUS, & LUNG	14,810	57.7
CHRONIC BRONCHITIS, EMPHYSEMA, & CHRONIC OBSTRUCTIVE LUNG DISEASE	7,352	28.7
MALIGNANT NEOPLASM OF BLADDER	1,676	6.5
MYELOID LEUKEMIA	1,149	4.5
PULMONARY HEART DISEASE	203	0.8
ALL OTHER (5 CONDITIONS)	464	1.8
TOTAL	25,654	100.0

TABLE 3

SENTINEL DEATHS RELATED TO FAILURES IN PRIMARY CARE
MISSOURI 1972-1978

CONDITION	NUMBER	PERCENT
CERTAIN CAUSES OF PERINATAL MORTALITY	4,290	97.1
COMPLICATIONS OF PREGNANCY	81	1.8
ACUTE RHEUMATIC FEVER	17	0.4
TETANUS	15	0.4
MEASLES	5	0.1
ALL OTHER (11 CONDITIONS)	9	0.2
TOTAL	4,417	100.0

TABLE 4

MAJOR CONTRIBUTORS TO SENTINEL DEATHS
MISSOURI 1972-1978

CONDITION	NUMBER	PERCENT
DISEASES RELATED TO SMOKING	24,505	67.4
CERTAIN CAUSES OF PERINATAL MORTALITY	4,290	11.8
ALL OTHER (69 CONDITIONS)	7,574	20.8
TOTAL SENTINEL DEATHS	36,369	100.0

TABLE 5

EXAMPLES OF SPECIFICITY PROBLEM
MISSOURI 1972-1978

CONDITION	NUMBER OF DEATHS
MALIGNANT NEOPLASM OF TONGUE	
DORSAL SURFACE	0
BORDERS AND TIP	1
VENTRAL SURFACE	0
PART UNSPECIFIED	275
MENINGITIS	
H. INFLUENZAE	43
PNEUMOCOCCUS	50
DUE TO OTHER SPECIFIED ORGANISM	35
WITH NO ORGANISM SPECIFIED AS CAUSE	105

Use of Health Records in Health Promotion Efforts

Concurrent Session N

DEVELOPING HEALTH PROMOTION STRATEGIES THROUGH MEDICAL RECORD AUDIT

Edward F. McGuigan, The Toledo Hospital

"That society which can reduce professional intervention to a minimum will provide the best conditions for health."[1]

The national focus on the promotion of health and prevention of illness has gained momentum in recent years. Many consider this trend to be a viable alternative to traditional medicine's emphasis on curative care.

The renewed attention given to positive lifestyle changes as a means toward improving the quality of life has developed, in part, through a better understanding of causes and risk factors of chronic diseases. Further, there has been an awakening that medical interventions with treatment emphases are too expensive.

All too frequently patients wait until symptoms are present and in the acute stage before seeking medical assistance. This crisis care orientation lends itself to the proliferation of sophisticated and expensive treatment methods.

The effect of therapeutic medicine's curative nature has been marginal at best. Statistics indicate that life expectancy has not increased substantially, despite the fact that the United States annual health expenditures since 1960 have increased by 700 percent.[2] Essentially, the status of Americans with respect to illness, disability and premature death have shown only minor changes in twenty years. The leading causes of death are still heart disease, cancer, stroke and accidents. Improvements will not come so much from increases in health care expenditures, as from the realization that changes are needed in personal lifestyles.

As we enter into the 1980's the relationship between death rates, health status and lifestyles are becoming better understood. Health workers are now directing their attention to lifestyle factors as major determinants of health status.[2,3]

According to the 1979 Surgeon General's Report on Health Promotion and Disease Prevention, Healthy People, "Personal habits play a critical role in the development of many serious diseases." The report states that positive changes in personal lifestyles could substantially reduce at least seven of the ten leading causes of death in the United States, if individuals improved five habits: diet, smoking, lack of exercise, alcohol abuse, and use of anti-hypertensive medication. Further evidence on the role of behavioral factors as related to morbidity and mortality has been cited in the classic Belloc, Breslow study of nearly 7,000 adult residents of Alameda County, California.[4] The authors found a significant relationship between life expectancy and better health through the practice of these seven basic health habits:

1. Breakfast every morning
2. Three meals a day, no snacking
3. 7 to 8 hours of sleep per night
4. No smoking
5. No alcohol or in moderation
6. Maintain ideal or a little below weight
7. Moderate exercise.

Personal lifestyle choices, then, play a critical role in the concepts underlying disease prevention and health promotion.

It is recognized that the burden of good health should not be carried exclusively by the individual. Rather, in order to maximize well-being, a partnership between health providers and consumers should be explored as an appropriate means to achieve health goals. The aim of the partnership is to facilitate learning through responsible and active health care decision making. This concept can be best achieved in an environment condusive to the team approach.

About one and a half years ago the health team of the W. W. Knight Family Practice Center at The Toledo Hospital began the process of reorganization to include a more comprehensive program of patient activation and health promotion. The Center, located in an urban area of Toledo, has approximately 18,000 patient medical records on its computer. The patient population includes a mix of professional, white collar, ethnic blue-collar and low income clients. The health team consists of eighteen family practice residents, two full time physician directors, a part time psychologist, a part time pharmacist, four nurse educators, a dietitian, medical assistants and office and clerical staff. In addition a number of medical, nursing and pharmacy students use the Center for field experiences and clerkships.

An interdisciplinary committee, including patients, was formed to develop the overall program. Obviously, a primary goal of the activation/promotion program was to encourage all patients to become actively involved in their care. In an effort to facilitate participation and develop a commitment to positive health behavior, a variety of health strategies were incorporated into the Center's operation. These measures include the use of health risk appraisals, annual health maintenance reviews, and behavioral diagnoses. It was felt that this broad system of analysis would allow the health team to identify potentially complex problems affecting the individual's health. Further, it would provide an assessment of the educational needs of the patient population. In other words, health education/promotion programs could be developed based on the expressed needs versus assumed needs.

Prior to developing the system it was necessary to establish a mode of consistency and agreement on definitions. Basically, it was decided that the patient activation/health promotion program should be developed to assist and teach patients of the Family Practice Center to:

1. Assume greater responsibility for their own health;
2. Become better informed about their health problems;
3. Utilize the health care system more appropriately;

4. Reduce their health risk factors.

Consensus on program definitions was achieved when staff members agreed to the following definitions from the Office of Health Information, Health Promotion, Physical Fitness and Sports Medicine:

> Health Education - any combination of learning opportunities designed to facilitate voluntary adaptations of behavior (in individuals, groups or communities) conducive to health.
>
> Health Promotion - any combination of health education and related organizational, political and economic interventions designed to facilitate behavioral and environmental adaptations that will improve or protect health.[5]

It was felt that these parameters were necessary in order to provide a foundation and a philosophical basis for the program.

The committee wanted to avoid the pitfalls common to health education programs in a primary care setting. Often programs are unplanned, sporatic, educational experiences usually resulting in a negative learning environment with little or no positive change. The aim was to develop programs based on the premise that educational activities should be planned, coordinated, and evaluated. A framework for this structure was identified using the PRECEDE model for health education planning.[6] This model, developed by Green and co-workers, helped identify factors which influence the individual's behavior, his/her social environment, and economic or environmental constraints. These forces, which affect the person's behavior, can be categorized according to relevancy and changeability. With this information, the educator can perform an educational diagnosis which focuses on the appropriate intervention strategies. Further, the model considers various designs for an effective evaluation. An appealing feature of the PRECEDE model is the active involvement of the patient in the problem solving process.

The idea of shared responsibility to problem solving and health maintenance has gained wide acceptance, particularly in an outpatient or Family Practice setting. The health team at the hospital's Family Practice Center has been involved in the problem oriented approach for a number of years. Components of the system include a family history form, physical examination form, a problem list, which contains medication, immunization, and allergy history, and a screening flow sheet commonly known as a health maintenance review sheet. These components of the medical record provide a checklist for the health team, particularly when talking to the patients about major health risks.

All of the information from the medical records are coded and computerized. This system, programmed by Medical Data Systems of Olmstead Falls, Ohio is somewhat unique. For instance, a computer scan, coded by diagnoses, problem areas or by medications, could be undertaken to assess educational program needs, identify potential participants for health education/promotion programs, or alert patients regarding medication problems. Recently a scan was completed which identified all patients on a particular drug. These individuals were notified that the drug was being taken off the market and they should visit the Center for a re-evaluation and new prescription.

There is also a general instructional code which allows a scan and identification of all patients who have been involved in either one-on-one or group health education/promotion programs. This, of course, is useful for follow-up and research activities. An example of this potential can be seen in a Breast-Self Examination program. A scan can be made which identifies all former participants of the program and a reminder letter sent regarding monthly compliance.

An exciting new component to the Center's health record system is the inclusion of a health risk appraisal. The Health Questionnaire from Medical Datamation in Bellevue, Ohio will be available to all patients participating in the health promotion programs. The appraisal is an individualized, computerized analysis of lifestyle, health habits and longevity predictions. Basically, the concept relates to health risks faced by the person because of age, race, sex, heredity and lifestyle. Combining these factors with information from the patient's health history, physical exam, and other records allows the health team members to determine the health risks of the patient. With the proper counseling the patient can be referred into individualized or group health education classes. The patient receives a copy of the computer analysis for his/her own records.

Fortunately, Medical Datamation feeds into the same computer system as Medical Data Systems. Therefore it may be feasible to include this data base into the Center's systems network. This, in turn, would give the Center a more comprehensive health records system. Currently, Medical Datamation provides quarterly reports which contain group statistical information. This data will be used as an adjunct to the computer scans to help determine educational priorities.

In order to provide continuity and establish direction for the health team, the health promotion committee developed a series of departmental policy and procedures. The most relevant for this discussion is entitled "Health Promotion Visits." Briefly, those patients electing to participate in the Health Promotion Program are identified via the monthly computer list. A letter regarding their appointment and information about the program is sent to the patients. Individuals requesting an appointment are sent a Health Questionnaire which is to be completed and returned to the Family Practice Center. This in turn is forwarded to Medical Datamation and the results sent to the Center where it is reviewed by members of the health team.

When the patient visits the Center a medication history is taken. The patient receives the appropriate examination and briefly reviews the health questionnaire with the physician. Upon agreement to the appropriate health care plan the physician refers the patient to the nurse educator. The Health Questionnaire is

then reviewed in detail with the patient. If indicated a behavioral diagnosis is undertaken and educational plans are determined. These activities are entered into the computer for the patient's record.

The health team is anxious to initiate this new portion of the patient activation/health promotion program at the Family Practice Center because it is believed that it is an effective means of involving the patient and the health team in a mutual learning experience. Further, the program offers an alternative to the traditional mode of health care delivery. There will almost assuredly be a need for role adjustments on the part of the patient and health team members. However, the alliance achieved by this sharing concept should convey an atmosphere of trust and confidence, thus, contributing to the quality of care.

The full potential of the health records computer system, obviously, has not yet been realized. As the health promotion, risk reduction concepts gain wider acceptance among the medical staff at The Toledo Hospital's Family Practice Center it is envisioned that additional computer programs will be developed to provide more comprehensive information for health promotion strategies. Currently, the hospital is exploring the potentials of this computer system to other areas of the hospital. Outpatient services has similar capabilities as they are hooked into the system. The information that can be returned from the system would be immensely helpful from a health education program perspective. Finally, the hospital is pursuing the idea of health risk appraisals for all 3600 hospital employees. This would be based out of the Employee Health Department and would be phased in as part of new employee and annual physicals. The computerized quarterly report would provide an assessment of needs which could lead to additional health promotion programs for the hospital employees.

The Toledo Hospital's Family Practice Center has taken the initiative to develop health promotion strategies for its patient population. This trend toward the promotion of healthful lifestyles is expected to generate a personal awareness and a sense of responsibility among all involved. The plan of action includes the use of health records, health risk appraisals, and a health education planning model to identify and establish appropriate health education/promotion programs. Computer scans, coded according to diagnosis, problem areas, medication or instructional code will provide an innovative information system for program analysis. Potential for expansion of the system into other areas of the hospital are currently being explored.

The active involvement of patients in the promotion of positive health clearly presents a challenge to traditional health beliefs. However, it is understood that responsibility for good health involves a partnership effect and an attitude of trust. Thus, the key to a better quality of life involves cooperation, dedication and determination.

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THE USE OF HEALTH RECORD INFORMATION BY HEALTH SYSTEMS AGENCIES FOR HEALTH DISEASE PREVENTION AND HEALTH PROMOTION DECISIONS

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Introduction

Health record information can play a key role in decisions by Health Systems Agencies to advocate health promotion and prevention strategies in their Health Systems Plans and Annual Implementation Plans. To adopt such goals, HSAs must first be able to verify that health status gaps exist in the local community as compared to desired levels and secondly to show that health promotion efforts can be cost-effective and efficient in improving health status as an outcome. When available, health records can often assist in doing both.

This paper discusses how indicators for preventable conditions and diseases can be used to evaluate health status and possible sources of the necessary data in health records. Also discussed is the use of this type of data to show positive community impact in terms of successful existing or demonstration programs so that promotion efforts can be made in HSP or AIP priorities. Specific uses of data such as vital records, medical records, registries and self-reported data are discussed in their use for HSA decisions toward health promotion strategies.

The Role of HSAs in Health Promotion

As much as half of the mortality in the United States has been attributed to unhealthy behavior or lifestyle. Americans seem to be becoming increasingly aware that future significant gains in health status are not dependent on the efficacy of medical care, but rather on approaches based on health promotion and prevention. In addition, there is mounting concern over the escalating cost of acute health care services especially hospitalization. Avoidable illness, disability and premature death also provide a costly burden which is reflected in health system expenditures.

Health Systems Agencies (HSAs) were created, among other reasons, to address these particular issues. Section 1513(a) of the National Health Planning Act sets out these purposes for HSAs:

1. improving the health of residents of a health service area,
2. restraining increases in the cost of providing health services.

In addition, Congress has specified several priorities which promote prevention and are to be considered in the operation of the health planning program. As listed in Section 1502(a) of the Health Planning Act as amended in 1979, these priorities include:

1. The promotion of activities for the prevention of disease, including studies of nutritional and environmental factors affecting health and the provision of preventive health care services.
2. The development of effective methods of educating the general public concerning proper personal (including preventive) health care and methods for effective use of available health services.

Because of these mandates, it is not surprising that the federal blueprint for prevention and promotion Healthy People specifies health systems agencies as a potential means of implementing suggested actions outlined in the report. (p.145). HSAs have many methods by which to foster promotion and prevention activity - through plan development, implementation, agency plans and projects, public education, technical assistance, project reviews and appropriateness reviews.

The record of HSAs in advocating promotion and prevention and bringing about movement in the health care system toward this end is mixed at best. Obviously, each HSA may be responding in different ways since dedication to prevention at each HSA may depend on the way the agency perceives its role, the local environment and available staff and community resources. HSA activities to date have leaned heavily toward public education - wellness and health education centers, resource directories and guides. Where expansion of personal or clinical health efforts has been supported, the targets have often been those where federal or state funding priorities have been established in advance of HSA actions.

Barriers to HSA Action

This paper identifies and discusses four sets of barriers which have kept HSAs from being more successful in advocating and implementing preventive strategies. In line with the theme of this conference, there is a focus on the role of health records. Later in the paper the effects of these barriers on plan development and implementation in one HSA will be analyzed. The four barriers discussed are:

1. Structure of the health care system.
2. Structure of the Health Planning Program.
3. Need for available information (knowledge) about prevention and promotion.
4. Lack of good local data.

The Health Care System Structure as a Barrier

Prevention as a concept is not always easily understood nor does it fit neatly into the health care system. Admittedly, the task of health planning is to reshape the health care system to what should be rather than to reinforce what is. This is no easy task. Implementation is largely the art of the possible and funding is an especially real constraint.

Preventive services address an especially complex and interrelated set of health conditions and social situations. Services needed often go beyond the traditional health care system and into diverse sites such as schools or community action programs. New funding arrangements may have to be forged and monies found from taxes whereas third party payors readily reimburse acute services. Only 2.6% of the health care dollar currently goes for government public health activities. When consumers must pay out-of-pocket for preventive services, they may opt not to participate since the benefits are not immediate or they have become used to not paying directly for "health services" and don't desire to do so for prevention.

The Health Planning Program as a Barrier

Though HSAs may constitute a strong potential institution for moving the society toward health promotion and prevention, the operation of the health planning program at the regional and national levels has not been an ally in implementing this change.

Ardell and Robins asked HSAs what their major obstacles were in attempting to promote wellness (1, p. 440). They reported that the overwhelming response was that "HEW officials at the Bureau of Health Planning and the regional offices are the main barrier".

One of the most glaring ommissions in the Health Planning Act is the failure to recommend a public health representative on HSA Boards. This is despite the facts that HSAs review most federal funds for public health and that the law specifically names as possible Board members such medical system groups as podiatrists and physician assistants.

Another possible factor in the lack of impetus for prevention and promotion has been a tendency of the health planning program at the national level to focus on cost containment in the acute care sector, especially hospitals. Whereas the Secretary has been required to issue a statement of national health planning goals as well as resource standards (guidelines), the issuance of final regulations and their emphasis has been acute care supply standards aimed at cost containment. A set of draft guidelines incorporating promotion and prevention standards was issued in 1976, but never finalized. The slowness in addressing these issues was responsible, in part, for a resolution by the National Council of Health Planning in March 1979 urging the promulgation of the national health planning goals required by P.L. 93-641. Released for public comment in October 1979, these have also yet to be finalized.

Lack of Knowledge as a Barrier

A number of issues must be addressed before preventive programs can be endorsed by HSAs. Among the nondata questions which must be answered are:
(3, pp. 28-29, 7, p. 11)

- Which diseases are preventable?
- Are safe, effective preventive measures available? What is their impact?
- Do the benefits outweigh the costs and risks?
- Is the cost-effectiveness ratio of the strategy superior to other approaches?

Until recently, the situation in prevention and promotion bore some resemblence to Dr. Davies' description of the state of the health education literature.

> "It is jumbled, confused and untidy. It is an omnium-gatherum of science, pseudoscience, tenuous theory and unmitigated claptrap". (2, p. 1476)

The federal government has taken a philosophical approach to this problem. Health United States 1979 (p. 29) states that:

> Preventive programs like most public policy action must be designed in the absence of complete information.

On the other hand, HSAs need conclusive studies, especially demonstration projects, to evaluate the cost-effectiveness and impact of preventive strategies. Such studies are especially difficult to perform in this realm because a great deal of time is often needed to show impact and variables may be extremely interrelated. In cost-effectiveness studies, the savings must be evaluated by placing a value on a life or disability.

In the past few years, several excellent documents have been put together which can assist HSAs in learning of effect ive preventive strategies and the background literature which can help evaluate them. These are:
HEW, Preventive Disease/Promoting Health: Objectives for the Nation. August, 1979.
HEW, Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention. DHEW (PHS) 79-55071. July 1979.
HEW, Model Standards for Community Preventive Health Services. August 1979.
Orkand Corp., Planning for Prevention: Preventive Strategies, Disease Antecedents and Conditions. HRA (BHPRD) Contract 239-75-0060. September 1976.
Also, the work by Rutstein (7) on sentinel events has given HSAs a list of conditions and diseases where preventive approaches may bear fruit.

Data Availability as a Barrier

Perhaps the major deterrent to HSA developments in prevention and promotion is the lack of the necessary data, especially that at the local level. Some of the weakest data components available to planners, morbidity and indicators of occupational and environmental health, are especially important to preventive strategies.

Establishment of plan development goals or project review criteria and standards related to prevention must usually begin with the measurement of health status locally and comparison to an accepted norm. The indicators chosen must be:

- Valid - measure what you are trying to assess,
- Reliable - repeated applications give similar results,
- Sensitive - distinguished significant differences in health status or health system performance,
- Practical - will be available with relative ease, reasonable cost, interpretation not difficult, comparable data available.

In addition, the HSA must be able to use the indicator to determine the current health status locally preferably including not only the HSA as a whole but also HSA geographic subunits and population subgroups such as age, race, sex, education and income. Once identified for the region or regional subgroups, a normative (desired) goal level must be chosen for the indicator. Many sources, differing in quality, exist for the choice of normative levels. Some of these are:

1. Arbitrary/educated guess
2. Assume that health status or system performance should be the same for geographic units and/or population groups as currently exists for some of them.
3. Comparative units: regions, state, nation
4. Other medical systems (HMOs, other nations, model or demonstration programs)

5. Need or demand
   Consumer based; professionally based
   Subjective assessment; objective assessment
6. National guideline
7. State goal
8. Standard for accreditation or licensure
9. Technically achievable level

When concensus seems to assist on desired health status goals, the job of the HSA is made appreciably easier than when order must be brought to conflicting information.

Figure 1 shows the major categories of major health record sources which can be used to provide data for local health status. Also shown is their general availability to HSAs. Few sources are generally available and most of those relate to mortality rather than morbidity. Some sources, though available, are of poor reporting quality such as reports of communicable diseases which are known to be greatly under reported.

Figure 1
HEALTH RECORD SOURCES, LOCAL AVAILABILITY
BY TYPE OF HEALTH CHARACTERISTIC

HEALTH CHARACTERISTIC	VITAL RECORDS	MEDICAL RESULTS	SELF REPORTED	SERVICE USE	COMMUNITY REPORTS
MORTALITY	Death Certificates (+)				
MORBIDITY					
GENERAL	Birth Certificates (+)	Physician Records (-) Pathology(-)	Surveys (-)	Hospital Discharge Records (?)	
ACUTE	Communicable Disease Reports (+)				Accident Reports (?)
CHRONIC	Registeries (?)				
DISABILITY	Workmans Comp. Insurance, Gov. Records (-)		Absenteeism (-) Bed-Days(-)	Agency Records (?)	
POSITIVE HEALTH		Physician Records (-)	Preventive Behaviors(-)	Physician Records (-) Health Dept. Records (+)	Immunization Records (?) Absenteeism (?)

(+) generally available, (-) generally not available (?) sometimes available.

While vital records are summarized and made available to health planning agencies and others, most of the other health record sources are not widely available. These include results of medical tests, self reported and individual questionnaires, diagnosis specific records of health service use, and reports of community agencies. Without local data to "plug into" indicators of the need for prevention, the development of local preventive goals and standards is virtually impossible. In some cases, data may be available, but not generally released such as PAS or hospital discharge records. In other cases, the data may never have been organized into a usable form. Lab test results may be such an example. Though some agencies have performed household health surveys, others consider them too costly or difficult.

Experiences of one HSA in Preventive Strategies

Figure 2 shows a generalization of the plan development process. Many aspects of this process, including informational needs, have been discussed in earlier portions of this paper. Essentially, a variety of barriers must be successfully handled in order to reach a priority goal with properly chosen recommended actions. Among these are a proper indicator, data at the local level, and knowledge of effective strategies including cost/benefit analysis. The agency must conclude that the preventive approach is superior to treatment approaches to the problem.

Table 1 indicates problems or conditions known to be preventable and the possible action approaches which can be utilized. The following summary looks at the amount of progress made in acceptance of these approaches by Comprehensive Health Planning of Northwest Illinois, a small HSA serving about a half million people in northern Illinois. For those topics where progress has been minimal, reasons for the lack of progress is analyzed.

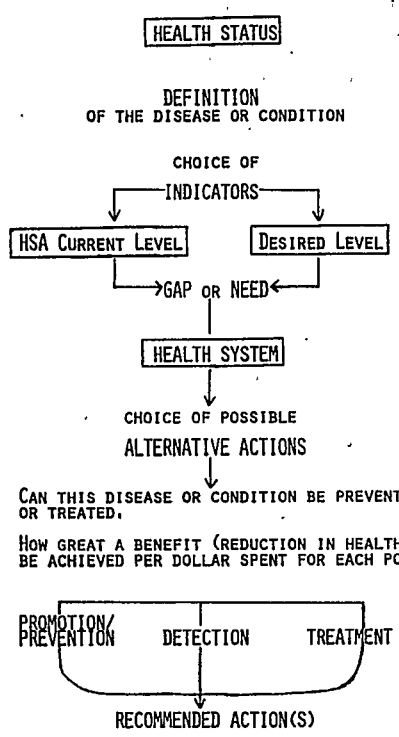
Immunizations is the prevention area of both greatest acceptance and action. Data on current levels, available from school reports, indicated that they were well below accepted standards. Additionally, the need for immunizations was backed by a (largely uninforced) State law and low cost for the action. The top priority for 1978, CHPNI coordinated an immunization campaign including media coverage for greater awareness and fifteen clinics in shopping malls and similar sites across the region. Over a thousand children received free immunizations at the clinics and the final evaluation showed that compliance levels in the region, on the average, were 20% above levels for the previous year.

Immunizations provides an example of a problem which easily met all needs for an accepted preventive approach. Many other problems are stymied because the current HSA level cannot be determined from any available source. These include such problems as toxic and chemical

accident effects and hospital infection control, occupational data is nearly nonexistent in our region. Admittedly, an agency can utilize synthetic estimates from national data, but doing so subverts a basic concept of local planning. Lack of good environmental and occupational data often preclude developments in these areas.

Figure 2

HEALTH SYSTEMS PLAN DEVELOPMENT
INITIATED BY HEALTH STATUS ANALYSIS



For some problems, the Board has felt that little can be done beyond current efforts or that the changing of human behavior is almost impossible. Characteristic of these problems and actions are obesity, smoking and stress reduction (cardiovascular), sexually transmitted disease control and alcoholism and mental illness. Known approaches are not felt to be cost-effective relative to other actions.

Accepted with some questioning of its impact has been the area of health education. School health education has been a top agency priority, encouraging the development and adoption of integrated curricula by local schools. Support for developing a focus for health education through a local center has been weak.

Priority areas more widely accepted have been hypertension control (cardiovascular), maternal and child health and the need for dental health including fluoridation. Even with some of these, key local data elements are missing such as the numbers of unwanted children (family planning) dental caries or the number of persons with elevated blood levels or complying with regimens.

Table 1

PREVENTABLE DISEASES AND
MAJOR PROMOTION/PREVENTION ACTIONS

PROBLEM OR CONDITION	ACTION APPROACH
CARDIOVASCULAR/HYPERTENSION	HYPERTENSION CONTROL
	OBESITY CONTROL/DIET
	SMOKING
	STRESS REDUCTION
MATERNAL AND INFANT HEALTH	NUTRITION
	PRENATAL CARE
	FAMILY PLANNING
	GENETIC SCREENING
	COUNSELING
COMMUNICABLE DISEASES	IMMUNIZATIONS
SEXUALLY TRANSMITTED DISEASES	STD CONTROL
TOXIC AND CHEMICAL AGENCY EFFECTS	OCCUPATIONAL SAFETY AND HEALTH
CANCER	SMOKING
	OCCUPATIONAL HEALTH
ACCIDENTS	ALCOHOL/MOTOR SAFETY
	OCCUPATIONAL SAFETY
DENTAL DISORDERS	FLOURIDATION
	PREVENTIVE EXAMS
INFECTIOUS DISEASES	HOSPITAL INFECTION CONTROL
	FOOD INSPECTION
CIRRHOSIS	ALCOHOLISM MODIFICATION
INDIVIDUAL/FAMILY MENTAL HEALTH	ALCOHOLISM, DRUG ABUSE MODIFICATION
	FAMILY PLANNING
GENERAL HEALTH (WELLNESS)	CONSUMER HEALTH EDUCATION
	PROVIDER HEALTH EDUCATION
	NUTRITION
	PHYSICAL FITNESS
	STRESS REDUCTION
ENVIRONMENTAL QUALITY	AIR, WATER QUALITY
	RADIOLOGIC HEALTH
	SANITATION/WASTE DISPOSAL
	VECTOR, ANIMAL CONTROL
	NOISE CONTROL

Conclusion

Though prevention would appear to be a key to the HSA mandates to lower health care costs and improve health status, progress has been slow. Barriers to acceptance by HSAs have included the need for information and data, including evidence for cost-effective preventive approaches and the health planning program emphasis at the national level on hospital cost containment.

To improve the situation, a constituency for prevention needs to be formed to promote the

concept and to assure improved data at the local level and an integrated information base to provide evidence of cost-effective approaches. Data already available needs to be mobilized and an impetus provided toward collecting other essential information.

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SURVEILLANCE OF SURGICAL STERILIZATION: CENTER FOR DISEASE CONTROL

Jack C. Smith, Center for Disease Control

Introduction

The popularity of both male and female sterilization in the United States has greatly increased in recent years. In 1977 more than a million women of reproductive age had either a tubal sterilization or a hysterectomy (1) and almost one-half million men had a vasectomy (2). Surgical sterilization has become the method of fertility control for almost one-half of all white couples in the United States who have been married 10 years or more (3).

As with other surgery, surgical sterilization has associated medical risks which vary both with the type of surgical procedure used and the health status of the patient. In order to evaluate the general public health effect of surgical sterilization the Family Planning Evaluation Division (FPED), Center for Disease Control (CDC) has initiated a program of epidemiologic surveillance of sterilization. The purpose of this paper is to state the objectives of our sterilization surveillance activities and to describe the surveillance methods which we presently use or intend to use in order to accomplish our objectives.

Background

As a part of the overall mission to examine the public health impact of legally induced abortion in the United States, the FPED more than a decade ago began a program of abortion surveillance (4). The abortion surveillance activities have been important in providing a national perspective on the characteristics of women who have abortions and the morbidity and mortality risk associated with abortions (5-10). Similarly, within the past decade as surgery in general and surgical sterilization in particular has emerged as an issue of public health concern, the FPED began a program of sterilization surveillance. As with abortion surveillance, it is intended that the sterilization surveillance activities will provide a national perspective on the health aspects of surgical sterilization.

Surgery is a relatively new health concern, having its major entry into the practice of medicine only after the use of anesthesia became widely accepted early in this century. Prior to the late 1960s, female sterilizations were performed primarily on the advice of a physician for medical or obstetrical conditions that would contraindicate future pregnancy or for women who satisfied the obstetrical rule of 120 (age times parity $\geq$ 120) (11). These sterilization procedures were usually performed immediately following delivery. Male sterilizations were first performed primarily involuntarily on prisoners and mental patients for eugenic reasons because it was believed that criminal tendencies and mental illness were passed on directly to offspring (12).

Today virtually all tubal sterilizations and about one half of all hysterectomies are performed not for medical reasons but at the request of a woman for a permanent method of fertility control (13). Furthermore, the procedure is no longer performed primarily in connection with a delivery (14,15). The influence of old eugenic laws of the early part of this century is gone so that male sterilization is now chosen voluntarily.

Two important points should be made before we discuss the objectives and methods of sterilization surveillance. First, most epidemiologic studies of health aspects of fertility control focus on females. Although most of the temporary methods of contraception such as the oral contraceptive pills and IUD are methods used only by females and abortion procedures are exclusively for females, sterilization is for males and females alike. On the contrary, among some population groups more vasectomies have been chosen by husbands than tubal sterilizations chosen by wives (16). Studies of health risk associated with male sterilization have, however, not revealed a level of morbidity and mortality which is recognized as a significant public health concern (17). Although our sterilization surveillance objectives include both male and female sterilization, our methods of surveillance have concentrated on learning more about female sterilization for which there is a recognized morbidity and mortality risk.

A second point to be made is one primarily of semantics. Sterility and sterilization are terms that can inappropriately be used interchangeably. Our surveillance activities are interested in surgical sterilization (tubal sterilization, hysterectomy, and vasectomy which result in permanent infertility) rather than biological sterility which can occur in males and females for a number of reasons such as age or disease. We are interested in surgical sterilization regardless of the purpose for which it is performed. For example, some surgical sterilizations are performed only for medical reasons, some only for contraceptive reasons, and some for both medical and contraceptive reasons. It should be noted that women beyond the reproductive age (15-44) can also undergo the same operations used to produce surgical sterilizations, particularly hysterectomy. Although there are health risks associated with these operations in post-reproductive-age women, the scope of our sterilization surveillance activities is limited to sterilization procedures in reproductive-age women only.

Objectives of Sterilization Surveillance

There are 4 objectives of our sterilization surveillance activities: 1) To determine the incidence of surgical sterilization, 2) to assess sterilization related mortality, 3) to assess sterilization related morbidity, and 4) to suggest ways to reduce or prevent mortality and morbidity related to sterilization.

Objective 1. The first objective is aimed at determining the magnitude and characteristics of surgical sterilization nationally. More specifically we would like to estimate the annual number of surgical sterilizations in the United States; characterize the persons having surgical sterilizations by such variables as age, race, sex, marital status, and place of residence; and

describe the surgical event by such variables as type of procedure, place of occurrence, and length of hospital stay. This first objective presents some interesting problems. Historically, case counts have been kept by the medical and public health community on many diseases and conditions, but the type of treatment (medication, surgery, etc.) or therapy used is seldom quantified. For example, while the number of persons with gonorrhea or syphilis might be reported, the number of shots of penicillin to treat the disease is not generally given attention. Furthermore, since most surgical sterilizations in the United States today are for contraceptive purposes, and are performed on healthy individuals with no disease or condition, it is even less likely that an account of such surgery is kept. An additional problem is that surgical sterilization is performed as an adjunct procedure such as tubal sterilization at the time of abortion or delivery, in which case the abortion or delivery is most likely to be identified as the prominent event. There is, therefore, no national effort to collect or aggregate national case counts of surgical sterilization performed either medically as a "treatment" or non-medically as a method of fertility control. Just as there is no national systematic count of males or females who are sterilized, there are no statistics collected for the purpose of presenting a descriptive picture of surgical sterilization nationally. Thus as the discussion later of sterilization methods shows, that epidemiologists must use a variety of data sets in an attempt to make estimates which achieve the first objective.

Objective 2. The second objective is to assess the mortality associated with surgical sterilization. This objective is focused on female sterilization since there are no documented deaths in the United States associated with non-medical vasectomy, i.e. vasectomy for contraceptive reasons. Two major problems encountered in assessing sterilization mortality are 1) the difficulties of actually identifying deaths which might be due to surgical sterilization and 2) the medical/legal problems encountered in attempting to do an epidemiologic investigation to verify that a death, once identified, is directly or indirectly associated with surgical sterilization.

The first problem, identifying sterilization deaths, stems from the fact that technically sterilization is not a cause of death. Under the International Classification of Disease system, surgical sterilization would be classified as an operative procedure and operative procedures cannot be the cause of death. Thus, the death certificate of any person whose death is directly or indirectly related to surgical sterilization would not reflect surgical sterilization as the cause of death. Furthermore, while operative procedures are usually recorded in detail on medical records they are seldom mentioned on the death certificate.

The second problem centers around medical/legal difficulties which arise when a death, alleged to be related to surgical sterilization is in litigation. This often makes it impossible to gain access to the most needed records necessary to conduct an epidemiologic investigation, such as hospital record and autopsy report.

Objective 3. The third objective is to assess the morbidity associated with surgical sterilization. Again, as with mortality, the objective is focused on female sterilization since vasectomy is simple and safe and most of the morbidity that has been noted is short term and minor (17). Surgical sterilization of females involves various degrees of risk depending on a host of factors such as the choice and complexity of the procedure, type of anesthesia used, concomitant procedures such as abortion and cesarean section and post-operative health condition(s). Because of the multiplicity of factors which can affect morbidity related to female sterilization and because of the epidemiologic complexities associated with the assessment of short- and long-term post-operative complications, CDC has undertaken a prospective epidemiologic study in cooperation with several medical facilities. It is intended that this study will help in achieving the objective of assessing morbidity associated with surgical sterilization.

Objective 4. The fourth objective of our sterilization surveillance is to identify specific factors which contribute to sterilization morbidity and mortality and to suggest how these factors might be eliminated or modified in order to reduce or prevent morbidity and mortality. From the public health perspective it is very important that both the medical community and the public at large be aware of the health risk associated with surgical sterilization so that both can make informed decisions when recommending or having a sterilization. For example CDC widely disseminated information through its Morbidity and Mortality Weekly Report (MMWR) on the risk associated with ectopic pregnancy following failed tubal sterilization (18,19). The purpose of these articles was to alert physicians to the fact that signs and symptoms of pregnancy after sterilization should not be disregarded because sterilization failures, though rare, do occur and an ensuing pregnancy has a greater probability of being ectopic with accompanying higher morbidity and mortality risk.

Methods of Surveillance

The methods of sterilization surveillance are based on the objectives of surveillance stated above, namely to determine the magnitude of surgical sterilization in the United States annually and to assess the morbidity and mortality risk associated with sterilization including factors that contribute to increased risk.

One of FPED's first major surveillance activities has been to explore data sources which might be useful in estimating the number and characteristics of surgical sterilization nationally. These national estimates will provide a basis for calculating morbidity and mortality rates when estimates of the number of sterilization related deaths and complications

are available. Three national surveys conducted by the National Center for Health Statistics have been explored as possible data sources: 1) the National Hospital Discharge Survey (NHDS), 2) the National Medical Ambulatory Care Survey (NMACS), and 3) the National Survey of Family Growth (NSFG).

The annual NHDS has proved extremely useful in determining the number of females 15 to 44 years of age who received surgical sterilization in non-Federal hospitals for each year beginning with 1970. Currently the majority of sterilizations performed on women are done in hospitals, thus the NHDS survey design includes the appropriate universe (hospital discharge records) for estimating the number of females sterilized. An analysis from the NHDS has resulted in the preparation of separate descriptive reports for tubal sterilization and hysterectomy for the period 1970-1975. The FPED published these 2 reports (20,21) and disseminated them to a broad spectrum of the health community interested in sterilization. Two similar reports on tubal sterilization and hysterectomy for the period 1976-1978 are in preparation. The intent is to publish an annual combined tubal sterilization and hysterectomy report beginning with the 1979 data.

Although most sterilizations performed on women are done in hospitals, tubal procedures are also being performed outside of hospitals in surgical clinics and physicians offices (22,23). Our surveillance activities are exploring how to best identify these clinics and determine the number of surgical sterilizations performed annually.

The preponderance of sterilizations for males, e.g., vasectomies are performed not in the hospital setting but by private physicians in their offices (24). Thus, in order to obtain a national estimate of the number of and characteristics of men obtaining vasectomies we explored the use of data from the annual NMACS which collects information from private physicians offices. Because of the wording of questions in the survey prior to 1977 it is not possible to identify specifically sterilizations performed on men. In 1977, however, the survey questionnaire was changed to allow collection of data on sterilizations for men. Unfortunately, the current sample size of NMACS prohibits making a precise estimate of the total number of vasectomies performed per year (25). If the size of the sample were increased, the data would provide a more accurate national estimate of incidence of sterilization of men.

Recent estimates of the prevalence of surgical sterilization for both males and females are available from the NSFG which is conducted periodically (1973 and 1976). The first 2 surveys mentioned measure surgical sterilization events as they actually occur and where they occur, that is, sterilization of females in hospitals or sterilization of males in offices. Information on male and female sterilization for the NSFG was obtained by personal interview from a sample of female respondents who were married, previously married or single with children of their own in the household. There is a potential for an underestimate of surgical sterilization for 2 reasons: 1) problems related both to a respondent's reluctance to discuss her own sterilization and her lack of information and reluctance to discuss her spouse/partner's sterilization (for females responding about their spouse/partner's sterilization), and 2) certain reproductive-age females are excluded from the survey population, namely all single women with no children in the household.

Another major surveillance activity has been the development of a method to identify deaths which might be in any way related to surgical sterilization, and once identified, to acquire enough information about each death to ascertain if that death was directly or indirectly associated with a sterilization procedure. Our surveillance of sterilization mortality has, as previously mentioned, been directed toward females.

One of our primary surveillance efforts has been to explore the use of death certificates to identify deaths associated with sterilizations. This was done by a retrospective and a prospective study to review death certificates. In the prospective study we asked the nosologists in 2 state vital statistics units to be set aside for a 6-month period of time each death certificate of a female 15-44 years of age regardless of the cause of death. They were then to review in detail the certificates set aside for any mention of surgery that might have produced surgical sterilization. The results of this prospective study made it clear that either sterilization mortality is too low to detect with the small number of certificates reviewed or the death certificates do not usually have any indication of surgical sterilization.

At the same time a retrospective study was done with the cooperation of 2 other state vital statistics units to see whether reviewing selected categories of deaths would identify those associated with surgical sterilization. For this study a list of all nonviolent deaths (excluded homicides, automobile, and other accidental deaths) and noncancer deaths was produced containing all data on the certificate of females 15-44 years of age who died in the study year. This list from each state was reviewed by an epidemiologist with special attention to cause of death. The death certificates for selected deaths which might have resulted from a surgical procedure were pulled and reviewed. Again we found that either the mortality due to surgical sterilization is too low to detect in our limited study or surgical sterilization is not recorded on the certificate. Thus we concluded from the 2 studies that identification of sterilization-associated deaths directly from an ongoing surveillance which relies either on retrospective or prospective death certificates was not feasible.

Other surveillance activities related to identification of sterilization-associated deaths have centered around the use of hospital records. Three studies have been or are currently being done--one using national sample data from the NHDS, another using data from hospitals associated with the Commission on Professional and Hospital Activities, and

another using hospital-care data from one state which has 100% reporting of hospital discharges to a state health department data system.

While the NHDS has proved extremely useful for obtaining an estimate of the number of women surgically sterilized per year, a study we conducted using NHDS data showed that it could not be used either for a national estimate of sterilization mortality or identification of sterilization-associated deaths specifically. The sample size was too small to make reliable estimates of the number of sterilization deaths nationally, and confidentiality restrictions placed on the use of the data prohibits disclosure to CDC of identifying information which is necessary to confirm the data.

We have now undertaken a study with the cooperation of CPHA and PAS hospitals which should determine whether or not an ongoing surveillance of sterilization mortality is feasible based on routinely collected hospital discharge abstracts reported to CPHA. In this study we sought permission for a CDC epidemiologist to review medical records from all hospitals that had had a possible sterilization death within the 2 year period 1977-78 (as determined from the CPHA data file). This review should verify the occurrence of a sterilization-associated death and provide descriptive epidemiologic information. The shortcoming of this surveillance effort, even if the study shows that CPHA data can be useful, is that hospitals included in CPHA do not necessarily represent a national cross-section of hospitals so that statistical inference nationally would not be possible.

To determine the completeness of coverage of sterilization mortality in a state for 1 year, we chose a large state which has both 100% reporting of hospital discharges from all hospitals and an ongoing thorough review of maternal deaths that should identify sterilization deaths to postpartum women even after discharge from the hospital. The result of this more detailed look at identification of sterilization-associated deaths in 1 selected state is not complete.

For the years 1974-1978, CDC in cooperation with the state health departments is conducting an indepth study of maternal deaths based on review of death certificates, autopsy reports, and other medical records. When the study is completed, we hope to have an epidemiologic perspective of maternal mortality nationally. Although not the purpose of the study, for the 5-year period we should also gain a better view of mortality related to sterilization performed in connection with abortion and delivery.

Currently, one of the most valuable sources of information on sterilization-associated deaths has come from informal reporting of deaths to CDC by physicians and other interested persons in the health community. More than half of deaths identified for epidemiologic investigation since 1978 have been reported informally. In order to make our interest in sterilization mortality more widely known, we have asked several national groups and organizations and state health departments for their assistance. FPED staff have made presentations before the National Association of State and Territorial Maternal and Child Health Directors, the Association for Voluntary Sterilization, and the American Association of Gynecologic Laparoscopists, and other groups specifically asking their members to notify CDC of any suspected sterilization-associated deaths. Also, the first Tubal Sterilization Surveillance Report was mailed to all members of the American Association of Gynecologic Laparoscopists, the Association for Voluntary Sterilization, and Fellows of the American College of Obstetricians and Gynecologists along with an accompanying letter asking that members of these organizations notify CDC of any sterilization-associated deaths from 1978 on that might have come to their attention.

Additionally, in 1979 the FPED sent a letter to the Director of Maternal and Child Health in each state health department enlisting their cooperation in our surveillance activities. We asked for specific suggestions on how to best identify deaths associated with sterilizing procedures especially those that are related to the postpartum period since the investigation of postpartum deaths comes under the direct purview of directors of maternal and child health.

Our third major surveillance activity has centered on assessing morbidity resulting from surgical sterilization. We recognized at the outset that the assessment of morbidity would require a thorough epidemiologic study in order to deal with the problems of the definition of a case, definition and classification of complications, standardization of clinical information, and obtaining follow-up data.

Our first morbidity study conducted with the cooperation of 3 hospitals was primarily a retrospective review of medical records in order to determine who had had surgical sterilizing procedures and to abstract relevant clinical data. The results of this study led us to conclude that reliance on retrospective record review was not sufficient for doing a precise epidemiologic analysis of complications because of 1) difficulties in determining just who actually had a surgical sterilization, 2) difficulties in locating necessary medical records within the hospital, 3) missing or inadequate information from medical records, 4) lack of comparability of clinical data among the participating institutions, and 5) problems of locating women for follow-up.

Based on our experience with the retrospective study we designed a prospective study with a 2-year follow-up period. This study collects 2 sets of detailed clinical and epidemiologic data--one on women having tubal sterilization procedures and another on women having hysterectomies. We are in our second year of data collection. The study, though not designed to allow statistical inference of complication rates to a larger population of reproductive-age women, will be the largest data set specifically designed to identify both short- and long-term complications in a group of women who undergo surgical sterilization. Furthermore, the study will help to determine

factors which contribute to sterilization morbidity.

SUMMARY

In summary, CDC recognizes the need for establishing a clear epidemiologic perspective of surgical sterilization in the United States. We have begun on several fronts to establish ongoing surveillance of the magnitude of surgical sterilization and of the morbidity and mortality associated with surgical sterilization. We are still examining different surveillance methods to determine which would be the most useful in the long term and are continuing to seek assistance from public health and medical groups which can provide insights on how to best improve our surveillance methods.

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Statistical Approach to Health Promotion

Concurrent Session O

OBJECTIVES FOR THE NATION IN HEALTH PROMOTION AND DISEASE PREVENTION AND REQUIREMENTS TO MEASURE OUR PROGRESS

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The Public Health Service has conducted a series of formal steps in developing consensus on national objectives for disease prevention and health promotion. Quantifiable objectives have been set for 1990, and in some cases, for earlier years. To track the Nation's progress toward these objectives over the 10-year period requires systematic monitoring and surveillance. New data are required in many instances. Some of these new data can be obtained through minor additions to existing national health surveys and State registration systems. Some, however, will require new surveys and new recordkeeping systems. This paper will illustrate specific data requirements for the decade and will identify sources in government agencies and the private sector for the data required to monitor our progress toward the goals for the Nation in disease prevention and health promotion. Some concerns with the quality of data available from prospective sources will be examined.

Description of the Objectives for the Nation

The approximately 200 objectives generated from the systematic reviews and comments received following the June 1979 conference in Atlanta were grouped under each of the 15 priorities in health promotion, health protection and preventive health services:

ACTIONS FOR HEALTH

Health Promotion
- smoking cessation
- reducing misuse of alcohol and drugs
- exercise and fitness
- stress control
- improved nutrition

Health Protection
- toxic agent control
- occupational safety and health
- accidental injury control
- fluoridation of community water supplies
- infectious agent control

Preventive Health Services
- high blood pressure control
- family planning
- pregnancy and infant care
- immunizations
- sexually transmitted diseases

The implied hierarchy of objectives can be seen as a causal chain of events and outcomes that must be achieved in order to accomplish the broad goals outlined in the Surgeon General's Report on Health Promotion and Disease Prevention. There were five categories of objectives for each of the 15 areas: (1) improved health status; (2) reduced risk factors; (3) increased public/professional awareness; (4) improved services/protection; (5) improved surveillance/evaluation systems. The approximate relationships among the objectives are shown in Figure 1, omitting the set of objectives for improved surveillance and evaluation systems.

Figure 1. Structure of the Objectives for the Nation in Disease Prevention

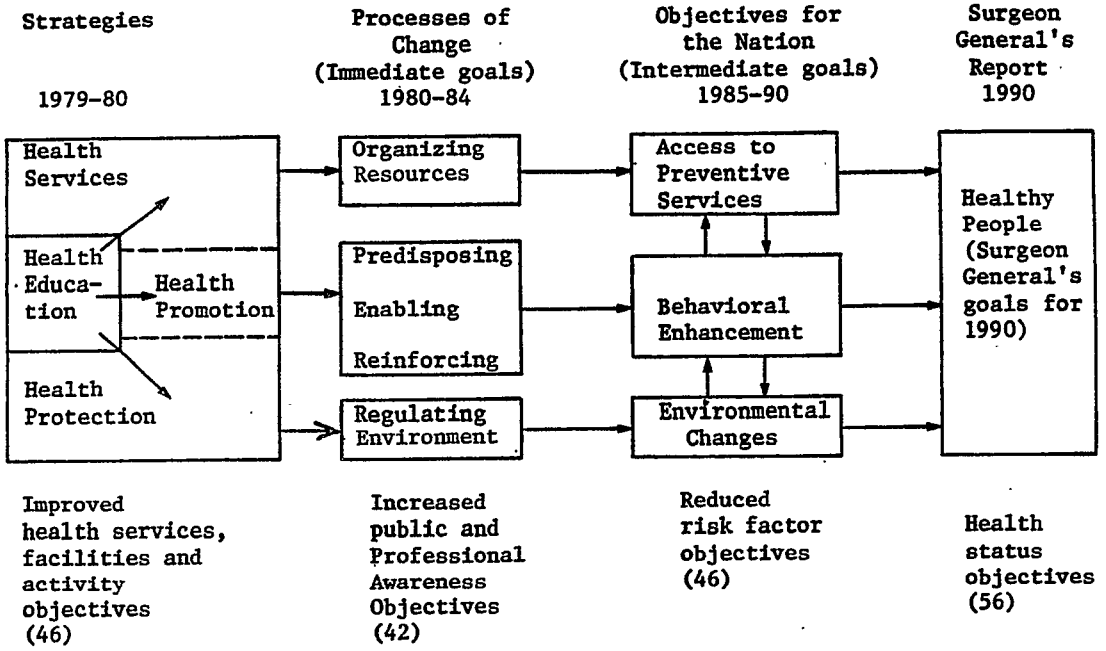

Table 1. Number of Currently Measurable and Non-Measurable Objectives by Type of Objective Group*

Current Measurability Status	Objective Group				Total
	Health Status	Reduced Risk	Increased Public Awareness	Improved Services/ Protection	
Measurable 7/80	50	35	4	23	112
Not measurable 7/80	6	11	38	23	78
TOTAL	56	46	42	46	190

*Not including objectives in Improved Surveillance/Evaluation Systems.

Objectives are stated in several ways. Most are expressed as an absolute reduction in a rate, e.g., "By 1990, the fertility rate for 15 year old girls should be reduced to 10 per 1,000. (In 1978, there were 14.2 births per 1,000 for this age group.)" Others are expressed as an absolute reduction in a number, e.g., "By 1990, the incidence of compensable occupational dermatitis should be reduced to about 60,000," or call for the complete elimination of a hazard, e.g., "By 1990, there should be virtually no preventable contamination of ground water, surface water or the soil from industrial toxins associated with waste water management systems established after 1980." Finally, goals relating to improving data sources are not quantifiable, e.g., "By 1990, data should be available with which to evaluate the short and long term health effects of participation in programs of appropriate physical activity."

Some terms used in the objectives statements will require more precise definition before they can be quantified, e.g., (in stress) "By 1990, stress identification and control should become integral components of the continuum of health services offered by organized health programs."

Types of Data Systems

Many types of existing data systems have been proposed to be used in the tracking of the prevention goals. The range of possible data systems includes (1) regulatory or quasi regulatory systems such as those operated by the Food and Drug Administration (FDA) or the Environmental Protection Agency (EPA) and suggested to be used in the area of toxic agent control; (2) surveillance and monitoring systems, such as those established by the Center for Disease Control (CDC) for sexually transmitted diseases, infectious diseases and the monitoring systems in EPA; (3) population based surveys such as the National Institute on Drug Abuse's biennial national survey on drug abuse, and the National Center for Health Statistics' (NCHS) Health Interview Survey and Health Examination Survey; and (4) data systems based on records, either a sample of records, such as the National Ambulatory Medical Care Survey and Hospital Discharge Survey of the NCHS or a complete count of records as in the birth and death registration systems. Some of these record-based systems use administrative data, such as the Medicare claims and enrollment files.

Most of the data systems proposed for tracking goals are Federal systems, as shown in Table 2. Some are aggregations of State data such as the Vital Statistics Registration System. A few are in the private sector, such as the data from the Professional Activities Survey of the Commission on Professional Hospital Activities, but projections to a larger area or population are questionable.

Surveillance systems based on voluntary reporting, or at least not enforced reporting, of all events of a given kind such as the CDC reporting systems for sexually transmitted diseases or the childhood illness reporting systems are also operational.

Table 2. Agencies and Organizations Constituting Actual and Potential Sources of Data for Tracking - July 1980

Type of Agency	Number of Agencies	Current Source of Data # of Objectives	Potential Source of Data: Via add-on to existing surveys, surveillance or administrative record systems Estimate # of objectives	Potential Source of Data: New systems required Estimate # of objectives
Federal Agencies				
o within DHHS	12	131	100	5
o other	8	18	10	10
State Licensing				3
Private Organizations	11	1	29	5
Public Opinion Poll Organization	10		15	—
TOTAL	41	150	154	23 (at most)

NOTE: For some objectives, more than one source of data is available and needed. Therefore, the number of data sources does not tally with the total number of objectives.

The types of data sources for the currently measurable objectives of the four levels of process and outcome are shown in Table 3. There is a heavy reliance on administrative records and surveillance systems as sources of data for the health status objectives, particularly the National Vital Registration System's death statistics from NCHS and the Morbidity and Mortality Weekly Reports of CDC. The risk reduction objectives lay heavy reliance on surveys, whereas the improved services measures derive about equally from surveys, surveillance and administrative records.

The prospective data sources for the currently unmeasured objectives are shown in Table 4. Most of these objectives can be measured or tracked through survey questions.

Table 3. Characteristics of Data Collection Sources for Tracking Currently Measurable Objectives: By Objective Category and Number of Objectives

Collection Characteristics	Objective Group*				
	Health Status # of objectives	Reduced Risk # of objectives	Increased Public/ Professional Awareness # of objectives	Improved Services/ Protection # of objectives	Total Objectives measurable
Number measurable objectives	50	35	4	23	112
Number objectives measured by:**					
Survey	13	20	4	9	46
Surveillance systems	27	5	--	7	39
Administrative record reporting	17	10	--	8	35

*Excludes the objectives in the category: Surveillance and Evaluation.
**Numbers not additive since some objectives are measurable via more than one system.

Table 4. Characteristics of Potential Data Collection Sources for Tracking Currently Unmeasured Objectives: By Objective Category and Number of Objectives*

Collection Characteristics	Objective Group*				
	Health Status	Reduced Risk	Increased Public/ Professional Awareness	Improved Services/ Protection	Total Objectives
Number of objectives not now measurable	6	11	38	23	78
Number of objectives potentially measurable by:**					
Survey	7	5	12	16	40
Surveillance systems	4	2	2	5	13
Administrative record systems	2	2	6	7	17

*Excludes the objectives in the category: Surveillance and Evaluation.
**Numbers not additive since some objectives are potentially measurable through more than one system.

Specific Problems with Trend Data

The tracking of most of the health promotion objectives will be based on data collected by interview, either self-administered, personal interview, or telephone interview. Goals for smoking, drug abuse, stress, nutrition, family planning, and hypertension all require at least some interview data on personal health behavior or public and professional awareness. Under existing data systems such data are collectable, with the behavior data generally easier to collect and interpret than the knowledge data. Knowledge data are required to measure progress toward the goals in nutrition, hypertension and stress. Questions on knowledge are particularly sensitive to precise questionnaire wordings. The NCHS' Health Interview Survey has done little in measuring knowledge in past surveys, but will probably move in this direction in the future.

Trend data on health behaviors are easy to collect, but the stability of questions repeated over a number of years is jeopardized by several factors. The state-of-the-art in survey methodology continually advances, or at least we think the changes are advances, and it is very difficult if not impossible, to resist applying these advances to later surveys, thus affecting comparability. Even if identical question wording can be maintained other factors subject to change include: the context in which the questions are asked, interviewer training, instructions, sample design, coding, editing, data processing errors. All of these can effect comparability. Questions on cigarette smoking have become somewhat standardized over time, but as the emphasis changes from investigating the relationship between smoking and health to studying more detailed aspects of changes in smoking behavior itself, it is easy to foresee efforts to "improve" question wording on smoking habits, again affecting comparability. There is little consensus on what standard questions to ask for alcohol consumption, although serious efforts are under way in this area.

While the problems of comparability are most at issue with interview survey data, other trend data are not immune from those problems. For example, in the measurement of blood pressure in the Health Examination Surveys there were differences in procedures between the first survey of adults and the later surveys. Periodic changes in the international classification of diseases can result in some comparability problems, although efforts are made to keep them to a minimum. A positive result of the recent 9th revision of the international classification is the addition of more specific diagnostic categories for sexually transmitted diseases which will permit better monitoring of these diseases. The 10th revision will probably be instituted in the late 1980s.

Definition Differences

Occasionally multiple data bases which collect similar information can be used as baseline data to establish objectives and to set goals. Compatibility of variables assumed to be similar must be studied. Several of the occupational injury objectives, for example, are focused on the reduction of workloss days due to injuries. Two data sources are frequently used for this measurement: the Bureau of Labor Statistics (BLS) data based on reports from industry and data from the Health Interview Survey (HIS). Both of these sources are used in National Safety Council reports. While both BLS and HIS use the measure "workloss days," the BLS definition includes only days lost from work beyond the day of injury, while the HIS definition includes any day on which at least half of a normal work day is lost. The impact of such definitional problems may be less significant than other aspects of the two data bases, such as how the data are collected, e.g., records versus interviews, but definitional differences add confusion and complexity to analysis of data.

Evaluating Systems

An interesting problem arises in the process of evaluating the usefulness of sample survey data for monitoring goals, as opposed to other types of data. Large statistical data systems based on probability samples usually are accompanied by very detailed descriptions of their methodology, indicating both the strengths and limitations of the data derived from such systems. These limitations are often not described for some of the less rigorous data gathering mechanisms. There is a tendency, when data systems are compared, to emphasize the limitations of a data system when they are clearly acknowledged, but to overlook limitations of other systems when they are not clearly identified.

Measuring Incidence

The need to develop systems for measuring and monitoring the incidence of selected diseases, such as hypertension, or conditions related to certain toxic agents will not be easily met. It was probably well that many of these goals were stated in terms of developing the measures rather than reducing incidence. Incidence, that is the number of new cases of disease over a given period of time, requires information on the onset of the disease as well as the population at risk. Onset information is difficult to obtain in interview data and often does not exist in record data. When data from physician and hospital records are used to measure incidence it is also necessary to make adjustments for persons who go to multiple sources for their medical care. Also a distinction must be made between new cases of a disease and newly diagnosed cases. The need for improved measures of incidence has also been recognized by the National Center for Health Statistics and has been given an increased priority as a result of their new responsibilities in relation to environmental health.

Converting National Goals into Subarea or Subgroup Goals

National data bases exist to track many of these goals, but if the goals are to be tracked for smaller geographic areas, such as a state or HSA, or for subgroups of the population, such as specific minority groups, data are often not available, neither baseline data nor trend data. The major exception is the birth and death data from vital records, but even here, up to date population data for the denominators are rarely available for particular subgroups or geographic areas for intercensal years. In addition, the relatively small number of certain events, such as maternal mortality, in a small geographic area make the application of percentage reduction goals questionable.

Surveillance systems have been and will continue to be used to track certain diseases and processes. A number of these systems have been

developed by CDC and have been in operation for many years such as those in sexually transmitted diseases and for some of the childhood diseases. It is necessary, however, to evaluate the completeness of reporting in these systems since they are frequently based on voluntary reporting. Sources participating in these systems may include all providers of medical care, as in the case of certain reportable sexually transmitted diseases or from a limited number of sites such as labs or clinics. The sites may or may not have been selected as a representative sample of all such sites. Data derived from these systems are published as "reported" cases of; for example reported cases of gonorrhea or of measles.

These types of data pose several problems when used to monitor objectives. First, the proportion of cases that are reported may vary by the type of disease and perceived significance of reporting. Many physicians do not report childhood diseases through the appropriate public health channels. In fact it has been estimated that as few as 1 in 10 measles cases are reported. Data from probability sample surveys such as the Health Interview Survey and the CDC United States Immunization Survey both indicate a marked underreporting of measles by the surveillance system. While the actual level of reporting in the surveillance system is often considerably lower, the trend patterns are usually very similar between the sample data and the surveillance data. Both the surveillance and the survey data identify periods of increased activity.

There is a danger, however, that the surveillance "reported" cases will be interpreted and used as total incidence and then used to monitor progress toward a goal. This appears to be happening with the program to eliminate measles by 1982. Figures used to monitor progress have been the reported cases, which are markedly lower than both estimates from population based surveys as well as estimates from samples of physician office visits, such as the National Ambulatory Medical Care Survey.

A second problem that can arise is the possibility that the level of underreporting in a surveillance system can change over time. As more public attention is given to a specific disease, e.g., through a major prevention program, the completeness of reporting can improve. Therefore, the data used to monitor progress will show increased levels of incidence, when in fact there is only an increased proportion of the actual cases being reported. The greater the degree of underreporting, the greater the potential for this to occur.

Future Data Plans

Several new developments should be mentioned. First the National Center for Health Statistics is developing the capability to conduct telephone surveys primarily through the use of random digit dialing sampling techniques. This would open up the possibility to collect certain health behavior and health knowledge data from national samples on a periodic basis. They have been conducting for the Office of Health Information and Health Promotion a national telephone survey of personal health habits and health consequences.

The Center's National Death Index is a potential data source in toxic agent control. This data system or more precisely, research tool, will be available by the end of 1981 with a user's manual available soon. The first year of data will be 1979. This index will assist researchers in determining if persons in a study sample have died in subsequent years.

There is a need for monitoring pregnancy and infant care objectives to match birth and infant death records. Efforts are now under way at the National Center to conduct a pilot study of this process. Most States already have at least a numerical match between these two types of records, so the next step of actually linking the data should not be too difficult.

The Center's National Survey of Family Growth will provide much of the tracking data for the family planning objectives. This survey is being conducted again in 1980 and is projected to be repeated about every two years. While the past surveys have been restricted to evermarried women or single women who have offspring in the household, the 1980 and future surveys will sample all women ages 15-44, and place a special emphasis on teenagers and unmarried women.

The family planning objectives also reflect the need for socioeconomic status data for births. The new National Natality Followback Survey conducted by the Center in 1979 will provide such data for a sample of 8,000 birth records for this one-time survey. In addition, the National Fetal Mortality Survey will study 6,000 fetal deaths of 28 weeks gestation or more.

Several of the objectives require data collected in HANES, for example, data on dental caries, height and weight, obesity, and hypertension. The need for such data should be formally communicated to the Center for use in planning future HANES surveys.

The Health Interview Survey will continue to collect data on cigarette smoking and questions on alcohol consumption will soon be added.

To stimulate the needed attention to analysis of existing data files, the Office of Health Information and Health Promotion is sponsoring a series of seminars for investigators around the country, and is co-sponsoring a grant program with the National Center for Health Services Research to support secondary analyses of existing data sets.

Conclusions

1. The large number of agencies (41) already collecting or compiling national data on the approximately 110 measurable objectives, or postured to get measures on another 80 by adding to their surveys, surveillance or administrative record systems, will make monitoring progress over the decade a highly political and sensitive task of organization and coordination, especially with limited new money available to offer them.

2. The majority of immediately available statistics tell us about the final end-products (the health status objectives), the last figures likely to be affected by prevention programs. The least available data are on the more immediate outcomes, the public and professional awareness and risk reduction behavioral objectives. These will require immediate attention in the government's monitoring and surveillance systems and national surveys.

3. The majority of currently unmeasured or unavailable objectives are ones that most readily can be tapped by adding items to existing surveys

or adding new surveys. Survey methodologies and their financing will likely become major concerns of the Public Health Service in the years ahead.

4. Numerous problems of comparability, definition, measurement procedures and analytic strategies remain to be worked out in the process of mounting the tracking systems to monitor our progress toward the 1990 Objectives for the Nation in disease prevention and health promotion, but we are not starting from scratch; much progress in filling the gaps is already evident.

ENHANCING THE USEFULNESS OF HEALTH DATA: A CASE FOR LOCAL DETERMINATION*

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On a clear day Mt. St. Helens is visible from my office. Living near an active volcano can alter your perspective on the future. If the reader detects a note of determined pragmatism in this paper, the occurrence is more than coincidental.

The theme of this conference is new challenges for vital and health records. One of those challenges, in my view, is to improve the working relationship between the National Center for Health Statistics (NCHS) and those operating programs in the field at state and local levels. This is necessary so that more useful data are produced and a constituency developed which will support the collection of, analysis and distribution of, health data as required functions, particularly when resources are scarce and difficult choices need to be made.

The subject of this paper is a discussion of one way to improve the working relationship between NCHS and state level health data programs. The central thesis of this paper is: The federal government can increase the value and usefulness of health data by allowing and encouraging states to use federal funds to meet data needs as states determine them rather than as determined at a national level, thereby increasing the ability of states to directly meet the needs of local users of health data. The experience of Washington State forms the basis of the paper's conclusions.

In its final report, the panel evaluating NCHS's Cooperative Health Statistics System recommended a long term funding plan with the objective of providing basic assistance to essentially all states by 1985. The panel further recommended that direct federal support of state agencies should take several forms: (1) a fixed amount per state to develop a basic competence and to bring all states to some minimum level of capability, (2) an additional matching grant based on population and perhaps other factors unique to each state in order to encourage states to develop their capability above this basic level, and (3) contracts to purchase data on an agreed upon unit rate.

The first two of these funding sources is particularly important because they provide a state with flexibility in how it uses its resources so it can better respond to needs of particular users within the state. The availability of limited amounts of federal funds to be used by each state to develop a critical mass of data resources is a major factor in the maintenance of state data capability. The importance of being able to design data systems and control their application at a state level is perhaps best seen by examining the use of health data.

When asked to give several examples where the Washington State Center for Health Statistics (State Center) was instrumental in improving decision-making through the use of health data, the staff of the State Center responded with three cases. The first dealt with pharmacists. The Center had completed a survey of pharmacists and issued a report, Pharmacists in Washington, 1977. At the same time, a joint Committee on Schools of Pharmacy had been formed to study pharmacy education in the State. As a result of reviewing a combination of information including, (1) an intensive analysis of survey data, showing characteristics of pharmacists by school of graduation, and (2) available data on school records and population projections; the Committee concluded that there was no need for the State's School of Pharmacy to expand and, in fact, the Committee recommended that they cut back on enrollment in the future. To continue their existence, the schools of pharmacy are now considering more emphasis on continuing education programs. The Committee was able to reach these conclusions with the assistance of Center staff, who helped by interpreting the survey results and commenting on the survey findings. In short, had the Center staff lacked the capability to assist in this manner, it is unlikely that the survey information would have been as useful to the Committee. In fact, it is possible that the existence of the information would have been unknown to the Committee. Publication of survey findings can be of assistance, but the analysis and interpretation of those findings for users having particular needs can be of even greater value. University of Washington staff are currently analyzing dentist, physician, and registered nurse data using the same methodology as with the pharmacist data.

The second example Center staff provided related to physical therapy. Researchers at the University of Washington were working on a physical therapy project trying to determine if a regional physical therapy program should be established similar to one that had been earlier developed for physicians. They reviewed summary statistics from a 1978 physical therapy survey the State Center had conducted and prepared a questionnaire for mailing out to physical therapists licensed in five northwestern states. A joint survey by the University and the State Center was suggested to eliminate costly duplication and to increase response rates. The University team declined because of a perceived difference in objectives over the two surveys and other complications. Through a series of meetings where survey results were discussed in detail and with the assistance of the Region X data coordinator, the University group was convinced that one survey could serve their purposes.

As a result of doing the survey jointly, the total savings has been $2,500; more importantly than dollar savings, have been the advantages that have come about through cooperation and the interchange of ideas. Physical therapists were not asked to answer the same questions twice. Based on their experience with the Washington State Center, the University contacted the Oregon Center and arranged to have their survey of Oregon physical therapists run concurrently. Advice from the University team on

* Presented in place of Dr. Dever's presentation

changes in survey wording was accepted at the State level and favorably received at a national meeting. In exchange, Washington State Center staff were able to provide the University group with advice on coding and layout of their survey form and hints to make computer processing of the surveys easier. Most important in all of this interchange was the flexibility State Center staff had to modify their position to meet a local need. If the format of the State's survey had been unduly restrictive, the University of Washington would have had just cause to do their own survey, resulting in added costs and inefficiencies.

Separate surveys at times will be justified but State Center staff should have the capability and commitment where joint surveys are appropriate to make them a reality rather than always allowing constraints and conditions to overpower more important criteria such as reason and economy. The need for consistency and comparability are often used as reasons why more flexibility cannot be exercised in the design of surveys and other information. As a result of the Washington Center staff being responsive to the University staff doing the physical therapy study and the Oregon Center being willing to modify their forms so that it more closely resembled Washington's, the data were more comparable from state to state. A slavish adherence to an existing format would in this case have worked against consistency.

The last example concerns a statewide inpatient orign study conducted in the spring of 1977. This study was the joint effort of several organizations. The State Center was responsible for design of the study and the survey form, collection and editing of the data, and preparation of the data tables. The Washington Office of State Health Planning and Development conducted the majority of the data analysis. The State's four Health Systems Agencies provided advice on what information was needed. Cooperation of hospitals in the State was essential to completion of the study.

Without this cooperative effort, the possibility of a statewide study being conducted would have been very remote. Any localized patient origin studies conducted by individual health systems agencies or groups of hospitals would most likely have been minimally useful for statewide health planning because of the probability that data item identity or definitions, or the time frames involved, would not have been comparable.

This study, which provided an outline of where the State's residents seek hospital care, has proved to be extremely valuable to a number of agencies, institutions, and organizations throughout the State. To assist the planning function, this study provided the basis and foundation for the development and use of a population-based hospital bed projection methodology. This methodology is unique compared to previous projection methodologies used in Washington State as it accounts for travel patterns of residents by using the patient origin study and allows for specific adjustments in use rates, market shares, and population to meet localized situations, plans, and policies. Such a dynamic methodology would not have been possible without an extensive patient origin study. The study has also been used by individual hospitals and hospital consultants in the preparation of long-range plans and in applications for Certificates of Need. It has been used to analyze facility market shares and to determine where gaps in service exist for inclusion in these plans and applications. Health systems agencies have used the study not only for developing hospital bed projections, but in analyzing patient flows, determining where shortages exist, and proposing specific strategies and actions in their plans to address shortages or surpluses of service. Thus, the patient origin study is an example of multiple data collectors combining to meet the needs of multiple users. Another patient origin study is currently underway with the State to update the 1977 data. The State Center role is more limited this time; the general format and approach having already been determined.

These three examples point out the need for the State Center to have flexibility in carrying out its mission. Cooperation and flexibility are not only conducive to collecting useful data and maximizing the usefulness of data; in many cases they are necessary for these activities to take place at all. Data users are more likely to cooperate with a State Center if they find it responsive to their own needs and have positive experience where they receive useful data or assistance. Since it is not the intent of a State Center to be responsible for all data activity, there has to be a willingness to adapt to surveys already in progress or commitments already made. There should be a willingness and ability on the part of the Center to adapt and change their methods. Concern over consistency should not be allowed to become a hobgoblin, overshadowing all other factors. Highly consistent data, establishing trends over many years, is only of value if users need information being collected. Compromise is essential if a State Center is to gain a constituency.

The current requirements under which State Centers are funded restrict and inhibit the kind of flexibility being suggested in this paper. Fixed contracts requiring specific data items do not provide the latitude State Centers need if they are to gain recognition and be viewed as valuable at the state and local level.

A portion of the federal funding provided to states for health data support should have these specifications:

1. The funds would be of sufficient amount to bring all states to a minimum basic level.
2. The funding mechanism would allow states to collect and analyze those data determined to be useful at a local level.
3. Data needs would not be required to be anticipated in advance. Some funding could be used in reserve to support data needs as they are identified.

Recognizing that Congress has neither the intent nor ability to provide funding to states without expecting some accountability, I would suggest that the federal government require the

following of organizations receiving funding as described above:

1. Documentation as to the process used to determine data needs.
2. A survey of data users to determine from them the value and responsiveness of the State Center.
3. Assurance that staff were able to analyze and interpret data as well as collect it.
4. Clear and understandable presentations of data so that the general public is aware of the information's significance.

Some may argue that in time of restricted funding, the federal government should be imposing more controls, not less. It is my contention that it is as much in the federal interest as it is in the State's interest for a portion of federal data support to be used in a flexible manner. To assume that this is a state responsibility could mean that some states would never achieve a basic capability in this area.

The progress and success of the Cooperative Health Statistics System has been measured in the past by the number of states having one or more data components. As we are finding, the only real security comes from having a program which is viewed as worthwhile by those needing its services.

1 Directions for the '80's: Final Report of the Panel to Evaluate the Cooperative Health Statistics System, Moshman Associates, May 1980, Washington, D.C., p.ii.

2 Pharmacy Study: W. Read and P. Diehr, unpublished results. 1979.

3 Physical Therapy Study: J. McMillan, A. Hinrichs, and S. Atwater, University of Washington, Physical Therapy Manpower Survey, Northwest Region, unpublished results. 1980.

4 Patient Origin Study: 1977 Patient Origin Study conducted by the Washington State Department of Social and Health Services, in conjunction with the State's four Health Systems Agencies and the Washington State Hospital Association.

STATISTICAL REQUIREMENTS OF A SHIFT IN EMPHASIS FROM ILLNESS TO WELLNESS: A NEW WAY OF LOOKING AT NATIONAL HEALTH CARE RESOURCES

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The program for the 1980 Public Health Conference on Records and Statistics gives emphasis to what most of us would perceive to be an increasing concern for the promotion of positive health behavior and the prevention of disease in national health policy. It is the presumption of those who have organized these sessions that such a policy shift will have implications for the collection of national statistics on health care resources (especially health personnel and health care facilities).

Having worked for several years toward the development of the health manpower and health facilities components of the Cooperative Health Statistics System (CHSS), and having been involved with a major private foundation in the development of a national program of community-based health promotion activities (that is, having worked in both arenas: health promotion and health statistics), I am personally somewhat surprised at the sudden degree of attention to the statistical aspects of these health promotion programs. Although I can agree that a policy shift is occurring, I fail to see what has brought so much statistical attention to this set of emergent issues at this time. There is something of a "bandwagon" appeal to the health promotion theme which is of potential importance in view of the unfinished statistical agenda which seems to have been set aside in recent policy decisions related to the development of the Cooperative Health Statistics System (CHSS).

This fascination with the new emphasis on health promotion reminds me of a story told by a former Lieutenant Governor of our State. As the story goes, former Lt. Governor Pat Taylor was strolling down Main Street in his home town of Wadesboro, North Carolina when he met a friend leading a common hound dog with a rope around his neck.

"What in the world are you doing with that hound dog in town, Josh?" he asked of his friend.

"Why, don't you know? There's a dog show going on over at the high school gym, and I thought I'd enter her."

"Well, you know she hasn't got a chance of winning anything," said Taylor. "All those dogs down there are thoroughbreds, and they've got pedigrees and papers to prove it."

The friend's response was straight to the point: "Of course I know that. She won't win any blue ribbons, but just think of the contacts she'll make!"

Somehow I feel that those of us who work with health personnel and health facility statistics really doubt the utility and relevance of our concern for this effort to develop national programs in health promotion/disease preventiion . . . but, we seem to feel that so long as the emphasis has shifted, we need to make our presence felt in this new arena anyway. After all, this may be a new way to justify what we've been working on all along.

I'd like to examine the nature of the policy shifts we think are occurring in order to better understand the nature of the shifts themselves and their implications for health statistics programs. Then, I'd like to suggest certain directions in which health personnel and facility statistics systems may have to move if they wish to make their work relevant and useful to the emerging policy issues in health promotion/disease prevention.

The Nature and the Extent of the Shift in Policy Emphasis from Illness to Wellness

The health promotion/disease prevention movement is reflective of at least two major paradigm shifts. The first of these concerns the way in which we account for the causation of disease and the status of "health." The second concerns the way in which we conceptualize efforts to improve health status.

In terms of theories of disease causation, we have seen a shift away from the doctrine of "specific etiology" (Dubois, 1959) and other single-factor theories to multi-causal explanatory models. More importantly, in recent years we have seen an increasing emphasis on the social factors in disease causation. Among the social determinants of health and illness are the choices made by individuals and groups with respect to lifestyle that present risks to health or protection from disease. We have now begun to view health status as, in part, a result of voluntary risk taking in personal behavior and lifestyle choices (Veatch, 1980).

The magnitude and significance of these changes can be appreciated if one recalls the period from the mid-1960's to the latter part of the 1970's. During that period it was a national health priority to guarantee equitable access to personal health care services, especially primary health care. In order to develop programs for the attainment of these social goals and in order to measure our progress in their attainment, arrangements had to be made for the collection of national, state and local statistics on the supply, characteristics and distribution of health personnel and physical facilities.

Throughout the 1970's and to the present time, many of us worked with a determination and spirit of cooperation rarely observed in intergovernmental relations to bring about a national system of inventory statistics of value for social planning, analysis and program development. But as the 1970's drew to a close, the political demands for unhindered access to medical and other health care services began to diminish as policy analysts and Congressional committees became convinced that the problem of access to primary health care services had disappeared as a result of an apparent oversupply of physicians, dentists and other health personnel.

Prior to the end of the 1970's, there was an apparent assumption that health care resources were a critical indicator (or predictor) of health potential among the populations served. As the decade ended, there was widespread doubt that the availability of health personnel or facilities could guarantee health status or demonstrable health benefits. Not only were there questions about the relation between health service/resources and health status, but these questions were raised by groups not previously known for their anti-health care points of view. We were accustomed to the political rhetoric of the New Left and the medical nihilists like Rick Carlson (1975) and Ivan Illich (1976). We were familiar with the critique of the health and medical care system offered by such authors as Barbara and John Ehrenreich (1971) and Vincente Navarro (1976). But we were surprised by the arguments and forcefulness of the critique offered by American corporate management and the leadership of the trade union movement. Despite the claims of the American health industry that the quality of health care available in this country was unequaled by that available anywhere in the world, labor and management leaders were disturbed that the rate of inflation within the health care sector was requiring nearly 10 percent of Gross National Product without a clearly demonstrable effect on the health of the American people. Even though amazing technological progress in health and medical care had been recorded, there were widespread claims that acceptable and satisfactory health services for the "ordinary" health and medical care problems of most people were not being adequately attended to by this vast medical care industry and precious little effort was seemingly devoted to the prevention of disease and the promotion of positive health. Nevertheless, we observed that we had managed to construct, over a period of thirty years, a vast health professional educational system in this country which left us with a tremendous capacity to educate additional health personnel who might not now be in such critical need as they were when these facilities and programs were developed.

These shifts from a concern with ensuring access to basic health services to a view that we may have overextended our capacity to train additional health personnel, coupled with our fear of the potential "over medicalization" of our society and the corollary problem of health care cost containment, led us to a series of ideas, programs and policy decisions designed to make corrective adjustments in the flow of resources into the health care system.

These changes affected the poor and the medically underserved in a most dramatic way, placing these groups squarely in the middle of the controversy. In the 1960's and early 1970's, the poor and the medically underserved were told that they did not use services wisely nor often enough. Programs were begun to increase their access to medical and other health care services. As these policy shifts began to take place in the late 1970's, the poor and the medically underserved were told they were using services (of questionable efficacy) too often for the wrong reasons. The health promotion/disease prevention movement, with its concomitant concern for cost containment, was proposed as one possible solution. While these movements were, for the most part, outgrowths of the middle and upper classes who wanted to break away from what were perceived to be trends making individuals more and more dependent on professional sources of health and other human services, the health promotion movement was proposed in the case of the poor and the medically underserved as a means of channeling the health behavior of those perceived to be "overutilizers" and less desirable clients of health and medical care to other, more self-reliant modes of dealing with personal health problems.

It is for these reasons that the health promotion movement in this country cannot be easily classified as either "progressive" or "conservative/regressive." Elements of both political orientations are encapsulated in the movement and one needs to examine particular programs with great care before such judgments can be made.

Health Promotion Programs As A Vehicle for the Implementation of Other Policy Objectives

It is apparent that the health promotion movement tends to be considered a "quick fix" for many of the very general problems that confront the American health care scene at the present time. For this reason it possibly deflects our attention from the critical problems of guaranteeing universal access to health care services. This is precisely the situation that confronted the young mother who was beset with the problem of dealing with her unruly son -- so unruly that she found him just about impossible to control.

On the advice of one of her friends, the mother took her son to a psychiatrist.

After talking with both the mother and the child, the psychiatrist said:

"Yes, madam, you do indeed have a problem with that child, but at the moment I am more concerned about <u>you</u>."

He prescribed some tranquilizers for her and asked that she bring the boy back in a week's time for a second session with the two of them.

When the mother appeared with her son the next week, the doctor asked, "Now, tell me, has the boy improved any in the past week?"

To which the mother replied: "Who cares!"

The health promotion/disease prevention movement has shifted our emphasis from the characteristics and resources of the <u>system</u> of health care in this country to the personal resources of the <u>individual</u> and his/her personal health behavior and practices. This has occurred at a time when (in view of the multifactorial explanation of disease) the individual is becoming <u>less</u> capable (not more capable) <u>as an individual</u> of controlling her/his personal health environment. While it may be true that most of the leading causes of mortality in the United States are thought to be linked to patterns of personal health behavior, we are not so certain that the genetic, environmental and social situations that

surround us are not more important determinants of mortality. The capacity of our employers and the general society to change the total health risk we experience each day far outweighs our individual capacities to alter the factors which reduce the risk to life.

New Statistical Requirements

We might ask what it is that makes us think that there will be new requirements for statistics on health personnel and health facilities associated with these shifts in health policy toward illness prevention and health promotion? Will there be requirements for new units of health care services? Will new programs/activities be required of extant service providers such as hospitals, physicians, or dentists? It is unfortunate that the health promotion movement has seemed to be presented as an "alternative" to current health programs offered by existing providers of conventional health care services.

In the past those of us who have worked with health resources statistics have taken a clearly simplistic approach to issues such as the problem of ensuring access to care. We have usually conceptualized the problem of access in terms of "personnel-to-population ratios." We have included few considerations of the content of care, very little emphasis on the characteristics of practice organization, and practically no consideration of consumer reaction/perception of the care delivery system. The data requirements for tracking the implementation of a social policy which shifts the focus from health care system to individual behavior requires a form of data that transcends the limitation of statistics on the availability of service delivery units. We simply have to move beyond mere "inventory" statistics.

Inventory Statistics as a Prerequisite for Program Evaluation and Monitoring

It is unfortunate that this expanded need for health resource statistics has come at a time when our effort to develop a national system of comprehensive and reliable inventory statistics for health personnel and facilities is threatened with being disbanded. Without good and reliable statistics that allow us to "inventory" existing providers of health care services it is practically impossible to imagine an adequate statistical system that would enable us to track a national effort to transform our health care sector from an "illness-" to a "wellness-oriented" delivery system. Health statistics are not generally popular among those who appropriate public funds for the development of new governmental programs. When health statistics are needed, they are critical; when they are not, they are dispensable. Unfortunately statistical systems cannot be developed overnight and it takes a considerable amount of foresight in order to adequately plan for their availability.

In all of these endeavors our problem is not one of data analysis. Ours is the problem of data availability. Now that the CHSS has encountered difficulty, many have come to believe that these problems will never be solved.

A Potentially Useful Outcome of the Policy Shift from Illness to Wellness

There is one advantage to the recent shift in policy emphasis for those of us who continue to work with health personnel and facility statistics . . . an advantage that relates to the use of health resource statistics. But this advantage cannot be realized without the continued effort to assure the availability of timely and reliable statistics on health personnel and facilities. The advantage of which I speak is that this policy shift may help to redirect our emphasis from the "numerology" of health resources to a concept of the "burden of illness" (Rice and White, 1977) to be dealt with by our national health care resources. Hopefully this will encourage us to look at national health resource statistics in relation to morbidity and mortality data. Perhaps this new policy emphasis will encourage health personnel and health facility statisticians to use, as the denominators for their work, the health status indicators that reflect the "task" of medicine and the other health professions (McKeown, 1976). We might begin to ask about the "health risks" prevalent in certain populations and to associate these with known capacities of certain health occupations or certain types of health facilities to intervene in an ameliorative manner with respect to these "risk factors." Thinking about interventions (programs, personnel, or facilities) in relation to populations at risk to disease or illness may lead to higher levels of intellectual work in the health resources statistical literature, as well as stimulate some of those who zealously support health promtion programs to examine the health resources implications of the policy recommendations they make. If we move in this direction, we will need greater precision in our determination of which factors are indeed "risks" to health and where "individual responsibility" ends and begins with respect to particular risk factors. With such information we can then work toward the quantification of personal health risk and its distribution in society in relation to available supplies of health personnel, facilities and programs for dealing with these problems. These developments could add a degree of excitement to the data use and analysis aspects of health personnel and facility statistics. With this sort of potential, it is even more disturbing to hear that, along with the problems of financing the CHSS, Dr. Green sees a future of limited support for the Health Education Risk Reduction Grant Programs at the state level.

Conclusion

A concern for what the British would call "the National Health" is clearly more than a concern for access to personal health care services. However, it is my view that a concern for access to a minimum level of health care services must remain a cornerstone of any responsible national health strategy. I have

raised a concern that the emphasis on individual responsibility as a basis for health policy could deflect national attention from the important goal of guaranteeing universal access to basic health care services.

There is little question that a major shift has occurred in this country in the way we view the significance of health care resources and health care services as a precondition of health status goals. Alternative approaches are sought to conventional health care. The cost of conventional health care services have demanded a higher proportion of our Gross National Product than in most Western nations. There are serious questions as to whether we can afford more health care services. But the redirection of our efforts toward health promotion programs having an emphasis on increased individual responsibility for health status has a number of ethical, political, and administrative problems associated with it.

There are significant questions as to which health promotion programs work best and most effectively with which target groups. There is a lack of evidence that health promotion programs really do reduce health services expenditures/costs. For some population segments, the effort to persuade individuals to exchange a present cost for a private benefit that will be realized at a considerably distant future time may have little emotional impact . . . especially when we are uncertain which benefits will accrue, if at all (Fuchs, 1980).

The groundswell of interest in health promotion/disease prevention programs, by lay groups and by health care providers, has raised new questions about the kinds of personnel and requisite training for these new health care/health educational roles. We are not certain as to how to compensate health personnel and health are facilities who engage in these newer forms of health service. Some are even concerned that the health professions are somehow being bypassed or excluded from participation in these movements.

There is likely to be considerable confusion about many of these new initiatives in health promotion in the next several years. Certainly we should all hope that many lessons of the last ten or twenty years will be applied to such issues as the credentialing and regulation of new health occupations which may emerge.

A balanced, truly progressive health strategy must start from certain fundamental components. To track our progress in health we need to ensure that we do not lose the ability to measure our achievement of the fundamentals. As health statisticians we need to invigorate our efforts to develop a national inventory of health personnel and facility statistics. Only then can we add the new dimension of activities and programs that address health promotion goals.

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HEALTH RESOURCES NEEDED TO REDUCE RISK OF ILLNESS-A HOLISTIC APPROACH*

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Apparently, in the development of man's attitudes toward life, we have assumed that a particular event (death, injury, or disease)will always happen to the other person. Further, we think these events may occur at any point during life, in a most random manner. The fact is, these events have a high probability of occurring to us, and the life stages at which they occur are predictable. The predictability of mortality and morbidity by life stage, therefore warrants investigation.

Whether or not a person will experience a particular event during a particular life stage is dependent upon several factors: life style, environment, biology, and the health care system. Whether or not a person will avoid a particular event during a life stage is also dependent upon several factors: self-responsibility, exercise, nutrition, stress management. Most individuals have the ability to prevent mortality or morbidity in the predictable areas at each life stage, if they choose to make such a choice.

Presently, we as a society have the ability to reduce substantially and, in some instances, to eradicate completely our major cripplers and killers at each life stage. As an example, let us look at the case of hunger and point out the parallels to our health problems.[1]

In the past five years, more people have died as a consequence of hunger than have been killed in all the wars, revolutions, and murders in the past 150 years. Every minute of every hour of every day, 28 persons--21 of them children--die of hunger. The result is that 15 to 20 million people in the world die each year because of hunger and malnutrition.[1] What can we do about this tragedy, besides feeling sad and helpless?

In the United States in the past five years, from a health viewpoint, more people have died as a consequence of poor life styles, including inadequate diet, lack of exercise, and excessive stress, than have been killed in all the wars, revolutions, and riots in the last 100 years. In America, 2,740 die every day, 114 every hour, and two every minute. The result is that about one million Americans die each year because of destructive life styles.[2] What can we do about this unnecessary tragedy, besides feeling sad and helpless? Perhaps tilt the wheel of fortune in hoping it will happen to the other person?

No one dies of hunger because there is not enough food to go around. Enough resources and knowledge do exist to grow, store, distribute, and provide enough food for every person on earth to be nutritionally self-sufficient from now on. Experts report that the world already produces enough food to supply every human being on the planet with more than the amount needed for a proper diet. In addition, with available methods of farming and food-production technology, we have the capability to produce enough food for all future generations. If scarcity is not the reason why millions starve, what is?[3]

No one dies from the major cripplers andkillers because there is not sufficient knowledge about the causes of these diseases. Knowledge is sufficient about such factors as smoking, nutrition, exercise, and stress as related to disease, so that every person in the United States is able to prevent or to reduce substantially the risk of incurring major diseases that are present today.[4 5] Studies by experts have reported the benefits of a "no-smoking" program, adequate nutrition, proper exercise, and stress reduction in combatting today's diseases.[6 7] Additionally, specific technological components of the health care system have the capability of producing change in disease patterns. We have enough knowledge and technology for everyone in the United States to be healthy and free of major diseases. If lack of knowledge about diseases is not the reason why thousands are dying, what is?

Today's disease patterns do not persist because the knowledge to prevent them is not known. We do know how to prevent them! Of course, the same is true for ending hunger. There are workable, proved, affordable solutions to preventing today's life-style disease patterns. If we just shift emphasis from lack of concern and feeling that somebody else will take care of the problem to one of conern and self-responsibility, we will solve today's disease patterns. These patterns are NOT inevitable. Everyone knows that people will suffer from heart disease, cancer, and stroke--the way everyone knew that man would never fly, that the world was flat, that the sun revolved around the earth,that slavery was an economic necessity, that a four-minute mile was impossible, that polio and smallpox would always be with us, and that no one would ever set foot on the moon.[8]

* Not presented

These events were believed to be true until some courageous person challenged an old belief, and a new idea's time had come. All the forces in the world are not so powerful as an idea whose time has come. So the decisions we face today are not hopeless, endless problems. The question is, who can make the eradication of life-style diseases an idea whose time has come?

The diseases of life style persist, not because we can't prevent them, but simply because we haven't.[9] If we have enough knowledge, if we have enough technology, if there are solutions we can afford, why do thousands of us continue to die from the diseases of life style? Why do millions of us continue to starve?

It is because we lack the will to get the job done.

In 1978, the U.S. Department of Health, Education, and Welfare published the results of a study on health promotion and disease prevention (a report by the Surgeon General) supporting our contention that about 50% of U.S. mortality is because of unhealthy behavior in life style.[10] [11] [12] [13] The report suggests that within the practical grasp of most Americans are simple measures to enhance the prospects of good health and to evaluate our life-style disease patterns. Now you know the only thing keeping us from ending our life-style disease patterns is that we lack the will to do it. Who has the power to create the will, the commitment to prevent life-style diseases? In 1979, the Surgeon General's report tells us that the prevention of life-style diseases can be significantly changed through actions individuals can take themselves.[14]

George McGovern, Chairman of the Senate Select Committee on Nutrition and Human Needs, points out that government can't legislate or require people to choose a healthy diet. But government can identify the known risk factors and make suggestions to correct them. The rest is in the people's hands--disease prevention is up to the individual.[15]

YOU MAKE A DIFFERENCE. The ability to create a national commitment to prevent life-style diseases in this century resides only within the individual. These diseases persist in a condition in which we believe we are powerless, that nothing we can do will make a difference. When we recognize the truth--that diseases of life style can be prevented--that condition is transformed, and our natural desire to make a better health status for everyone can be expressed. The commitment generates action, and action transfers an idea into reality.[16] Thus, a national commitment to prevent life-style diseases begins within you. It expands as you tell and demonstrate it to others. Now you know: you have the power to make the prevention of life-style diseases an idea whose time has come.

If our diseases are predictable and we know that only we can make the difference, then the resources needed to reduce the risk of illness are already within our grasp. However, a major question to be asked, is when do we begin these efforts and what are the expectations? We begin these efforts immediately and the effects will occur thoughout the entire life span.

The issue of good health in late adult life is the result of multiple factors operating throughout the entire life span. These factors must become part of the daily culture in which we live and further, must be transmitted to the generation being born, so that good health in childhood will reflect the level of health the adult has achieved.[17]

> "On balance, children have significantly improved prospects for adult health if their parents endow them with education, better childhood health, good health habits self-confidence, and the will to select a job they can enjoy. Children who are given a college education rather than a high-school education, who do not smoke before 25, who have regular checkups, lack any major childhood illness, and select occupations because they like the work and anticipate financial success and job security will have, on average, a 10% to 15% lower chance of adult bronchitis, a 13% to 16% lower chance of heart disease, and a 14% lower chance of being psychotic or neurotic. These gains are sizable by any standard." [18]

The results from this ongoing study begun at the time of World War II clearly underscore the need to analyze life-stage health patterns from an epidemiological, psychological, and sociological perspective. Indeed, habits developed in early life determine disease patterns in the adult life. For instance, it may be that good health occurring in late adult life is the result of mulptple factors that have been operating throughout all life stages. Alternatively, poor health habits developed in the early life stages and continued into the later life stages reflect poor health, making many of the mortalities predictable.

Individuals must take this "resource of self" seriously and we must attempt the arduous task of being sensible about health habits rather than falling prey to deleterious habits which will have a negative impact on our life in later

life stages.

FOOTNOTES

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Costs and Benefits of Prevention

Concurrent Session P

A DATA BASE FOR STUDYING EFFECTIVENESS OF CHRONIC DISEASE MANAGEMENT

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Chronic Disease Management and Prevention

Prevention as a general concept refers to pushing back the stage at which intervention occurs in processes leading to decline in the health capital stock of individuals in society. At a given time, there are many in the population who can no longer benefit from an intervention predating disease onset and many conditions that cannot be terminated. In this context, chronic disease management (CDM) finds its place as a preventive process.

CDM is a production process in which physician inputs of health status evaluation, prescribing of therapy, and monitoring of conditions over time are provided in encounters with patients. Physician-patient interaction is learned on both sides. Behavioral outputs of the production process include patient adherence to drug treatment, return visits for monitoring, and modification of life style. These are intermediate products; the final products relate to health status although for asymptomatic individuals, there may be little perceived improvement of health in the short run. While this discussion focuses on the physician, in part because current ambulatory data bases are oriented toward physician services, it can be extended to cover non-physician services.

Variation in Effectiveness of CDM

While measuring effectiveness of CDM is critical for policy decisions, assessment is not simple. British experts disagree with U.S. medical authorities' pronouncements as to the need to put mild hypertensives on drugs (1) and as to the need for insulin if diet does not control diabetes (2). In every day clinical practice, treatment may be started after too-brief evaluations, which may result in apparent success or failure of treatment, avoidable side effects, and resource waste. Even when diagnoses are well-confirmed, each disease population may have subgroups that vary in responsiveness and in risks of later damage from a disease.

Provider variation in evaluating disease presence and severity may be caused by differences in experience and training, desire to assure benefits of treatment to patients, revenue considerations, and fear of malpractice actions. When life style change is significant in CDM, evaluating the effectiveness of inputs through the health care system is made more difficult by 1) information that people acquire outside the system, and 2) the effect of education on people's response to information from various sources. For instance, the most reduction in serum cholesterol levels in the general population in recent years occurred at the highest educational levels (3).

Using National Data to Monitor CDM

National statistical data on ambulatory care would be most useful if it enabled us to measure and monitor processes of chronic disease management and their effectiveness in given population groups. Such data would include the following: A factors: Physician actions to establish a diagnosis and evaluate the condition. Physician inputs for evaluation in chronic disease do not end at an early stage but are part of the continuing process of care. B factors: Physician actions to establish a directive regimen for disease control, including medication, personal behavior, and revisit schedule. C factors: Patient actions complementary to the directive treatment plan in B, aimed at reducing impact of the disease. D factors: Outcomes measured by health indicators that are appropriate for the disease.

The detail of interest under each of the "action" factors (A, B, and C) could vary by disease since recommended sequences of steps for particular chronic diseases have been specified by various authorities.

The national data base should also provide information on costs of service per individual per year, related to effect achieved, and categorization of data within each set of factors by socioeconomic variables, severity, source of service, and other variables of interest.

The role of the physician in the process of CDM is a multiple one. Physicians offer detection technology to the public and know how to follow an initial gross screen with a detailed evaluation. They are viewed by the public as the most reliable source of health information (4) and are thus in a position to advise the patient on behavior that will minimize the impact of disease. They have the authority to prescribe medications and are able to adjust choice of specific drugs and dosage schedules to correct side effects and retain drugs that are found to be helpful. They can also adjust the revisit schedule for optimal protection of the patient, and include in the contacts reinforcement of behavioral advice and encouragement to stay on medication.

While controlled clinical trials to determine efficacy ideally use clearly defined therapies and protocols and take place in optimal settings and under conditions of excellent compliance, effectiveness in general population groups is affected by difficulties of identifying "true" positives and of selecting appropriate drugs and dosage schedules for individuals in different circumstances. Measurement is handicapped by the need to allow for variation in compliance, responsiveness of disease to treatment, and subjective factors in functional impairment and morbidity when these are used as outcome measures. Most critically, an irregular diffusion of state-of-the-art technology

throughout all of clinical practice occurs and affects the level of success in disease control in the general population under care.

Data bases created by the National Center for Health Statistics give us partial insights into the CDM process but many gaps remain. The remedy for these may lie in further analyses of existing tapes, collection of new information items, an expanded sampling frame, or changed concepts of the data base.

For example, the patient's reason for the visit as recorded in the National Ambulatory Medical Care Survey leaves some mysteries. Although the log allows for entering both a most important problem or other reason for the visit and a second reason, published tabulations are confined to the principal reason. While this could be because second stated reasons are sparse, patients may employ different approaches in order to accomplish health-related purposes in both initiating and going through an encounter. A patient may revisit for a condition that is under good control in order to satisfy concern about a second problem. A patient may go to a second doctor for a general checkup or a minor illness in order to get a second opinion about the management of his or her chronic condition. Patients may either encourage or discourage the doctor in regard to the acceptance and timing of a return visit schedule and may or may not keep appointments depending on their health status.

Another limitation of NAMCS with regard to CDM is that, although type of services provided is recorded, the reason for the service - involving the doctor's decision process - is not. Was a certain procedure done to test a particular diagnostic hypothesis or a surmise about the course of a condition, or was it part of a general protocol for all patients in a given age group?

Tracing of the four phases expressed in A, B, C, and D factors is a basic step in developing research on CDM. Conditions under which people are "assigned" to the population for a given disease and the degree of confirmation are important for measurement of effectiveness. A CDM data base organized as described would allow analysis of current physician practices used to evaluate disease prior to instituting treatment, and practices in regard to medication, prescribed appliances and mechanical aids, suggested personal behavior, and the neglected area of recommended changes in work practices and the environment of work. Adequacy of physician services could be compared over time and across specialties, and for patients with definite/less definite, severe/less severe disease. Since various chronic diseases differ as to reversibility of major signs under treatment, remissions, and subjective variability of symptoms, the study of monitoring may help in thinking about criteria for adequate health care practices.

Data on compliance would reveal whether individuals tend to be consistent or inconsistent. It has been shown for preventive practices that some individuals treat direct risks differently from indirect risks in their risk-averting behavior and others do not (5). For CDM one would wish to know if, for example, diabetics who are observant with respect to diet are also following recommended foot care practices.

The preparation of the data base, therefore, involves concern with facilitating comparison and aggregation. Outcome measures that are appropriate to a given disease tell little about effectiveness of care for another disease. Accordingly, the data base should contain a battery of appropriate health indicators for major conditions. Information on restricted activity days, bed days, and hospitalization needs to be supplemented by measures of impairment of physical and social functions, and mood or well-being. However, a major problem in study of effectiveness of ambulatory management is how to deal with mortality and other events that remove individuals from the population used for interview samples. (This problem is discussed in the final part of this paper.)

Valuable end products of a systematic analysis of the stages of CDM would include a typology of doctors based on the differences in their approaches to disease control, a typology of patients based on their disease profiles and behavior, and a typology of doctor-patient pairs that would identify different "contracts" or implicit arrangements and compare them as to their prevalence and usefulness in CDM.

Cost analysis of the inputs involved can be carried out if sufficient detail on visit content and pricing customs is built up. Few data have been collected, and none nationally, on patient costs of compliance including medications tried and discarded, appliances purchased (using an appropriate amortization period) and time burdens. If compliance behavior such as exercise is eventually seen by the patient as pleasurable, the valuation of time used is affected. Costs can be related to the number of cases evaluated, the number of cases of disease detected, the number of patients initiated into a recommended regimen, the number staying with it, and the health outcomes reported. Health care costs of evaluation of disease, monitoring of its response to treatment, and assuring compliance could be developed.

Among the hypotheses of interest concerning the relations among A, B, C, and D factors are the following:

1. If physician evaluation inputs are more frequent and comprehensive, they are more likely to result in establishing a directive regimen.
2. Patients whose doctors start a directive regimen addressed to personal behavior (as distinct from taking prescribed medicines or revisits) are more likely to follow practices currently believed to be favorable to disease control.
3. Patients with frequent and comprehensive monitoring visits are more likely than others to

adhere to recommended personal behavior and to follow doctors' orders as to medication.
4. Patients who follow all aspects of a directive regimen are more likely to have good health outcomes.

Recommendations from health education media and personal associates enable some patients to adopt various therapies and remedies without MD visits. In other cases, the physician's diagnosis may provide the cue for following the guidance of general health information sources, and in still other cases, the physician's authority, and explanations adapted to a specific individual's circumstances, could be significant inputs into patient behavior.

Information on chronic disease management for hypertension, diabetes, and arthritis contained in data from the Health Examination Survey, the Health Interview Survey, and the National Ambulatory Medical Care Survey were reviewed as a means of examining national data base needs in the field of CDM. These diseases all represent significant prevalence, morbidity, and use of health care services (6,7,8). They are alike in that selections from the repertoire of recommended therapies and behavior may vary among individual practitioners. In each disease there is controversy over the worth of particular elements of control, and also, to some extent, as to existence of subtypes that vary as to risk of major disability and as to responsiveness to particular regimens. In each of these conditions biological, psychological, and social factors are interconnected; hence, variation in the patient's adjustment to the disease, including capacity to follow a given control program over long periods and perceived interference of the disease with usual activities complicates study of effectiveness of physician inputs.

The diseases differ as to the critical negative outcomes to be avoided. Hypertension is a leading risk factor for cardiovascular mortality (9, p.77), the leading cause of death; thus, although bed days and hospitalization do occur, risks of heart attacks and stroke are salient concerns. For diabetes, serious illness and mortality from the disease itself and from complications, and specific impairments such as visual damage, concern the patient. For arthritis in general, moderate to crippling disability is the most common adverse outcome, although for certain joint diseases involvement of other body systems, hospitalization, and even mortality may occur. Patient attitudes towards risks of different seriousness and probability may influence their compliance. Moreover, since the degree of current symptoms may vary, physicians must find different motivations to assure patient compliance. At the same time, patients may have to be helped to live with symptoms rather than incur problems of overmedication such as joint damage following removal of pain.

Hypertension

An important point of reference for discussion of hypertension is the research of the Hypertension Detection and Follow-Up Program, which presented evidence in 1979 on the opportunities for management of mild hypertension in a general population (10). The study revealed a significant reduction in mortality from all causes in five years, the improvement being concentrated in the 50-69 year age group.

However, the replication of optimal environments for care seems to be a precondition for diffusion of a successful technique - a condition that is hard to satisfy in a system of pluralistic organizations and atomistic providers. The relative contribution of drug selection, drug compliance, diet, etc., to the achieved results is unclear but is crucial for resource allocation. The authors themselves recognized more structured care as a treatment feature apart from the regimen's content.

A 1973 survey conducted for the National Heart and Lung Institute by Louis Harris and Associates (4) reports on the public's knowledge and attitudes, which are significant for compliance with doctors' recommendations and for self-directed changes in behavior. A large majority know there is treatment for hypertension and most recognize elements currently used, and understand that treatment must continue even when blood pressure drops.

A nationwide survey of physician knowledge, attitudes and reported behavior concerning hypertension management and treatment conducted for the National High Blood Pressure Education Program (11) produced information on the understanding and practices of clinicians of different ages, specialties, and board status and the concordance of their approaches with state-of-the-art knowledge. There was variation in many aspects of physicians' self-reported case management steps.

The special study of hypertension in the 1974 Health Interview Survey produced information on disease prevalence, use of physicians' services, types of medical advice given, patient behavior with respect to the advice, and current reduction of health status due to hypertension (12). Other useful information was provided by disaggregation of NAMCS data for 1975-6 to show office care for circulatory system diseases (13). Unfortunately, the two data bases cannot be merged to show care of a given individual over time as reported by patients and providers.

The experience of hypertensives as revealed by the 1974 HIS can be arranged by the A, B, C, and D factors as shown in Table 1. The published data do not trace individuals forward through the sequence and thus do not show whether physicians' evaluative actions were likely to lead to directive actions or to compliance behavior, and ultimately to better outcomes.

Using NAMCS data on visits and HANES data on prevalence to form a denominator, and taking into account that HIS data show 90% of those who ever had hypertension as seeing the doctor in the last year, the annual visit rate for those with any care can be estimated at 1.5 vis-

its. Actual cost of management of essential benign hypertension was estimated, using national mean values for Medicare prevailing charges for GPs and specialists to develop service prices (14). Prior visit status, exams of different scope, and diagnostic services were taken into account using NAMCS data. The result was $15.90 per visit including those without diagnostic services, or an average annual cost of about $24.00. Many of the visits for low-income persons were clinic visits not studied in NAMCS. This means out-of-pocket expenses may have been lower than expenses based on private office charges, but system resource costs are still involved. Separate estimates of costs of care for successful and unsuccessful doctor-patient relationships could be derived from the proposed analysis.

Arthritis

For arthritis, the information available for tracing CDM is less complete than for hypertension. Information on prevalence and receipt of care measured by self-report was gathered in the Health Interview Survey in a special supplement covering both chronic skin and musculoskeletal disorders (15).

Almost 25,000,000 persons report arthritis in household interviews in 1976 and an additional 10,000,000 report other related conditions. Activity limitation was reported by 1/5 of arthritic persons. About 1/10 had any bed days but there were 44.0 bed days per disabling condition. About 4/5 of the arthritics ever saw a doctor for the disease, but 48% did not see a doctor in the past year.

Another and more extensive study was conducted in connection with the first Health and Nutrition Examination Survey (HANES 1) of the civilian non-institutionalized population (16). It included a detailed arthritis examination and administration of an Arthritis History Supplement by the examining physician. Severity of disease is based on evaluation of X-rays of the knees and the hip area and medical histories.

The data, collected 1971-5, provide the most extensive information available on objective and subjective evaluations of joint problems, and on use of physicians' services. However, HANES does not have data on the frequency of visits over a given period of time, use of the telephone for advice, or visits for shots, X-rays or tests.

The treatment steps taken by the doctor can be derived from the reported contacts for some therapies. In at least one instance lumping of a drug requiring a prescription in the same question with a drug that does not lost an opportunity to trace the connection to seeing the physician. Patients were asked if they ever used a given modality, if it does any good, and if they use it regularly.

Published data from the HANES study show up to 16% of the population aged 25-74 having various symptoms of joint disorders for at least one a month. However, 39-57% of those with moderate osteoarthrosis of various sites have never been treated for joint problems; among those with severe conditions 44-55% were never treated. Currently 6.7% of the population is being treated for joint trouble.

The present data base would allow a partial analysis of the relationship of A, B, C, and D factors in arthritis care - e.g., the connection between having a significant history of pain and seeking of professional health care. While the X-ray evaluation of the degree of arthrosis would not now be acceptable because of present assessment of radiation dangers, fortunately, other objective examination techniques for arthritis are available and overall indicators are being created (17).

Diabetes

Mortality and morbidity from diabetes and its complications, including retinopathy, neuropathy, kidney damage, and myocardial infarction and stroke, are an important health problem (18). Medical authorities make a sharp distinction between insulin-dependent, ketosis-prone diabetes and non-insulin-dependent mature-onset diabetes (19). However, it is said that there is much confusion among professionals as well as patients as to the types of diabetes (20). The 1978 estimate for diabetes prevalence, based on HIS data, is 5.1 million persons.

Clinical management of diabetes as recommended by medical authorities includes determination of urine sugar and postprandial blood sugar and conduct of a standard oral glucose tolerance test (21). The process of evaluation merges with therapy and monitoring as a therapeutic regimen is initiated and adjusted to the individual. Diet (control of caloric intake) is regarded as the mainstay of therapy. Diets must be individualized so as to fit the social needs of the patient's life, including food preferences and meals away from home. Oral medication is used if diet compliance is inadequate or if diet is insufficient for control. The patient must be educated in monitoring the disease and adjusting food, activity, and medication (22).

Lack of knowledge of important kinds of information needed for self-care has been found in patient studies, implying the need for periodic assessment and reteaching of insulin injection technique, urine testing at home, management of hypoglycemia, etc (23). Time spent with patients has been found to improve understanding of and compliance with diet (24).

The Health Interview Survey for 1976 contained a Diabetes Supplement in addition to collecting data on diabetes as a condition causing activity limitation, disability days, physician visits and hospitalization in the main body of the HIS questionnaire. Information on treatment, compliance, and health levels can be derived from the Supplement. Other data on visits, services, and the probability of a definite revisit schedule are available from NAMCS (25).

Missing from our current data base on diabetes is information on the type of confirmation used to establish a diagnosis, specific tests performed initially and repeated, interactions resulting in adjustment of medication, instructions and patient behavior regarding foot care, and use of nurses, nutritionists and others to advise patients and solve problems. Tight control of blood sugar is currently accepted as desirable to reduce microvascular lesions of the retina and kidney, but evidence about its usefulness in preventing heart attacks and strokes is more controversial (26). Sosenko et al. show a connection between poor control in young diabetics and increased levels of cholesterol (27). Information on level of control, the care profile and the care costs of those diabetics with best health status would help to determine how much of current inputs is associated with successful results, including avoiding disability from the diabetes itself.

Summary

To sum up, the improvement of the data base for CDM is partly a matter of expansion and partly one of organizing the use of existing data so that profiles of adequate and less adequate management are revealed and the resources they consume can be estimated. To measure the economic offset to costs of effective care, cost data can be developed for saving in lost time of younger age groups, but this will not suffice as a policy guide because of the difficulty of evaluating the time of economically inactive groups. expanding the data base to find out more about the doctor-patient relationship may require trial of questions on small groups before entering them in a national survey. It would be desirable to develop a follow-back component, a matched sample, or other methods to take account of mortality losses and institutionalization in an ambulatory population with chronic disease. Finally, the question of the appropriate health status indicators to be used needs to be clarified. From the patient's point of view, chronic conditions are of concern for the risk factors they represent, the co-risk factors they elevate in importance - and the current disability and interference with life they entail. All of this will vary by disease, and therefore no single measure of effectiveness will serve.

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Table 1

Selected Statistics on Hypertension Management, 1974, Arranged by A, B, C, and D Factors

Source Page	A Factors (Physician evaluation and monitoring)	Percent	Based on (000)
29	Saw physician in last year	65.1%	E (29,789)
29	Saw physician often (5+ times)	21.9	E
30	Had frequent blood pressure tests (5+ times)	39.2	E
35	Had chest X-ray in last year	36.2	E
35	Had EKG in last year	29.8	E
	B Factors (Physician establishes or updates treatment regimen)		
37	Medicines were prescribed	65.5	E
58	Physician told about problems[a]	45.1	E
42	Advised re salt	44.7	E
51	Advised re smoking	33.0	E
44	Advised re weight loss	38.0	E
	C Factors (Patient compliance)		
38	Follows medication orders	92.8	M (12,462)
45	Trying to lose weight[b]	36.9	E
42	Using less salt	73.4	E
	D Factors (Health status)		
53	Hypertension causes very little bother	28.8	N (22,626)
53	Hypertension bothers [only] once in a while	68.8	N
29	Under 7 bed days in last year for hypertension	3.8	E
29	No bed days in last year for hypertension	92.8	E
55	Ever had heart trouble	20.1	E
55	Ever had stroke	4.9	E

E Ever had hypertension
M Medicines ever prescribed
N Now have hypertension

a 46.9% of E were told by someone; 96.1% of these were told by the physician

b Perceived overweight = 53.9% of E, trying to lose weight = 68.4% of those who perceived selves as overweight

Source: Reference 8

ECONOMIC BENEFITS OF PREVENTION: FOCUS ON THE ACUTE CARE HOSPITAL

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There has been a long history of concern with the prevention of illness. Until recently that concern stemmed from a desire to improve health status[1] and reduce human suffering. Since the early 1960's, however, concern with suffering has shifted to a concern with precipitous increases in health care costs, and where prolonged suffering is associated with prolonged costs even the previously unthinkable ("pull the plug") becomes routine thought.[2] While preventing illness is worthy of consideration on any grounds, it is not unreasonable to suggest that it has been rising health care costs that have been driving our interests in prevention.

The acute-care community hospital is the bulwark of the U.S. health care delivery system and its costs. Nearly every American's tragedy with cardiovascular disease, neoplasms, and the wide variety of diseases which seriously ail the population eventually finds its way into an acute-care hospital bed. Americans pay dearly for this. Hospital based health care costs are approximately forty percent of the Nation's growing health care bill. One potential benefit of prevention of illness is, therefore, a reduction of hospitalizations and concomitant hospital care costs. As a recent article in Hospitals, the journal of the American Hospital Association, put the prospect:[3]

> Community education and health promotion based on the concept of wellness is burgeoning forth. As hospitals have always prided themselves on providing high-quality care to unwell patients, so should they assume their rightful role in the prevention of illness. If this forthright position is taken by hospitals, they must face a possible decrease in the use of traditional hospital services. Institutions that have close ties to community groups, that are comfortable with change, and that are committed to a mission of health improvement rather than health management of their patient population will endorse this posture and establish plans to implement it.

As we will shall argue, however, it is a long step from the prevention of illness to a reduction in the use of hospital services and, from there, a reduction in hospital care costs.

In the period 1972 to 1977, discharges from short-stay community hospitals grew from 153.5 to 163.3 per 1000 persons. This increase took place in hospitals with 300 or more beds, and in fact, discharges actually declined in hospitals with less than two hundred beds.[4] At the same time, there has been a "shrinking" of the total number of short-stay community hospitals. Those that remain have, on average, increased in bed complement, particularly the voluntary not-for-profit hospitals.[5]

The number of full-time equivalent employees per one hundred daily patients in community hospitals had increased dramatically, growing steadily at an average annual rate of just under three percent per year since 1960. There were 226 full-time employees per one hundred patients in 1960; the ratio has increased to 369 per one hundred by 1977.[6] Outpatient visits to these hospitals have also grown dramatically during the 1970's, while visits to other ambulatory sources have declined. And, in the first half of the decade of the 1970's, outpatient visits per inpatient day grew by 5.4 percent annually, a growth rate which has somewhat subsided since then.[7]

The economic benefits of the prevention of illness would appear to be straight-forward: a decline in illness would reduce hospital utilization, both inpatient and outpatient, and avoid what would otherwise result in outlays on medical care.[8] If illness brings people to hospitals and we prevent illness, we will capture as an economic benefit of prevention the reduction in hospital costs. This reasoning assumes that there is a direct relationship between health status and hospital utilization, such that changes in health status account for "large portions" of changes in hospital utilization. There is no reason to believe, however, that the increase cited above in discharges per population, the increase in the average bedsize of hospitals, the increase in employees per patient day, or for that matter changes (increases or decreases) in the wide variety of statistics that underlie the costs of hospital care are a response to the health status of the population. On the contrary, every available indication suggests that the health status of the population has improved during the period of increased hospital utilization and increases in hospital resources consumed per patient day.[9]

The assumption that hospital costs, the value of the configuration of resources used in the provision of hospital services, are directly related to illness in the population is unduly strong. Certainly there is a "great deal" of illness in the population which "belongs" in the acute-care hospital bed and still resides elsewhere. Yet the beds of many hospitals are not filled to hospitals' and the

public's desired capacity.[10] There are hospital beds which are filled with persons who do not "belong" in the hospital. In some cases, there are empty beds in a hsopital and a queue of patients waiting for hospital admission.

Whether a bed will be filled and for how long is, in large part, a function of the practice of medicine and the socioeconomic system which allocates health care resources. Thus, whether hospital costs will be incurred is a function of the practice of medicine and the socioeconomic system which allocates health care resources. A general shift in medical practice, say, a view that the efficacy of tonsillectomies or coronary artery by-pass procedures is not as great as previously thought, relative to alternative medical interventions, will reduce hospital costs due to these procedures. However, an efficacious procedure or a new hospital-based technology can just as easily lead to an increase in hospital costs.

It could be argued, however, that if the prevalence of a given illness was reduced through prevention, the (hospital) costs of that illness would decrease. Perhaps. Even with a corresponding one-to-one direct relationship between illness and hospital costs, the aggregate costs of the illness are equal to the number of cases multiplied by the costs per case, and a decline in the number of cases is not enough to ensure a decrease in aggregate costs over time. Suppose we settle for a reduction in costs "for the moment" and avoid the possible perverse effects on costs of changes over time in the medical care system. If the expected cost per case is constant (i.e. the medical state-of-practice is unchanged) and the number of cases declines one may expect a decline in hospital utilization and concomitant costs. However there is no a priori reason to expect either a decline in hospital utilization or costs. Assuming away the complicating influences of the socioeconomic characteristics which affect utilization and costs, any specific illness does not exist in isolation of other illnesses. This has two implications: preventing a given illness may make one vulnerable to other illnesses. This does not mean that illness should not be prevented or that only "certain types" of illnesses should be prevented. It is simply a statement that, unless all illness is prevented, preventing a given illness still leaves us with the likelihood that another illness will occur. And, independently of the likelihood of a "replacement" illness, other persons may be queued and prepared to enter the hospital with their alternative problem. There is no reason to expect a reduction of costs in either situation. One cannot plausibly argue a progression theory in these circumstances, viz. that the replacement illness will be less "serious" than the prevented illness or that a triage system has queued up the less serious illnesses, and now these will enter. And, if one successfully argued a progression theory, one would then have to argue that there is a direct correspondence between seriousness, utilization and costs. Why do hospital costs appear to be independent of the health status of the population?[11]

The particular structural characteristics of the hospital industry are: It is primarily non-profit so that it "place(s) more emphasis on maximizing capital or services than maximizing retained earnings or minimizing cost per unit of output.[12]" And, since hospital insurance coverage is considered "widespread" and generally reimburses the hospital on the basis of costs incurred, "higher costs generate higher revenues (and) incentives for efficiency are lacking."[13] Put another way, the hospital's decision-makers have an incentive to add new services and expand existing ones as well as incorporate the technological advances of medicine as rapidly as possible.

There can be little doubt that hospital services have increased over time. In addition to earlier cited statistics, per capita bed supply in community hospitals increased from 3.35 beds per 1000 persons in 1950 to 4.34 beds per 1000 persons in 1973. Plant assets increased at nearly 7 percent per annum during that period as technological change led to further capital accumulation, and as the "mix" of services shifted so that "a day of care in 1973 represent(ed) greater output than a day of care in 1950."[14] And, it appears to be a further structural characteristic of the hospital that incorporating new technology leads to increases in the hospital labor force, rather than providing a substitution of capital for labor, the usual course of the production process in other industries. Thus, the number of hospital workers caring for the average patient increased from 1.8 in 1950 to 3.7 in 1977. Given the traditionally low-paid hospital workers' push for higher wages and a cost plus reimbursement scheme, hospital care costs are both pushed up and passed on.

Finally, there is an "inducement principle" which applies to hospital services. Know as "Roemer's law," the inducement is toward filling empty beds: a bed built is a bed filled. The mechanism may reflect physician preferences for centralizing their patients or maintaining claim to a share of hospital beds; it may reflect the desire of a chief of service to justify maintenance or expansion of the service; it may reflect the administrators' desire to obtain revenues (since unfilled beds continue to generate costs); it may reflect the relatively better insurance coverage for hospital services,

i.e. the hospital bed as a "less costly" alternative than uninsured ambulatory care. Since the operating and capital costs of the beds are reimbursed through third-party payment formulas, hospital bed expansion is rewarded or, at least, not penalized as long as beds are filled. Such reimbursement has the further impact of generating hospital bed sizes and range of services independently of the ability to provide these services at minimum cost--often termed an "efficiency" or "economics of scale" criteria. Thus, added utilization induced by inefficient size, combine to fuel the expansion of hospital costs.

How can we reduce hospital costs? Eli Ginzberg has suggested that decreasing bed capacity is "the only way" to insure against excessive utilization of inpatient services.[15] Such a policy would, as he points out, heighten both inequity and inefficiency in the use of health services. "Patients with favored economic or political status will always have easier access," according to Ginzberg, and "(t)he greater competition for beds which result from a reduced capacity may lead to discrimination against those who, although medically more needy, are socially less privileged."[16] That is the inequity. The inefficiency stems from the relative reduction in medical care to precisely the population for whom it would likely provide the greatest impact on health status. It is this population which would benefit from the prevention of illness. For them, however, prevention will be necessary because of a reduction in costs.

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[1]The desire to improve health status is both an individual and collective one, and in each instance a function of varied motives. Utilitarian concerns notwithstanding, health status is functionally related to labor and, in particular, the productivity of labor. This point has not been lost on those who purchase its services. See: Michael Grossman The Demand for Health, New York: Columbia University Press, 1972; Stuart D. Brandes American Welfare Capitalism, 1880-1940, Chicago: University of Chicago Press, 1976; Herbert G. Gutman Work, Culture, and Society in Industrializing America, New York: Vintage Books, 1977.

[2]For example, see Bioscience, Vol. 23, No. 8, August 1973, especially David W. Meyers "The Legal Aspects of Medical Euthansia;" also, Rudolph L. Leibel "Thanatology and Medical Economics," New England Journal of Medicine, Vol. 296, No. 9, March 3, 1977.

[3]Ellen Lawlor "Hospitals Will Survive in an Uneasy Economy," Hospitals, Vol. 54, No. 7, April 1, 1980, p. 59.

[4]Health, United States, 1979, Washington, D.C.: U.S. Government Printing Office, Table 41, p. 143.

[5]Ibid, Table 56, p. 165.

[6]Ibid, Table 59, p. 170.

[7]Ibid, Table 60, p. 172.

[8]In the general economic taxonomy, costs are labelled direct and indirect costs. The indirect cost of a health problem is the valuation of that which is lost (i.e. foregone) when an individual cannot function as he would have in the absence of the problem. This is usually termed "foregone product" and, for persons in the labor market, this is measured as lost earnings under the assumption that earnings are a good measure of the value of one's product. The direct costs are the expenditures on all of the real resources which are consumed in the course of dealing with the health problem.

[9]One could argue that it is precisely because of the increased consumption of hospital care, indeed, all medical care that the health status of the population has improved.

Note, too, that I am referring to "utilization," in general, and not a specific facet of it, e.g. discharges. Obviously, discharges could increase and overall utilization could decline if the average length of stay declined and occupancy rates remained unchanged. Nor should we view "utilization" as simply "the inpatient day." The early days of a hospital stay are usually more resource using than later days. Thus, by utilization, I mean a general index of the consumption of hospital services. This, most assuredly, has been rising over time.

[10]The level of occupancy rates is used as one of the primary indicators of whether there is a bed shortage or surplus. State reimbursement systems try to reward hospitals for acting efficiently or controlling costs. Since there is considerable confusion as to what role filled or empty beds play in the determination of costs, some systems reward hospitals for "high" occupancy rates, others for "low" occupancy rates, and still others ignore occupancy rates.

[11]The brief explanations provided in the text which follows are popular explanations. They are, however, uncertain and part of ongoing debate in the health services research and health economics literature. See: Fred Goldman "Economic Constraints on Health Care,"

Bulletin of the New York Academy of Sciences, forthcoming.

[12]Stuart H. Altman and Joseph Eichenholz "Inflation in the Health Industry - Causes and Cures," in Michael Zubkoff (Ed.), Health: A Victim of Cause of Inflation, New York: Prodist, 1976.

[13]Altman and Eichenholz, Ibid, p. 11.

[14]Medical Care Expenditures, Prices, and Costs: Background Book, DHEW Publication No. (SSA) 75-11909, Washington, D.C. 1975, pps. 36-49.

[15]Eli Ginzberg,"The Sacred Cows of Health Manpower," Man and Medicine, Vol. 2, No. 4, Summer 1977, p. 239.

[16]Ibid.

DATA ON EXCESS MORTALITY TO PINPOINT PREVENTION PROGRAMS: BALTIMORE, 1969-77

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As a necessary first step in planning preventive and/or other health programs, Health Systems Agencies (HSAs) are expected to identify the populations residing in small areas within their jurisdictions deemed to be at excess risk of ill health; they are similarly expected to identify those determinants of ill health which are amenable to intervention. Resource and other constraints dictate, unfortunately, that this is to be accomplished at least initially, with routinely available data (Mooney and Rives, 1977). One such data set consists of mortality statistics, which in many localities are coded by census tract and are therefore particularly useful for health planning.

The value of such data has long been recognized, and they have been produced in some cities since 1940 (even 1930 in one or two cities), with many suburban counties now coding mortality by tract. Recently the number of areas coding tract on death certificates has expanded, currently perhaps to exceed 65, a significant proportion of the U.S. metropolitan population. Baltimore's mortality data by tract (N=200 in 1970), as well as aggregated into coterminous Regional Planning Districts (RPDs; N=26 in 1970), provide the basis for the present analysis, a condensation of parts of a much larger study performed under contract with the Central Maryland Health Systems Agency. In the larger study populations and areas at excess mortality risk were identified for the nine-year period 1969-77 (and each of its three three-year components) for the total population of Baltimore, by age, race, sex, and for 23 major causes of death. Excess mortality risk is, in turn, separated into severe, moderate, and mild. Both RPDs and tracts constitute units of analysis in the larger study, but only limited data for RPDs are shown here because of space.

Census tracts as "small areas" for population data.

Census tracts, according to the Bureau of the Census (1966), are...

"...small, permanently established, geographical areas into which large cities and their environs have been divided for statistical purposes... The average tract has over 4,000 people and is originally laid out with attention to achieving some uniformity of population characteristics, economic status, and living conditions."

Tract boundaries were to remain unchanged for a long time, thereby to permit comparison from census to census. In the 1970 census, population data were tabulated by tract and published for 241 Standard Metropolitan Statistical Areas (SMSA's), 238 in the United States and 3 in the Commonwealth of Puerto Rico (Bureau of the Census, 1972).

Initially the number of data items tabulated and published by tract was small, but coverage and number of items have increased. Coverage has grown from large cities only (50,000 or more inhabitants in 1950), to adjacent areas, and to inclusion of entire SMSAs plus some adjacent areas. The number of items in 1970 included a wide variety of subjects under the two overall headings of Population (eight general tables) and Housing (five general tables). The 1980 Census will expand the list of items published by tract; the data should be of even greater usefulness for health planning.

Mortality by census tract for health planning.

A suggested set of procedures is as follows:

1. Identify the mortality risk levels of all tracts and larger areas or population segments in the planning area, especially those at "excess risk".
2. Construct "profiles" of the characteristics of areas and/or populations at excess risk.
3. Use the profiles, as well as other studies, to identify factors contributing to ill health and especially to excess risk.
4. Determine the "preventable causes of death". pinpointing areas and/or populations at excess risk specifically for them.
5. Set priorities for allocation of resources.

I. Methods

Population: sources and adjustments.

The 1970 population data by tract for age, race, and sex, used as denominators to calculate rates, are from the "hard copy" 1970 Census Tract Volume for the Baltimore SMSA (Bureau of the Census, 1972) and from Census Bureau tapes. Population estimates for 1976 are from a Regional Planning Council (RPC) report (Regional Planning Council, 1978); however, these estimates by tract are for total population only, i.e., not disaggregated by age, race, or sex. Disaggregated figures for 1976 and both totals and disaggregated figures for 1973 were estimated from these sources. (RPC population figures for 1976 had, in turn, been estimated by International Data Development, Inc. using automobile registrations and telephone listings.)

However, two RPDs are far larger than all others; to make them comparable, and therefore more useful for planning, each was split into two nearly equal segments; West Baltimore into West Baltimore North and West Baltimore South, and East Baltimore similarly into East Baltimore North and East Baltimore South. The present analysis therefore uses 28 RPDs.

Mortality: sources and adjustments.

Mortality data are derived from computer tapes containing unit records of death certificates for Baltimore, 1969-77. All deaths had been coded for census tract of residence and for age, sex, race, and cause of death by the Department of Health.[†]

Cause of death was coded according to the procedures of the Eighth Revision of the International Classification of Diseases. Adapted for Use in the United States (ICDA). (See U.S. National Center for Health Statistics. 1969, pp. xxix-xxxi.) These involve assignment and coding of the "underlying cause of death", thus determination of "the single disease or injury which initiated the train of morbid events leading directly to death or the circumstances of the accident or violence which produced the fatal injury". Much information remaining on the medical certification portion of the death certificate and relevant to health planning is therefore lost.

Twenty-three causes of death were analyzed and shown in the larger report. "Natural" and "external" causes were aggregated for analysis and shown separately, a unique procedure useful for planning because prevention programs required for each differ.

Mortality rates used here are annual averages over nine years (1969-77) per 100,000 population. The population denominator to calculate rates is the estimated 1973 population. Rates for "all ages" are "age-adjusted" by the direct method to the U.S. 1940

[†] The tapes were generously provided through the courtesy of Mr. John Sweitzer, Biostatistician of the Baltimore City Department of Health.

population; this is customary in most mortality analyses, and it controls for varying age-compositions.

Excess mortality.

The procedure used here for identifying excess mortality risk is purely statistical, thus avoiding arbitrary cut-off points. Populations with rates exceeding two standard deviations above the mean are considered at "severe excess risk"; populations between one and two standard deviations above are at "moderate excess risk"; and those above the mean by less than one are at "mild excess risk". Where mortality rates are normally distributed (as was generally true here) five tracts are likely to be, on average, at severe, 27 at moderate, and 68 at mild excess risk; for RPDs the corresponding numbers are 1, 4, and 9. (For planning it may be useful to combine severe and moderate excess risk.)

II. Excess Risk By Regional Planning District.

As shown in Chart 1, five RPDs had overall mortality rates with risk moderately in excess of the rest of the city; none had rates severely in excess. The five moderately excess RPDs were: 21 (East Baltimore, South); 17 (West Baltimore, North); 18 (West Baltimore, South); 19 (Metrocenter); and 20 (East Baltimore, North); all were inner-city RPDs. Their rates were, respectively, 1360.6; 1311.5; 1286.9; 1280.8; and 1216.8; they exceeded the city-wide mean average of 911.1 by a range of from 49 to 34 percent.

At mild excess risk were nine RPDs: 25 (Carroll Park); 16 (Rosemont); 11 (Waverly); 26 (South Baltimore); 8 (Lower Park Heights); 27 (Cherry Hill), 22 (Highlandtown); 9 (Druid Hill); and 15 (Irvington). Their rates exceeded the city-wide mean average by 24 down to one percent. All nine RPDs surrounded and six were contiguous to the very high five in the inner city.

With the nine-year periods (1969-77 divided into three three-year periods (1969-71, 1972-74, and 1975-77), the pattern of excess mortality risk over time was stable (data not shown here). There was only a relatively very slight shift in rank order from 1969-71 to 1975-77.

The five RPDs with moderate excess mortality were among the seven with lowest mean family incomes in the city in 1969 (as reported in the 1970 Census). The five—21, 17, 18, 19, and 20—had mean family incomes of $5,682; $6,382; $6,575; $8,413; and $7,591, respectively; the city-wide mena was $10,035. The correspondence between low incomes and high mortality rates was thus very close.

This relative stability was accompanied by a general decrease in mortality rates over time and an increasing concentration of rates toward the mean average. As a measure of the increasing concentration, standard deviations dropped from 284.2 to 232.3 and 194.0, respectively; and coefficients of variation[v] from .302 to .252 and .223, respectively (data not shown here). As an instance of the same phenomenon, while two RPDs experienced severe excess mortality in 1969-71, none did later.

Charts 2 and 3 show that excess mortality risk is patterned quite differently for whites and nonwhites in the city, with only relatively modest overlap. Thus among the 13 RPDs with excess risk for whites and the 14 for nonwhites, only six had excess risk for both; interestingly, these six—19, 21, 25, 26, 22, and 10—were at relatively high excess risk for whites, relatively low for nonwhites. As a possible explanation, some of the RPDs with the highest excess mortality risk for nonwhites (1, 12, 4, 13, 14, 2, etc.) are located on the city outskirts and have had considerable in-migration of nonwhites; consequently, their nonwhite population estimates for 1973 (and 1976), used as denominators for the computation of rates, may have been significantly underestimated in these calculations.

Diseases of the heart.

Chart 4, for diseases of the heart, again has the inner city as concentration point, with moderate excess in RPDs 21, 19, 18, 17, 20, 25, and 26.

Here a somewhat greater concentration is found toward the southern and southeastern sections of the city; thus RPDs 23 and 28 show mild excess mortality.

Malignant neoplasms, all sites and by site.

Chart 5 shows excess mortality rates from malignant neoplasms, all sites. Severe excess mortality is found in RPD 21, with moderate excess in 17, 20, 18, and 16. Mild excess risk appears in the northwestern and heavily industrial southeastern sections of the city, with the north and northeast almost totally free of excess risk. Digestive neoplasms[v] show a similar pattern, as does respiratory (Chart 6). Breast neoplasms however, exhibit a more diversified pattern, with high rates in well-to-do areas (Chart 7).

Neoplasms of cervix uteri, however are also poverty-associated, and a similar pattern appears for neoplasms of the prostate. Lymphatic neoplasms, however, are not poverty-associated.

Homicide.

Chart 8 shows the data of excess mortality risk for homicide, with here again a strong poverty association. The highest RPDs are 17, 18, 21, and 20; few well-to-do RPDs appear on this list.

* * *

The analysis reported here is but a first step in the public health planning process. It should be followed up, as suggested, by four steps; 1) construct profiles of the excess mortality risk areas and/or populations, 2) identify the factors contributing to excess risk, 3) determine the "preventable" causes of death, and 4) set priorities for allocation of resources. This process can make local health planning a reality and a viable force in improving the health of the population.

[v] Standard deviation divided by mean; the coefficient of variation represents a measure of dispersion adjusted to the level of the mean average.

[v] The data are not presented, due to space limitations, for digestive, breast, cervix uteri, prostate, and lymphatic neoplasms.

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EXCESS MORTALITY RATES BY CATEGORY OF EXCESS
FOR REGIONAL PLANNING DISTRICTS OF BALTIMORE, 1969-77

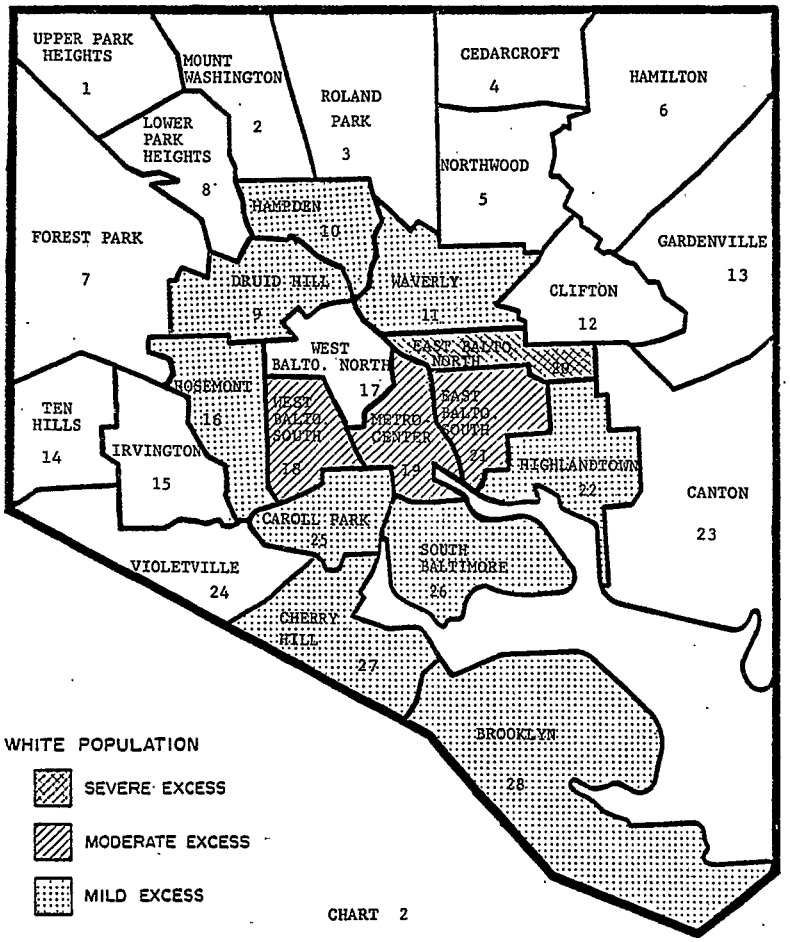

CHART 2

EXCESS MORTALITY RATES BY CATEGORY OF EXCESS
FOR REGIONAL PLANNING DISTRICTS OF BALTIMORE, 1969-77

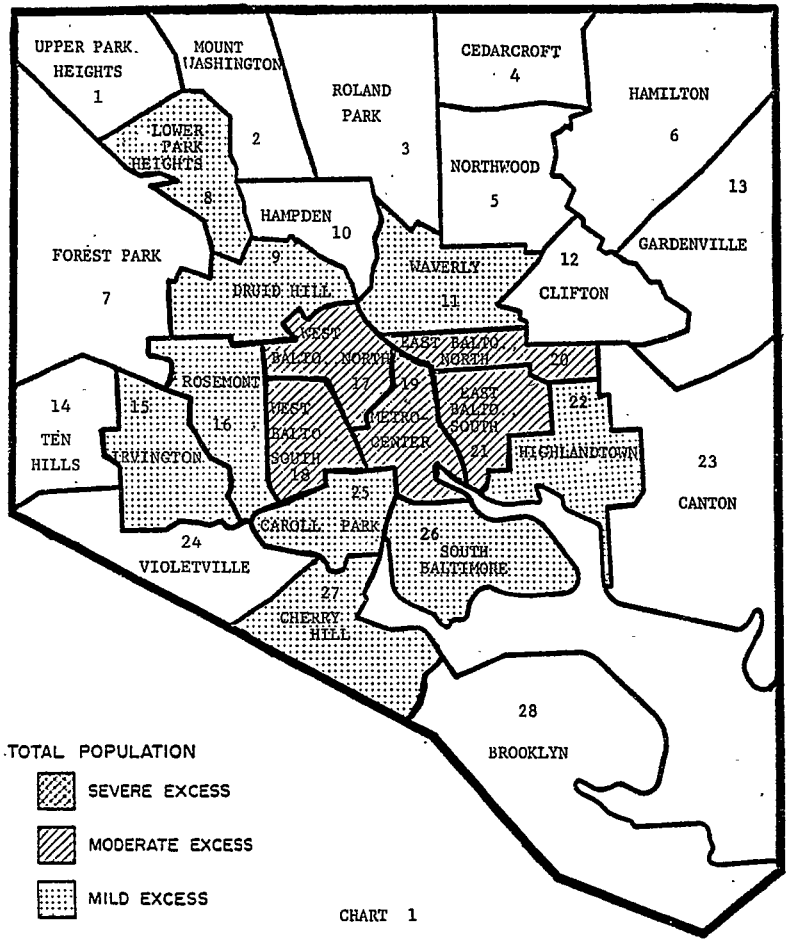

CHART 1

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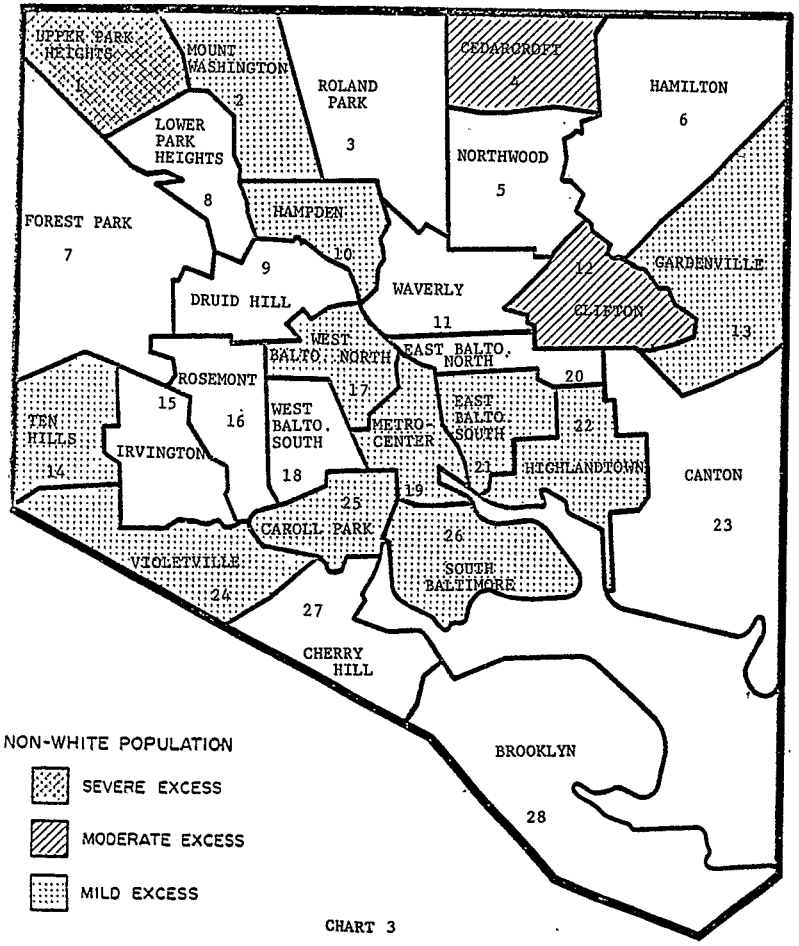

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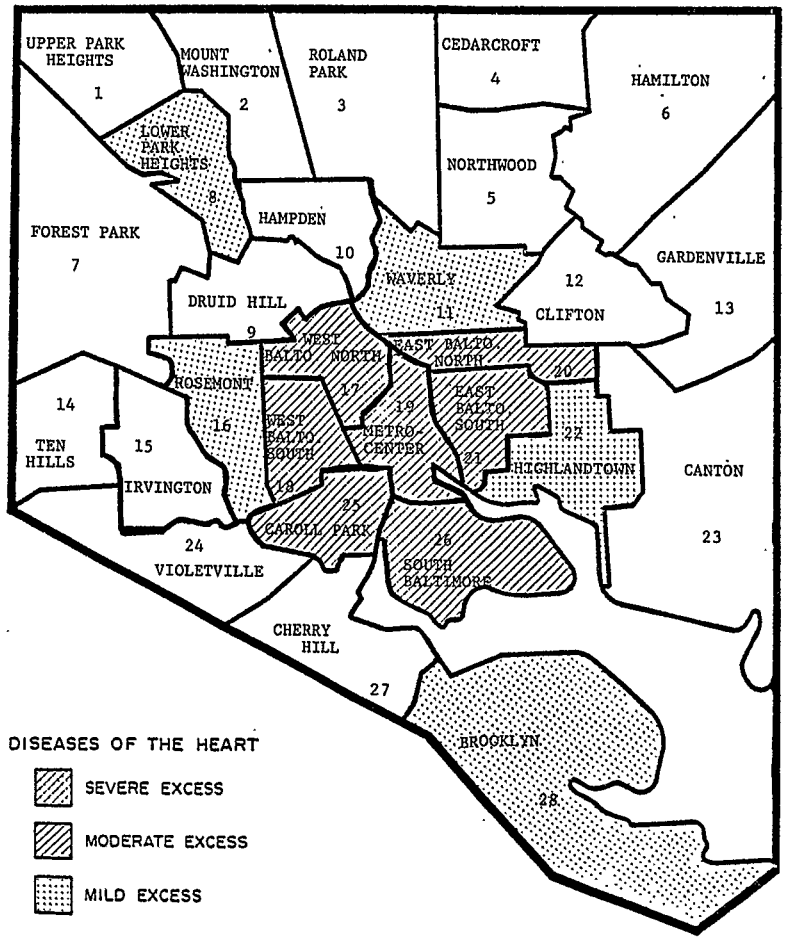

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FOR REGIONAL PLANNING DISTRICTS OF BALTIMORE, 1969–77

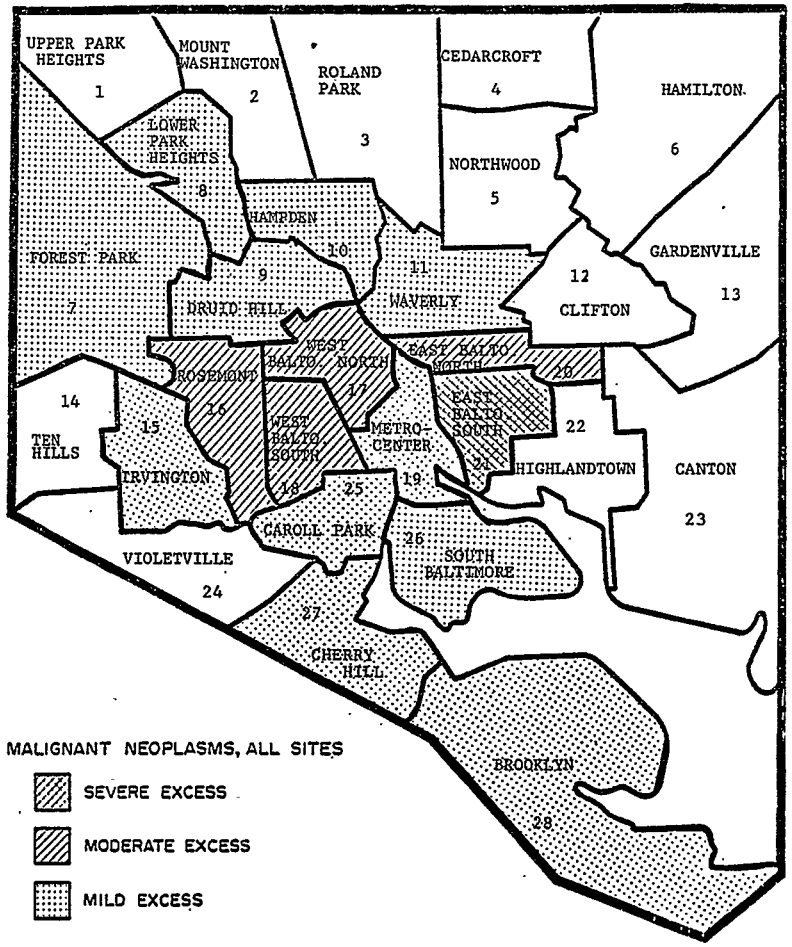

CHART 5

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FOR REGIONAL PLANNING DISTRICTS OF BALTIMORE, 1969–77

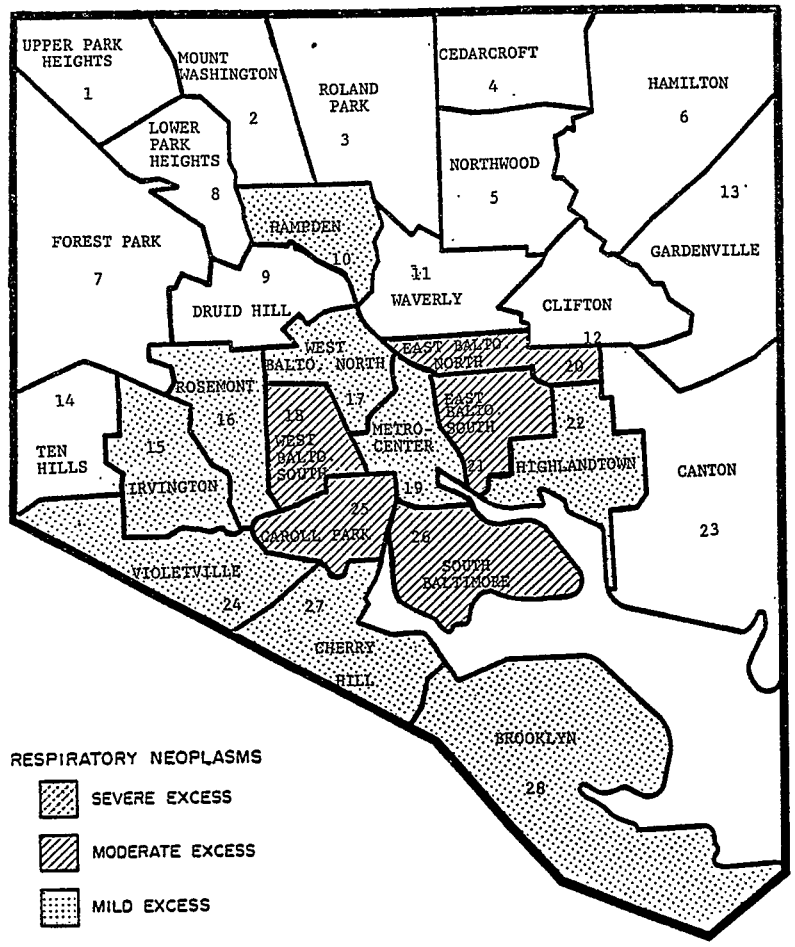

CHART 6

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FOR REGIONAL PLANNING DISTRICTS OF BALTIMORE, 1969-77

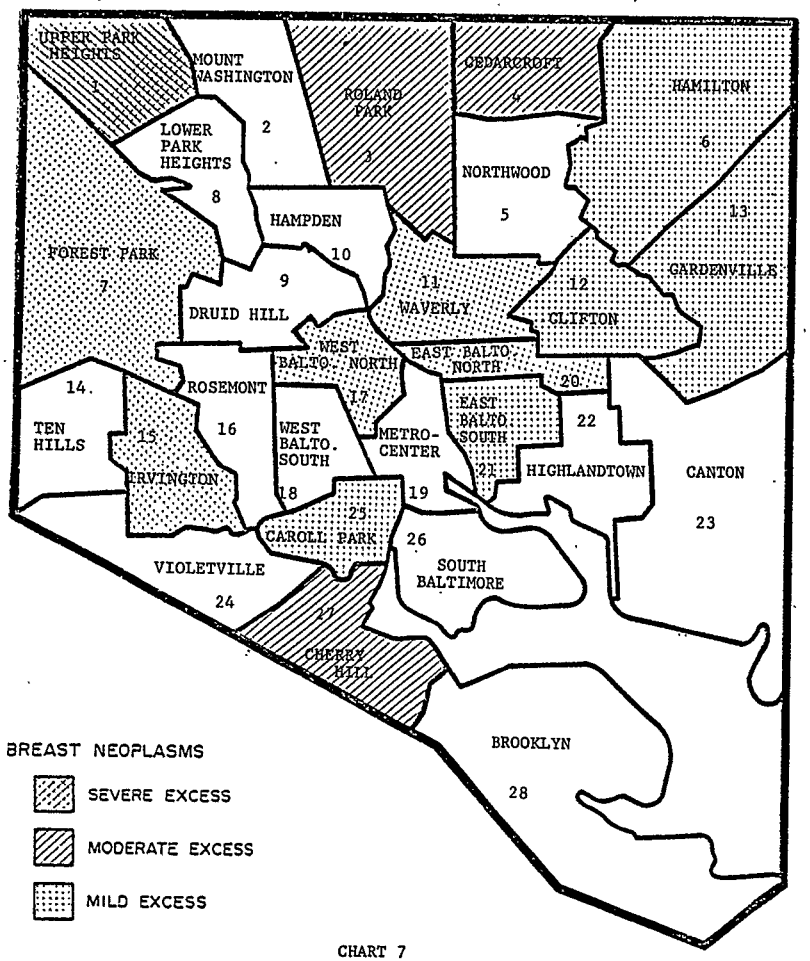

CHART 7

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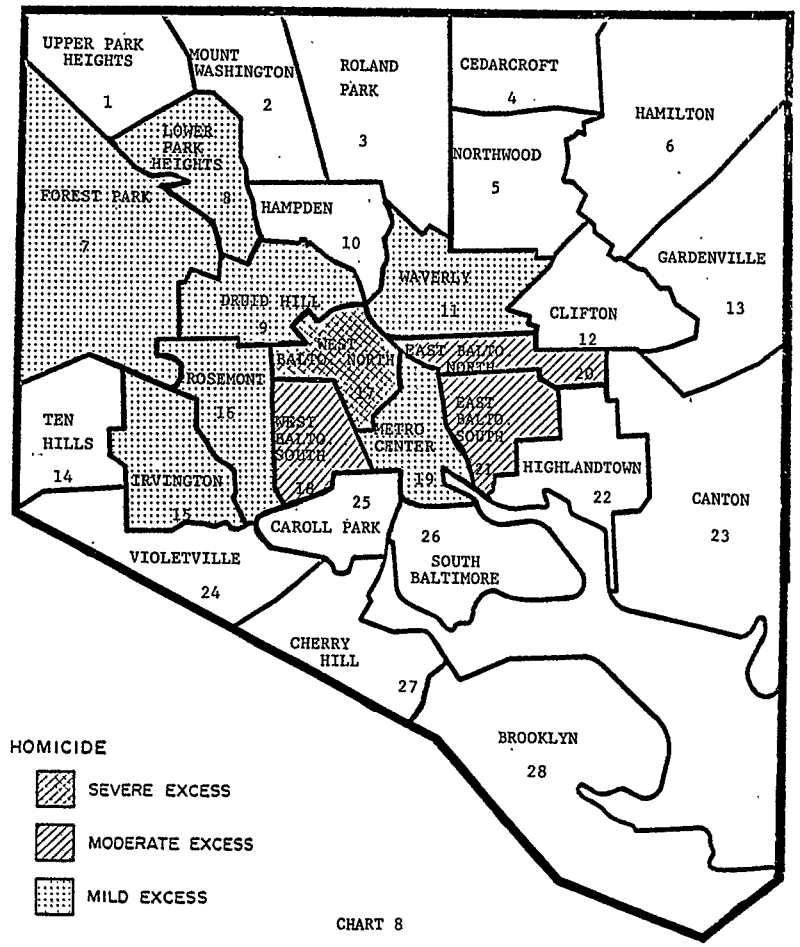
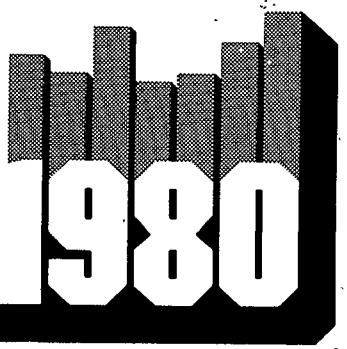


CHART 8

New Denominators for Old Numerators: The 1980 Census

Special Session



NEW DENOMINATORS FOR OLD NUMERATORS: THE 1980 CENSUS
Introduction

Earle J. Gerson, Bureau of the Census

You probably have not had any presentations on the decennial census, so let me start my introductory remarks by speaking briefly about where we have come from and what our goals are in the 1980 census.

First, during the 1970's we had a considerable change in the climate for statistics, particularly for decennial census statistics. Although the trend had started earlier, during the decade very substantial Federal funding grants were established that based a good part of the fund distribution on census data. Among these are revenue sharing programs, programs in the employment area and education, in housing, and in many others. As the amount of funding increased from these various programs, more and more attention focussed on the quality of the data from the 1970 census and from earlier censuses.

Earlier we had started evaluating coverage of the census and had published a number of research papers over the years. When people became aware that the funds they were receiving and their political representation depended so much on census data, coupled with the fact that we had announced that we had census undercoverage problems (which we quantified to the extent that we could), people became very worried that the 1980 census might not provide for them an equitable distribution of political representation and of funding.

As a result, very early in the process of planning for the 1980 census, we engaged in a series of outreach efforts that included contacting State and local officials and establishing advisory committees, some of them from professional societies. As a new development, we contacted representatives of minority communities to help us plan the census among population groups where we have had the most difficulty, and we established new programs for 1980.

This process of opening things up, of talking to everybody who has a stake and an interest and a possibility of contributing to the success of the 1980 census, also generated a fair amount of debate. As people became aware of our detailed plans, of our experiences and our tests, of our employment practices and many other aspects of the census, each area where we did not have full closure became a matter of full debate.

Thus, there has been a great deal of discussion of the design and the plans for the 1980 census, and, now that we are in the data collection phase, there has been further discussion of the implementation. As we will hear later, there has also been considerable discussion about how we should deal with the results.

Just backing up to the beginning, let me tell you a little bit about what we set as some of the census goals for 1980. This is not exhaustive, but it is illustrative of the kinds of things we are concerned about. While many of the problems and much of the debate focussed on the question of undercoverage and improving our performance over past censuses, we did concern ourselves with improvements in all areas of the census. Although coverage improvement was most important, we also had a strong desire to see that the content of the census was reflective of current needs for data. To accomplish this we established a very substantial outreach effort, involving meetings in over 70 cities around the country.

We have a program to reduce the error both in the collection phase and in data processing. We want to make the products as timely as we can. We have some products that we are putting out for the first time. One product mandated by law will provide data on population distribution according to racial group. This will be used for the redistricting within States for congressional and State legislature seats as well as other offices.

We also had a need to improve our geographic classification of returns. In every census, there are some errors due to the fact that although we count the housing units properly, we do not always get them in exactly the correct place through our geographic classification scheme.

Finally, another goal was to improve the reliability of data for small areas. To this end, we changed the sampling pattern in the 1980 census. In most areas of the country we have a long form filled out by one household in six. In the smaller communities, those of 2500 and under, we now have a one-in-two sampling rate, so that the sample data on the long form will be more reliable. The primary need for these data was for the revenue sharing program which requires a measure of income at the local level, but it also will be very useful for other purposes.

Now, a word or two about where we are in the census process. In the course of many of our public discussions during the development phase, we expressed our concerns both to budget officials and to the public about obtaining their cooperation and making this a successful census.

We were very much concerned about staffing, in particular about our ability to muster a work force of almost 300,000 people for a temporary job like the decennial census. In 1970 it was very difficult in some areas. In addition, there has been very substantial change in the work force over the last ten years. A much higher percentage of women who in 1970 and earlier censuses might have been available for part-time and temporary jobs are now in the full-time work force. We were very apprehensive, but fortunately our substantial advertising efforts have been fairly successful, and we have only spot staffing problems. I would say all in all it has probably been somewhat more favorable than our 1970 experience.

We have also experienced some very favorable response to our mailout. In 1970 we had a mail response rate of 85-87 percent . We thought that the climate for statistical activities was not as favorable in 1980 and, therefore, we projected for budgeting and manpower purposes a mail response of 80 percent. We actually experienced about 86 percent. We are very pleased by that, and certainly it reduced the number of enumerators we needed, thereby reducing our budget problem considerably.

Right now, the bulk of the data collection

is complete. The mailout and mailback were completed back in April and May. The followup of nonresponse is virtually completed. There are some offices in which it is not yet complete in a few of the larger cities. The bulk of the work on the second followup, which is a followup for quality of the returns and for certain coverage improvement efforts, is now done.

We are at the point now where we are starting to close up our field operation. As of now probably somewhere around ten or a dozen offices are closed, and are shipping their materials in to be processed.

Before we closed the offices, however, we enacted a new program that we think is very significant, but which has generated a fair amount of controversy, particularly in the press. That program is our local review. When we were partway through the census, after we had done most of the mailout, mailback, and the nonresponse followup, we compiled some counts of housing and population and submitted them to the local officials at the enumeration district level for their review.

With their help, and drawing on local resources and expertise, we asked them to spot for us any significant gaps in our coverage, particularly of new housing units, then inform us so that we could check out the situation doing additional field canvassing as required.

Now when some local officials saw these numbers, even though they are interim working numbers and not final results, they reacted with alarm. Particularly in the larger cities which have declining populations (and, again, coupled with the knowledge that there is undercoverage in the census), they have reacted to these as though they were preliminary results in the census. This is not quite appropriate, we feel, and we so informed them.

The local press that you have seen on this subject may reflect the fact that there is misunderstanding about the nature of these numbers. All in all, this operation seems to be going fairly well, and we are not turning up as many problems as we anticipated. This is probably reflective of the fact that the census field work has gone reasonably well, at least compared with previous censuses.

1980 COVERAGE IMPROVEMENT ACTIVITIES AND THEIR POTENTIAL EFFECTS

Earle J. Gerson, Bureau of the Census

My subject today is the undercount problem in decennial censuses, specifically programs built into the 1980 census to reduce the undercount problem and projections of the possible impact of the programs on the results of the census.

Undercoverage has been perceived as a problem since the very first census in 1790 and continues to the present. In 1950, based on demographic analysis, we estimate that the undercoverage was 3.3 percent of the population. In 1960 it had declined to 2.7 percent, and in 1970 it was estimated at 2.5 percent. Interestingly, a letter written by President George Washington in 1790 to Director of the Census Thomas Jefferson indicates that a crude estimate of the undercoverage at that time was of a similar magnitude, between 2 and 5 percent. So it does not look like we have made a great deal of progress over these 200 years or so.

In 1970, there were marked differentials for age, sex, and race. The 1970 rate for the white population was 1.9 percent, and for blacks, the undercoverage rate was estimated at 7.7 percent, a ratio of about four to one.

If we look at it further by age, among the black males 18 to 35, the rate was substantially higher than the 9.9 percent, about 18 percent, so we have very marked differences among the groups that we are able to identify through this demographic analysis method. Geographically, although our measures do not give us as much confidence as we would like, it appears that the rate of undercoverage is higher in the South than in other parts of the country.

There are two sources of the population undercount. First, there were persons living in units that were entirely missed in the census. These accounted for about 1.4 percent out of the 2.5 percent of the population that was missed. The people who are missed within enumerated units comprise the remaining 1.1 percent. These two categories include misses of an entire household and misses within a household.

Interest in the extent of undercoverage has grown and intensified during the past ten years. As I indicated, with the growing reliance on census data as the basis for distributing political representation and funds available under Federal and State programs, the quality of the data and the resulting issues of equity have been subjects of considerable concern.

Consequently, it was decided early in the decade to include in the 1980 census substantial efforts to improve coverage and to reduce the differentials of which we were aware. The resulting programs, some of which I shall describe, comprise a major cause of the sharply higher costs of the 1980 census and the increase in the time required for data collection.

Incidentally, because of the increased time required for data collection created by these programs, the legislated deadline for us to deliver the results for the reapportionment to the Congress has been set back one month in this decade. The results of the census are now required by law to be delivered to the President by December 31 of this year.

The 1980 census has included a much-expanded promotional effort involving advertising, community relations, and other activities. We consider this effort essential in reducing the component of misses within households. To the extent that these misses are willful misreporting, we are hoping that the message we delivered through advertising was effective in convincing people that the confidentiality of the census data is sufficient protection for them and that there are some benefits to be derived from full participation in the census.

We do know that the advertising outreach effort was fairly widespread and was well-promoted by the media, and that a very substantial percentage of the population was exposed to the message. To what extent they believe it, to what extent they acted on it, we do not know as yet, but it was a very important part of our program.

I shall now review briefly some of the major elements of the direct coverage improvement program in two categories, those aimed at the missed addresses and those aimed at the misses within enumerated households.

The first of the coverage improvement efforts was an extension of the mail procedure to a larger part of the country. In 1970 about 60 percent of the country was covered through a mail procedure and the rest through a conventional census. A conventional census is where an enumerator with a map systematically canvasses the territory, knocking on each door and doing the enumeration as the listing of housing units is created.

Coverage in the mail census seems to be better than a conventional census. An extension of this mail census procedure includes a set of checks involving the post office, enumerator visits, and the use of available commercial mailing lists. In combination, these efforts give us more complete coverage of housing units than we can get in a conventional census.

Moreover, in those areas where we do not have commercial mailing lists available, the list is compiled by an enumerator, who uses a map to systematically canvass and assign the territory. We then go through the subsequent series of checks, postal checks, and later we recanvass where necessary.

In addition to extending the prelists with an expected higher coverage, we improved and tightened up in our procedures for the prelisting, and we have better quality control and a more systematic way of preparing the listing. We do not have a measure of the effect of this extension of the prelist, so we cannot quantify the expected benefits.

Many of the test results that I am going to talk about as we go through these individual coverage improvement programs are based on single area tests, and should be considered in the light that we may not be able to generalize with a great deal of confidence to the Nation as a whole. In planning the census we operated on the basis of making use of whatever limited information we had to pick the most effective and cost-effective ways of improving coverage, our primary goal.

So where would the effects of these programs be felt? Obviously it would be in the areas that previously would have been done conventionally, but which are now being done by the prelist method. The conventional area is basically the rural area of the country, so one would expect that the rural area would benefit from this coverage improvement effort.

The next program is the precanvass program which should be one of the major contributors to mail list improvement. This was conducted in the areas where commercial address lists provided the foundation. We started with a commercial list, sending it through a post office check in the summer of 1979, and a second postal check early in March of 1980. Between this second postal check and the time of mail delivery on March 28, enumerators canvassed an enumeration district to see whether there was anything observable on the ground that did not appear on the original commercial list as updated by the post office. Here, we do have some measures of potential value from two or three of the tests in preparation for 1980 and a similar operation that we did on a small scale in 1970.

So in the tape address register areas, which are commercial list areas and include 45 million or more addresses, we expect based on the 1970 experience to add somewhere on the order of 2 percent to the coverage of housing units.

In 1970, in the 17 areas where we tried it, we had an improvement of 2.3 percent. In two of our pretests in Travis County, Texas, and in Camden, New Jersey, we added 1.5 percent and 2.3 percent respectively.

In Camden, the adds were roughly evenly divided between adding entire structures to our lists and adding units within listed structures. The adds picked up tended to be smaller units with an average household size of 1.4 versus 2.6 in the area as a whole. However, in Camden there seems to be no clear pattern based on the characteristics of the area. That is, we did not do appreciably differently in poorer areas as compared with other areas of the city.

The next program in prelist areas is a recanvass. At mid-census, after we had compiled the original list by the prelisting procedure, we went through the postal checks, the mail-out/mail-back procedure, and the followup. We then examined the records for our individual offices and identified those containing as many as 20 million addresses. These comprised about a fourth of the total number of offices. Next we recanvassed the enumeration district to see whether our list currently had either gaps or duplicates in the coverage.

This procedure was not tested at any time. Our concern for including it arose from the fact that we were extending the prelist procedures to areas that were very rural, where it was not done before. In these very rural areas, there is a question of the quality of the mailing addresses and the deliverability of the mailing piece. For insurance, we wanted to make sure that the post office did not eliminate as undeliverable an address that was really a valid address.

I should mention that although the census is now well advanced, the results of these improvement programs will not be known until our evaluation work is completed next year and perhaps going on into 1982, when we will have the final measures.

Another coverage improvement program is the extension of the post-enumeration post office check in conventional census areas. This was a procedure that we used in 1970. The problem was identified rather late in the game, and a census check was instituted where we submitted the address lists to the post office. In 1970 it was done in the South only, and in 1980 we are extending it to the Nation as a whole, so all of the conventional census area will have a post-enumeration post office check.

Actually, in 1980 it will occur at mid-census so that as we discover gaps or problems in the coverage our field force can go out and cover what was missed. In 1970, in the South we added about 1.4 percent of the covered housing units, including 1.3 percent of the population of the South. Part of the dress rehearsal was a conventional census in two relatively lowly populated counties in Colorado. There, about 1 percent of the covered housing units were added through this technique.

These efforts will impact on the areas that were not covered in 1970 but are covered in 1980, which would largely be the western and the northern tier of States, where the conventional census procedure will be used.

The next coverage improvement program is the unit status check. Basically, this is a program that recognized the fact that some of the housing units are misclassified as vacants when they are actually occupied. In addition, some units are indicated by the post office and by enumerators as being nonexistent when in fact they do exist. So we do a double check. An independent interviewer verifies the status, and we transfer a substantial percentage of the units that are so reported from vacant to occupied.

This is being done in all areas, and the size of the added group in our Travis County pretest was 0.7 percent; in Camden, 1.7 percent, and in Oakland, 1.8 percent. For 1970 the total added was 0.5 percent, so fairly consistently we are close to 0.5-1 percent improvement through this measure. In our current measure of our 1980 performance, it appears we are converting about 12 percent of the units initially reported as vacant to occupied.

We have programs designed to improve coverage within households. One of these is a household roster check. We identify those households in which there appeared to be some confusion about the roster of household members, and we do followup visits to be sure that we have full coverage.

In both the Travis County pretest and in Camden, we added 1 percent to our population coverage through this technique. In Camden we have some information of the characteristics we added. They were mainly black and Hispanic, but, of course, it is a city that has a very high minority concentration. About 60 percent were under 15 years of age, and 96 percent were under 35 years of age, with somewhat more males than females in the added group.

The final program that I will discuss is the nonhousehold source program, and this one was very specifically designed to attack the problem of

the observed differential rates of undercoverage between blacks and others in the population. This differential is also believed to exist among other minority populations, such as Hispanics. This program involves the use of independent lists. We obtain names and addresses of persons in minority areas where we use commercial lists and the tape address register areas. We geo-code the names in this list by computer, about 8 million such names, and we systematically compare the geo-coded names against the census returns to see if any of the names fail to appear. If a person's name is not on the completed questionnaire, we do some field followup to see whether he or she truly belongs in the household, and if so, the name is added.

Interestingly, this does not result in just adding the one missed person to the household, but for every addition we make that was found on the list, we get about one and a half persons added to the household. The pretests in Travis, where we dealt only with males 17 to 35 years, indicate that we added 3.6 percent to the blacks and the Spanish in the covered areas, and 0.7 percent to the total population. In Camden, where we had a very limited sample coverage, we added 0.5 percent to the total population. If there had been full coverage, it might have been as high as a two-percent add.

We are very encouraged by these test results, and hope that the 1980 experience will be very similar. The people we add, as you might expect, are generally not household heads and spouses. They tend to be either children of the "householder," other relatives, or, in some cases, unrelated individuals.

What will be the results of this improvement effort relative to the uncounted population and the differential rates of undercoverage among the subgroups? Although definitive answers are not possible at this time, some will be available after the census. Our test data give us some basis for speculation, so let us just run through the types of improvements that I have just described and their impact:

(1) The improved listing procedures will affect coverage in rural areas. (2) The precanvass will affect housing unit coverage in metropolitan areas, perhaps 2-3 percent improvement there. (3) The post-enumeration post office check will add about 1-1.5 percent if we follow our test experience in conventional areas, primarily in the West and the North. (4) On the prelist revancass, we do not know the size of the effect, but it will be primarily in the rural and suburban areas. (5) On the misclassified vacants, the unit status review, there will be no improvement relative to 1970 (assuming the procedures are equally effective) because in 1970 there was a similar program, but it was not done on a 100-percent basis across the board. Imputation was used to project vacancy conversions for the Nation. (6) With the roster completeness checks, the roster edits, we expect to add about 1 percent of the population across the board, concentrated in the young population and in minorities. (7) The nonhousehold source programs may add 2-3.5 percent in minority concentration tracts.

Thus, we have assorted efforts to improve coverage across the board. Only one of the programs offers substantial promise in reducing the differential between minorities and the majority population.

These results are based on limited tests and should be considered suggestive only. If accepted at face value, they would appear to virtually eliminate undercoverage, a result we do not expect. This anomaly results in part from the fact that these efforts overlap each other. The postal checks, the precanvass, the recanvass, the advertising, the roster check, and so on all overlap each other. We do not expect any one of them to answer the problem. We hope that the combined effect will yield the maximum coverage available in the census procedure.

As I indicated, address system improvements are being pursued in all areas. The greatest improvement could occur in metropolitan areas, where the precanvass appears to be a particularly effective addition to the program.

With reference to within-household improvement, the nonhousehold sources program appears to contribute significantly to population counts in minority tracts in metropolitan areas. This improvement will be concentrated among the black, Hispanic, and Asian populations. These additions appear to be people within the household rather than the head and the spouse.

Segal and Passel have done some speculation about what the census coverge will be like under various assumptions of coverage improvement. Let me just run through some of their numbers for you.

Given the change in the age-sex-race structure from 1970 to 1980, if we did nothing but retain the 1970 procedures, the undercoverage rate would have gone up from 2.5 percent to 2.8 percent. For whites, it would have gone from 1.9 percent to 2.1 percent, and for blacks, it also would have gone up 0.2 percent from 7.7 to 7.9 percent.

Now if we were successful in reducing the undercoverage of persons in missed units by half, then the undercoverage rate nationally would have been 2 percent with 1.4 percent for whites and 6.1 percent for blacks. If we were successful in reducing the misses within enumerated units, undercoverage would decline to 2.3 percent with 1.8 percent for whites and 5.7 percent for blacks.

If we had both types of omissions reduced by 50 percent, we would have 1.4 percent for total population (1 percent for whites, and 3.9 percent for blacks). Basically, under all of these assumptions, the differential between the black and other populations remain around 4 to 1. I believe the issues of equity that have largely been analyzed on the basis of this differential will remain so even under the most fairly optimistic set of assumptions. We still have to deal with the implications of differential within the undercoverage.

Obviously, we are not projecting how much improvement we will have in 1980. We are hopeful that this very large investment of effort and public funds will pay off, and we will see at the end of the year just how successful we have been.

MEASURING THE CENSUS UNDERCOUNT: GEOGRAPHIC AREAS AND SOCIOECONOMIC GROUPS*

Charles D. Jones, Bureau of the Census

Introduction

The 1980 census includes many new or expanded efforts over those used in previous censuses to try to achieve a complete count. We have developed and implemented additional procedures to try to overcome specific coverage problems that have been noted in past censuses. We have employed a substantial public information campaign which, we believe, has been very effective in increasing cooperation. We have also undertaken a number of reviews, especially with local officials, to insure that the counts are correct before we start publishing the results.

Nonetheless, we are sure there will be an undercount remaining in the 1980 census figures. As has been our practice in the last three censuses, we plan to estimate the undercount in the census figures for 1980 and to publish the findings.

There are a number of purposes for estimating completeness of census coverage. First, the estimates help users understand the strengths and weaknesses of census figures, so that more intelligent use and analysis of the data can be made. Secondly, these data are useful to Bureau planners to understand where problem areas remain, so that corrective action can be planned for future censuses. Thirdly, over the past dozen years the legally mandated uses of census data have proliferated to the point where the allocation of many billions of dollars depends on these data. Consequently, there has been a great deal of public and political pressure to adjust the counts for inaccuracies that remain in the data, and serious attention is being paid to this issue.

Our plans for coverage evaluation for the 1980 census have been developed with all of these objectives in mind. Thus, for 1980, we have expanded our efforts at coverage evaluation. I will describe our current plans and the data to be produced. In developing our coverage evaluation program, we considered a wide range of methodologies and study designs to estimate the undercount and its distribution. Some approaches were evaluated and discarded as not feasible. Others seem to work reasonably well, although some problems remain to be dealt with. Some have major methodological problems which are still being investigated, but these have been retained in our plans pending the outcome of that research. Thus, the plans presented here should be considered as those to be implemented under the most favorable circumstances (i.e., our most optimistic plans).

Studies to be Conducted

The Bureau will depend on two general approaches to estimating coverage: demographic analysis and matching studies. In demographic analysis, data largely independent of the census currently being conducted are combined to derive expected population numbers. That is, data from past censuses, statistics on births and deaths, data on immigrants and emigrants, and data from administrative record sources, such as Medicare, are combined to estimate the numbers of persons that should be counted in the census. Census counts are compared to these estimates. Differences are assumed to reflect net errors in the census.

For example, to estimate the expected numbers of persons aged 0-4 in 1980, we take the births registered between April 1975 and March 1980, adjust these numbers for unregistered births, and further adjust the numbers for deaths, immigration, and emigration. The resulting number is our best estimate of the population that should be enumerated in this age range in the 1980 census.

Note that this approach, which might be termed the MACRO approach, does not require us to identify individuals that were missed. Rather, it gives us an estimate of the net numbers of persons in various classes who were omitted from the counts.

In the matching studies, national samples of persons are identified and matched to the census records on a name-by-name basis. From these checks we can identify particular individuals who are missed, along with their characteristics. Weighting the sample results gives us an estimate of the numbers of persons in various classes omitted by the census.

Note that this approach might be termed the MICRO approach, as it depends on identifying a sample of individuals actually omitted by the census.

Demographic analysis will be used to produce a national estimate of net under-enumeration for the total population and national estimates of net census error, combining coverage and classification errors, for age, sex, and race.

The particular procedure used to estimate the coverage for the various demographic subgroups, notably age groups, depends on the nature of the available data and on the timing requirements of the overall evaluation program. For age groups under age 45 in 1980, i.e., persons born after 1935, estimates of the corrected population will be developed from birth, death, and immigration statistics. For the population over age 65, aggregate Medicare data adjusted for underenrollment will provide the basis for the preliminary coverage estimates. For the remaining ages, 45-64 years, the preliminary coverage estimates will be extensions of the estimates for ages 35-54 in 1970; these were derived from analysis of previous censuses.

One component of the expected population in 1980 for which data are lacking is illegal immigration. Obviously, because of the nature of this population, an accurate estimate of its size will be quite difficult, if not impossible, to make.

The range of existing estimates for the illegal population in recent years is quite broad. No satisfactory estimates of either the net flow or the illegal resident population in the United States are available. A variety of estimation techniques have been used to try to establish the number, but the true number remains unknown.

We have undertaken a review of the existing studies of illegal immigration and the illegal resident population and have considered various approaches to the estimation problem in addition to those previously employed. We hope to develop a range of working estimates of the illegal alien population to be included in the estimate of the expected population in 1980, but currently this remains as an unsolved problem.

* Presented by Charles Cowan, Bureau of the Census

Demographic Analysis (States)

A "demographic" method of estimating the coverage of State populations was attempted for 1970 (U.S. Bureau of the Census, 1977). The basic approach involved first estimating the coverage of the population born in each State (for ages under 35 in 1970) by comparing survivors of births with the census data on the population born in each State. Then, several different procedures and assumptions were used to convert the coverage estimates for the population born in each State into estimates for the population living in each State. The procedures and assumptions involved a number of parameters for which no data were available. Accordingly, a number of alternative sets of State coverage estimates were derived rather than a single preferred set. Other uncertainties in the estimation procedure led us to characterize the estimates as "developmental."

For 1980, we plan again to produce "demographic" estimates of census coverage for States. Several developments may remove some of the uncertainties in the estimation method to the point where it may be possible to simplify the procedure and to derive a working set of estimates. The match studies, if successful, would provide estimates of the relative coverage of lifetime interstate migrants and nonmigrants. This parameter is crucial to the estimation procedure; values had to be assumed for 1970.

The data on births which extend back to 1935 will cover a larger proportion of the population in 1980. In addition, research is underway to extend the data on corrected births back to 1925 or 1915. If successful, this project would virtually eliminate the need for ratio estimates in the middle age range. We also hope to remove some of the uncertainty in the coverage estimates for ages 65 and over with the results of studies being conducted at the Bureau of the Census on the accuracy of residence reporting in the Medicare files.

Matching Studies

We have carried out a considerable amount of research on the feasibility of conducting a sample survey as soon as possible after the census enumeration has been completed to meet the demand for estimates of census coverage for States and various local areas. Coverage error would be estimated by matching persons listed in the survey on a one-to-one basis with the census listing of names. The survey would be designed to provide reliable estimates of net coverage error at the State level for the total population.

From the matching studies we can expect to obtain a wide variety of useful analytical data. In addition to age, sex, and race, these studies can produce estimates for the Hispanic population, estimates for a variety of geographic categories such as urban-rural and metropolitan/nonmetropolitan residence, and data for socioeconomic characteristics such as labor force, income, and education.

Administrative Record Match. Matching studies were conducted as part of the 1950 and 1960 census evaluation programs. These studies were not successful in providing accurate estimates of the undercount for certain subgroups of the population, however. Other evidence, including estimates derived by demographic analysis, clearly indicated that the matching study estimates of underenumeration were seriously biased downward. Erroneous results such as these are apparently caused by "correlation bias." This bias stems from the fact that persons enumerated in the census tend to be enumerated in the survey at a greater relative rate than persons missed in the census; that is, persons missed in the census tend not to be reported in the survey for the same reasons that they were missed in the census.

Therefore, in 1980, in addition to conducting a sample survey to estimate census coverage, we are considering the use of additional data from "independent" administrative files to improve the estimates of coverage error. To the extent that satisfactory matching of the administrative files, the census, and a survey can be achieved without impairing independence of the sample data, more accurate estimates of coverage error should be produced than in previous match studies. Two administrative files are being considered for this purpose: The Internal Revenue Service (IRS) tax return file for persons aged 17 to 64 years of age, and the Medicare file for persons 65 or older.

The feasibility of using these files is currently being tested. The February 1978 Current Population Survey is being used as a proxy for a post-enumeration survey in this test. Data were collected to facilitate a match with the administrative files. Dual system estimates from this match for the total "corrected" population for February 1978 will be compared with "demographic" estimates of the total corrected population. If the problems of matching to the administrative files prove to be surmountable and the dual system estimates of total population are reasonable, coverage rates based on the administrative records could be used, along with "demographic" estimates, to adjust the survey estimates of coverage error in the 1980 census.

Combination of Estimates of Census Coverage

Demographic and survey-ARM estimates: Nation and States. Once estimates of coverage are available from the survey and the administrative record match, these estimates can be combined with the "demographic" estimates. Estimates from match studies can be derived for detailed demographic, socioeconomic, or geographic categories. The "demographic" estimates, however, will be suitable only for national or State estimates of various demographic categories.

The assumptions underlying the combination of data from the different sources are that the "demographic" estimates are more accurate than the estimates based on matching methods at the national level, but that the matching studies are better for measuring differences between geographic areas and are the only basis for measuring coverage differences between socioeconomic subgroups in the population. Estimates of coverage for State populations are expected to be available from demographic analysis and from the match studies. At this time, the relative quality of the two types of estimates cannot be known. Should either prove to be unacceptable, the other will be used alone. If, however, both sets of estimates are acceptable, it would seem desirable to combine them, taking the variances of the estimates into account in the weighting procedures.

A possible procedure for combining the "demographic" estimates and the match study estimates, which takes advantage of the better features of both types of estimates, would involve using the demographic estimates, particularly the national estimates, as "controls" or marginal totals for the

estimates from the survey. The final product of the estimation procedure would be sets of tables produced from the results of the survey (or a merger of the survey and demographic analysis) "raked" to marginal totals which correspond to the analytic estimates for age, race, and sex groups nationally. The resulting estimates would be the estimated counts for States.

Estimates for Sub-State Areas. Beyond the national and State estimates, there is a need for estimates of census coverage for cities, counties, and other local units of government. We obviously could not afford a survey to develop coverage estimates for these smaller areas because of the sample size that would be involved. Accordingly, we are conducting research into other techniques for producing coverage estimates for sub-State areas. At this point, it appears that any estimates produced will be experimental in nature. Techniques for validating sub-State estimates of census coverage have not been developed.

Two alternative procedures, regression and synthetic estimation, are being considered for obtaining estimates of census coverage for smaller areas. The matching studies are being designed to produce data which could be utilized by these procedures.

Adjustment

The decision on whether to adjust the census counts and, if yes, how to make the adjustments has not been made. The Census Bureau has been going through a challenging review process on this issue to make sure that all the critical assumptions have been identified and evaluated before the decision is made.

The first step in this process was the publication of a report of a panel of the National Academy of Sciences reviewing the census plans that concluded that some type of adjustment is feasible and that the technical responsibility for adjustment procedures should lie with the Bureau.

Secondly, the Bureau followed this activity with a conference in September 1979 which had as its purpose to identify the critical assumptions related to the various options on the adjustment issue.

Thirdly, a conference on the undercount was held in February 1980 which attempted to bring together the different perspectives of various scholars, statisticians, government officials, and interest groups for a dialogue.

Next we plan to bring together the various perspectives into a synthesis of the issues by:

(1) Publishing the proceedings of the undercount conference and obtaining further comments on the views presented.

(2) Based on the conference and other sources, a series of working papers will be prepared for general distribution to highlight and clarify the major elements of interest and concern on the adjustment issue.

(3) In September 1980, we will hold a workshop to synthesize findings and discuss possible recommendations. In this workshop we will deal with major issues such as: • Do the benefits outweigh the costs? • How do various interest groups perceive the benefits? • What will the law and the courts allow? • What will the political system allow?

(4) Following the September workshop we will officially publish our findings, making explicit the critical assumptions that will underlie our final decision.

(5) In November/December 1980 we will develop our final decision on whether and, if yes, when and how to adjust for undercount based on all available information, including any preliminary assessments as to probable undercount rates for 1980.

Of course, the decision about whether to adjust, and, if yes, how to adjust will have a tremendous impact on data users. We may have two sets of census figures, one unadjusted and one set officially adjusted. Or the decision may be to adjust only the intercensal estimates, leaving the census counts as is. Or the decision may be to produce a set of correction factors as we did in 1970, and make no adjustments to published data. The full range of alternatives will be considered in the decision process.

CHANGES IN CONTENT AND PRODUCTS AND DATA DISSEMINATION

Paula J. Schneider, Bureau of the Census

With all the current talk about coverage and undercoverage and improving and evaluating the count, many people outside and even inside the Census Bureau can forget that, along with these activities, we also collect data. I imagine most of you here would not be terribly interested in the census if we did not also collect some data about the people we find.

The 1980 census content and tabulations are not vastly different from those in 1970. They can be viewed more as improvements or modifications rather than radical departures. Most of the changes were made to reflect changing user needs during the 1970's as well as what we expect to be changing or continuing in emphasis during the 1980's.

Two broad areas of need which were reflected in the 1980 questionnaire are the increased need for data on race, Spanish origin, and ethnic or ancestry groups; and the need for more data as well as more reliable data for small areas.

In 1980, as well as 1970, all people were asked the race question. In 1970, this contained nine categories. By contrast, in 1980 the question was expanded to 14 categories, primarily to gain information on the Asian and Pacific Islander population. Among the changes was the addition of the category Asian Indian, which in 1970 was classified with White.

Another change was made with the race question in the classification of responses. In 1970, people who responded that they were Spanish were reclassified as White. In 1980, the response Spanish was classified in the Other Races category, and tabulated as such. We will provide tabulations that will show you how many people of Spanish origin answered White, Black, or Other, so if you need absolute comparability with 1970 you can go back and add them to the appropriate group.

An additional modification of the questionnaire was the inclusion of a single Spanish identifier on the 100 percent part of the form. In 1970, we had at least three different identifiers, including (1) the "mother tongue" or language item used in the majority of the U.S.; (2) the Spanish surname coupled with Spanish language, used in five southwestern States; and (3) the question on the parents' places of birth used to identify persons of Puerto Rican parentage in the three middle-Atlantic States. For the United States, this conglomerate of Spanish identifiers was called "Persons of Spanish Heritage."

During the 1970's we found a great need for a single identifier, not different ones for different areas of the country. Therefore, we modified the question that was asked on a five percent basis in 1970, specifically, "is this person of Spanish or Hispanic origin or descent."

The major change from the 1970 inquiry in this area is that we excluded the response category Central or South American. We had a very good reason for this. In 1970, our evaluation showed that people in the central or southern parts of the United States misinterpreted the question and marked that they were Central or South Americans. When we found a lot of South Americans in Alabama, we got a bit suspicious.

On the sample part of the questionnaire, we have two new questions relating to ethnicity. One concerns current language, language usage, and the ability to speak English. In 1970, a similar question was the "mother tongue" item, which asked the language used at home when the person was a child. This was an ethnic identifier in 1970, but the needs have changed to a demand for a question to identify areas where there are special needs for educational and social services for people with limited English speaking ability.

The other new question about ethnic groups was open-ended; it simply asked the person's ancestry. This replaced two questions from 1970 that asked for the place of birth of the person's parents.

We went to the open-ended, self-identifying ancestry question because we felt the need in the 1970's for an ethnic identifier that was not restricted to first and second generation. People may have puzzled over how to answer this question because there was no limit to what could be written there; it could range from one ancestry group to a string of ancestry groups.

We will code and have available data for the first two ancestry groups in any strings with the exception of some common three-group ancestries that we code separately.

That is basically it in terms of changes involved in race and ethnic data, but there were several other changes to the questionnaire. One of my favorites was the change to the relationship question, Question 2. In 1970, households were asked to designate who was the head, and we felt we might have been causing a lot of arguments in married-couple homes to make one of them put themselves as the head, and the other in a lesser position, so to speak. We heard quite a bit during the 1970's on how we should not be making that value judgment or forcing households to make that value judgment themselves.

In 1980, therefore, we asked the household respondent to put in Column 1 the name of one of the household members who owns or rents the living quarters. That got away from the term "head of household" and got away from saying the husband is automatically the head as we did in 1970. We let respondents enter either the husband or wife in Column 1, and then we geared the relationship of the other household members to that one person. This again will cause some loss of comparability with 1970, but our tests have shown it is not a dramatic loss, and maybe 10 percent of married-couple families have put the wife in Column 1 rather than the husband.

Also, we will be providing tabulations that will reclassify these groups according to the 1970 definition if there are people out there who need to have this on a comparable basis. In the same question, we added a category on partner/roommate, which was not there in 1970, mainly in recognition of the growing number of unrelated people who are living together.

That covers it on changes on the 100 percent portion of the questionnaire. On the sample questionnaire, in 1970 there was a question on dis-

ability status which was restricted entirely to work limitation. The question in 1980, however, is somewhat different in that in addition to covering work limitation, it included a question on limitations in using public transportation. You might call it a tradeoff. We lost the 1970 question on duration of disability in favor of obtaining information on public transportation.

The additional questions, reflecting the current concern with energy use and commuting patterns, inquire about commuting time and carpooling arrangements.

In the economic area, we had a new question on usual hours worked per week. This was primarily to use in conjunction with earnings data so that you have not only weeks of work, but also some indication of how many hours each week in order to do comparative earnings studies. You can then use the work input as a control. We also added a question on weeks of unemployment during 1979, so that in addition to the current unemployment indicator as of the census reference week, there is also some indication of how many people experienced unemployment during the previous year.

I will touch on two other comparability issues very briefly. For those of you who deal with occupation data, you should be aware of the new standard occupational classification system. The 1980 census and most other government programs using occupation data will be based on the standard occupational classification. This will cause a lack of comparability with 1970 data, but we do plan to make a variety of comparability products available for interpreting the trends over the decade.

Lastly, in content, those of you interested in farm data should be aware that the definition for classifying households as being farms has changed since 1970. It is now based purely on sales of farm products as opposed to an acreage requirement which is no longer used. This was not a Census Bureau decision; instead it was a governmentwide decision.

Now I will briefly go over the reports. There are basically three types of census reports. You notice the 1980 census is a Population and Housing Census. I did not mention any housing items, because I am from the Population Division, and obviously people are more important than houses.

In any case, there are combined Population and Housing Reports from the census. In addition, there are reports concerned only with population data, and there are reports concerned only with housing data.

To start, I will briefly go over the combined reports first. The first series is preliminary, which means it contains the counts that were clerically prepared in the local census offices. These should start coming out within the next couple of months, and should all be out by the end of the year, hopefully.

These are followed by the advance reports which are the final census counts for what we call higher level geography: States, counties, county subdivisions, census-designated places, incorporated places, Standard Metropolitan Statistical Areas (SMSA's), and congressional districts of the 96th United States Congress.

The next in a series of combined reports is block statistics which provide a series of data items on a very small level--city blocks--for SMSA's and for other places of 10,000 or more, and for other selected areas which have contracted with the Census Bureau to have their areas blocked and to have statistics provided for them.

The next series is census tracts which again are subdivisions of SMSA's, but which are somewhat larger than blocks, but very useful for local planners in targeting their funds or programs. This series of reports will contain both 100 percent and sample data from the census, and is scheduled to come out during the fall of 1981 or spring of 1982.

Finally, there is a new series of reports from 1980 that will be called "Summary of Characteristic for Governmental Units." This new series is designed primarily to provide local government people with at least the summary figures they need to fulfill Federal requirements for programs. It will not provide all the data they need, and a little bit later I will get into how that data will be provided.

The reports that are clearly population reports are called Volume I of the Population Census. There are four chapters, A, B, C, and D. Chapter A gives you the census counts for all "higher level geography." Chapter B provides the data on the characteristics collected on a 100 percent basis: age, race, sex, Spanish origin, marital status, household relationship, family characteristics, and so on. Chapter C is the report that contains the basic characteristics collected on a sample basis, such as employment, income, and occupation. These data are presented for States, counties, SMSA's, urbanized areas, and places of 2500 or more in population.

In Chapter D are detailed population characteristics, again based on the sample. Here the geography is much more restricted. It is for States and large metropolitan areas, large meaning 250,000 or more. It contains a detailed cross-classification of data, detailed occupation distributions, detailed income and earnings distributions by various characteristics, and so on.

Finally, there is a Volume II Subject Report Series which is composed of approximately 30 reports that focus on specific subject areas in great detail, with cross-classification and a focus at the national level.

I will not go over the housing reports. They are fairly comparable to the population side in terms of areas covered and types of data detail provided. I would like to go quickly over the Summary Tape Files (STF's) which are the computer files available from the census. Currently, there are five of them planned. STF 1 provides 100 percent data down to the very smallest geographic level, the blocks. STF 2 provides 100 percent data down to the level of census tracts and places of 1000 or more.

STF 3 is the first tape file with sample information on it, and this is where small localities would be able to get further information, because it will go down to the enumeration district and block group.

Sample data cannot be presented for the very small blocks. They would not be reliable, so we group them together without violating any geographic boundaries to present sample data on a reliable basis. This will also be available for all county subdivisions.

STF 4 contains more detailed sample informa-

tion for census tracts, places of 2500 or more, etc. Finally, STF 5 provides very detailed tabulations for States, metropolitan areas, central cities of metropolitan areas, and perhaps other large counties and cities. That has not yet been determined.

In addition to that, we have public use microdata files which are samples of individual records from the census with identifiers removed, so people who wanted to do their own tabulations, usually on a national basis, could cross-classify in any way they see fit.

In terms of dissemination, I will just quickly say we have printed reports. We have the Summary Tape Files and micro data files. All of the reports will be available on microfiche. The tallies from the Summary Tape Files 1 and 3 will also be available on microfiche. If money holds out, maybe more will be available on microfiche. There are State data centers across the country which can provide access to this data. Our regional offices in 12 cities across the country can assist in providing the data and there are summary tape processing centers that purchase and process census data.

The Assessment of Health Care Technologies

Third Plenary Session

THE NATIONAL CENTER FOR HEALTH CARE TECHNOLOGY

Seymour Perry, National Center for Health Care Technology

I would like to begin this session by asking some questions:

• How does CT scanning compare with other technologies used in diagnostic imaging? • Are dental x-rays actually being overutilized? • What are the reasons for the recent increase in cesarean deliveries? • How can end-stage renal disease be treated more effectively and efficiently? • What can or cannot coronary artery bypass surgery accomplish?

These are the kinds of questions that the National Center for Health Care Technology (NCHCT) was created to address.

Answers to these questions require the innovative use of data. Thus, we are grateful to Dorothy Rice and the National Center for Health Statistics for inviting us to organize this plenary session at the 1980 Public Health Conference on Records and Statistics.

Although the term "technology assessment" apparently was not coined until the 1960's, physicians and others have long been interested in evaluating means to prevent, diagnose, and treat disease. As Dr. Stanley Reiser has described so well in his book, Medicine and Technology, medical practitioners have long been assessing their tools and replacing existing modalities with newer and better ones. For example, the stethoscope supplanted earlier, less effective means of examining the heart and lungs; the sphygmomanometer for measuring blood pressure superseded more primitive instruments; and almost immediately after their discovery, x-rays were applied to medical practice--with very little consideration of potential risks.

Likewise, the use of statistics in medical technology assessment has a long history. In 1760 the mathematician Bernoulli presented to the Royal Academy of Science in Paris an essay analyzing the mortality due to smallpox, illustrating the advantages of inoculation as a preventive measure, and providing an estimate of the number of years that elimination of death from smallpox would add to life expectancy. In the following century, Pierre Charles Alexandre, known as the inventor of clinical statistics, used this approach to show that bloodletting was in many cases useless, if not detrimental.

Today, the need and demand for assessment of health care technologies are growing very rapidly. Biomedical research and development, especially since World War II, have dramatically increased our ability to manage a wide variety of diseases and to promote health. However, these same advances have brought with them an array of serious scientific, medical, economic, social, legal, and ethical issues. More and more, the public and its representatives, as well as the biomedical research community, are asking such questions as: Are new medical advances being applied rapidly enough? Or Or are they being applied prematurely, before their safety and efficacy have been adequately established? Are our health care dollars being spent wisely and fairly? What will be the impact on society of new technologies?

After several years of increasing concern over such issues, the Congress established the NCHCT in 1978 with a mandate to conduct and support activities in health care technology assessment and to coordinate such endeavors throughout the Department of Health and Human Services. The legislation defines health care technology broadly to encompass emerging, new, and existing means to prevent, diagnose, and treat disease and promote health. It also mandates the Center to evaluate technologies from all perspectives, including safety, efficacy, and economic, social, and ethical implications. Thus, the Center has many data needs and offers a wide range of opportunities to apply records and statistics--and we are eager to explore the applications and limitations of data from various sources.

We realize, of course, that the use of records and statistics in evaluating health care technologies presents many challenges and will require new approaches. Thus, as described in the NCHCT's recently issued program announcement, one of the two areas to which our extramural research grants program is giving highest priority for funding is the development and testing of methodologies for assessing health care technologies from the various perspectives mentioned above. Within this category two areas of particular interest are: (1) improved methods of using existing data sources for technology assessment, and (2) strategies for information retrieval applicable to technology assessment.

The other area of investigator-initiated research that the NCHCT is emphasizing is the performance of focused technology assessments relevant to health policy. Such evaluations should address concerns from any of the same variety of perspectives previously noted. The technologies identified by the Center and its Council as being of high priority for assessment include, but are not limited to, maternal serum alpha-fetoprotein testing for prenatal detection of neural tube defects, coronary artery bypass surgery, dental x-rays, ultrasound for cardiac diagnosis, heart transplants, means of managing end-stage renal disease, and computed tomography (CT scanning) of the head and body.

The Center also is responsible for what it is calling multifaceted or full assessments of high-priority technologies. These evaluations include analyses of safety, efficacy, and current and potential social, ethical, and economic impacts. In accordance with the law that created the Center, technologies to undergo such assessments are identified on the basis of: risks and benefits, the cost of the technology to the Nation, the technology's rate of use, and its stage of development. Thus, information obtained from records and statistics is basic even to the choice of technologies for assessment.

In performing its multifaceted assessments and other evaluations, the Center emphasizes three cardiinal principles:

• The first is the greatest possible openness in its activities.

• The second is the active participation of outside experts, both from other government agencies and from private institutions. Thus, in our assessments to date and in the future, we look to outside communities including those in records and

statistics, to provide data and perform evaluations.

• The third principle is the wide and rapid dissemination of conclusions and supporting evidence. Thus, a brief summary of the educational conference that the Center and the Food and Drug Administration held last week on screening for neural tube defects is already available.

Last week's conference on screening for neural tube defects relied heavily on conclusions drawn from records and statistics and clearly demonstrated the existence of many additional needs and opportunities to obtain and analyze data as this technology becomes more widely applied in the United States. Testing maternal blood for elevated levels of alpha-fetoprotein can aid in prenatal detection of 80-90 percent of all cases of anencephaly and spina bifida, which are among the most common and serious congenital malformations, with about 5000 affected infants born annually. Because the test generally results in 25 to 50 false positives for every true positive, availability of followup procedures such as sonography and amniocentesis is essential. Of the many questions posed by this screening procedure, some that the use of records and statistics may help to answer are: What are the sensitivity and specificity of the test under various field conditions. How costly are the programs of screening and followup? Are there sufficient numbers of facilities and equately trained personnel for the followup of women who will have abnormal test results? What are the effects of the screening programs on the prevalence of neural tube defects and the expenditures for care of affected individuals?

Evaluation of cesarean childbirth provides another example of the use of records and statistics in technology assessment. On September 22 and 23 of this year, the National Institute of Child Health and Human Development and the Center will co-sponsor a major conference addressing all aspects of this technology. In preparation for this conference, the Center obtained hospital discharge data from the Commission on Professional and Hospital Activities (CPHA). Analysis of this information, which was extracted from hospital records for the years 1970, 1974, and 1978, has helped in identifying the factors responsible for the recent rise in frequency of cesarean delivery, determining the mortality rate associated with this procedure, and elucidating the relationships of cesarean delivery to length of hospital stay and to method of payment.

Medical technology, statistics, and insurance have long been interrelated. Dr. Audrey Davis of the Smithsonian Institution has noted that as early as the nineteenth century, life insurance companies, which were interested in obtaining anatomic and physiologic standards of health and in evaluating individual applicants, required the use of various diagnostic instruments in the physical examination. Thus, the insurance industry appears to have fostered the increased use of medical technology by American physicians. Today, both public and private thirdparty payers need information on which to base decisions as to whether to provide coverage for various medical interventions. Conversely, insurance records are a potentially valuable resource in assessing health care technologies.

Consistent with this precedent, the scientific and medical evaluation of technologies for possible Medicare coverage constitutes another large portion of the Center's activities. The Center is responsible for providing the Health Care Financing Administration with scientific and medical advice for use in determining whether specific technologies are appropriate for coverage by Medicare. Other third-party payers have expressed significant interest in the results of assessments performed by the Center for this purpose.

Analyses of data from health records and other sources often could be of considerable help to the Center in reaching its recommendations regarding Medicare coverage. In most instances, however, appropriate information is not available readily or at all. As the Center has attempted during its first year of existence to discharge its responsibilities for assessing technologies in the context of Medicare coverage, serious deficiencies in the data base have become obvious. Simple data, such as those relating to the extent of use of specific technologies and the cost to the Nation, are not available, much less the incidence of adverse effects. With rare exceptions, in fact, third-party payers, including Medicare, do not have information on what they pay for and how much they pay. Thus, one can see that in discharging our mandate stating that high-priority technologies should be identified in part on the basis of use and cost, we are also severely handicapped.

As one effort to aid in data acquisition, the Center and both public and private third-party payers are exploring a mechanism whereby interim coverage would be provided for certain new technologies on a limited scale as they enter the delivery system, while the data needed for reaching a sound general recommendation are gathered. This approach is attractive but presents complexities that must be resolved before it can be implemented.

As the Center's activities related to Medicare coverage develop further, so will the need and potential for using records and statistics. At present, the Center bases its coverage recommendations only on medical and scientific considerations because Medicare by law is precluded from considering cost elements in reimbursement. However, it is inescapable that in the near future such factors as cost effectiveness and relative effectiveness will have to be taken into account. Thus, a wider variety of data and additional methods of analysis may be needed. In addition, use of records and statistics may aid in determining the effects of the Center's recommendations on the quality and cost of care.

Although time has permitted only relatively brief remarks about the Center and its activities, I hope that I have conveyed to you that the National Center for Health Care Technology faces many important, exciting, and challenging questions, and that the records, data, and statistics are critical to success in our mission. Indeed, without such information, we can offer little more than informed opinion. Thus, we will be listening attentively as speakers and members of the audience discuss the applications and limitations of data from various sources. I hope that the current session will mark the formal beginning of productive cooperation between the Center and the records and statistics community as we pursue our mutual interests in obtaining and providing information that will lead to better health care and better health.

MEDICAL AND SCIENTIFIC ASSESSMENTS OF HEALTH CARE TECHNOLOGIES

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I would like to discuss some of the general principles of evaluative research, and, where possible, relate them to the kinds of data that must be collected to obtain valid results. My remarks will be restricted primarily to the health benefits associated with new diagnostic and therapeutic technologies. To provide a sense of the breadth of research in this area, of the various kinds of data required, and of the costs of such investigation, I shall briefly summarize a large number of studies.* Most of the examples will be from the field of radiology, not only because I am a radiologist but also, and probably more important, because most of the methodologic work in health care technology assessment started in the field of radiology about 10 to 15 years ago.

I would like to frame my remarks in the context of a model of what the diagnostic and therapeutic process means in the health care system today and of what we consider in evaluating new diagnostic and therapeutic technologies. Generally, physicians are presented with a patient with particular symptoms of disease. That patient may have any one of several diagnostic tests which can provide more information than the physician had, can provide no additional information, or actually can be misleading. Then treatment or no treatment is instituted, and the patient can have any of a series of health outcomes, ranging from death to being perfectly healthy.

This model contains several places at which particular technologies can be assessed. We can evaluate diagnostic tools at the information content stage and sometimes also at the health outcome stage, and we obviously can evaluate treatments at the health outcome stage. We can study the effects of one diagnostic technology throughout the entire process. Furthermore, we can compare two diagnostic technologies in a single kind of institutional setting or in different contexts.

New technologies are expensive to evaluate, for the technologies themselves often are costly and large-scale prospective studies are necessary. Consider for example the need to assess the benefits of computed tomography of the head relative to those of conventional radionuclide imaging in the evaluation of patients suspected of having intracranial disease. One question was how much better computed tomography was than the available radionuclide devices for detecting intracranial disease. In search of the answer, a large-scale study involving five hospitals (1) compared the true positive ratio (the fraction of patients who actually have intracranial disease and have it detected by the modality in question) and the false positive ratio (the fraction of patients who are normal but are incorrectly shown to have disease) for the two technologies. For each true positive ratio, the false positive ratio for computed tomography was considerably less than that for radionuclide scanning. In other words, for any given proportion of true cases identified, computed tomography yielded a lower proportion of false diagnoses. Thus, this large-scale prospective study indicated that for disease detection, computed tomography is much better than is radionuclide scanning.

This study also compared the abilities of the two techniques to indicate the location of intracranial disease. Computed tomography also was superior in this respect, with a higher true positive ratio at each false positive ratio.

As data collectors and analysts, members of the audience may be wondering how much the study cost, how the data were collected, and how long the research took. The study was a cooperative project, sponsored by the National Cancer Institute, in which five hospitals in the East and the Midwest collected data over a three-year period. Each hospital was awarded between $400,000 and $500,000 for the data collection. The total number of patients entered into the study was approximately 3000. Because of the controversy associated at that time with computed tomography, the data were presented to an independent consulting firm for analysis, although radiologists were among the consultants.

Data from only 136 of the 3000 patients were suitable for analysis. Factors contributing to this enormous attrition included incompleteness of records at the participating hospitals, loss of computed tomographic and radionuclide images, and one hospital's ignoring some of the rules and using an unacceptable imaging technique.

The study did salvage an adequate, although small, amount of data and obtained extraordinarily good and quite convincing results, but it was expensive and time consuming.

Public policy makers and others often ask whether the additional information gained through new diagnostic technologies results in improved health outcomes. We lack the data to answer that question with regard to tomography. As described below, however, information is available on the impact of another diagnostic technique. The message that I wish to convey is: It is difficult to measure the health effects of diagnostic technologies and, even when such measurement is possible, improvements in diagnosis do not necessarily translate into improvements in health.

How do we know that? Consider a retrospective study of brain scanning at Johns Hopkins over the decade 1962 to 1972, (2) from the time that this technology was first instituted there until it had become a well-established procedure. During this period, the number of operations for patients with suspected neurological disease increased slightly, from 60 to 70 per year. Much more dramatically, the duration of symptoms in patients undergoing surgery for such disease decreased from an average of four years to less than one year thereafter.

The obvious question is: Did this earlier detection of disease extrapolate into improved health outcomes? The answer was no. Although brain scanning permitted considerably earlier diagnosis, it was not associated with a statistically

*For a more extensive discussion, see McNeil, BJ: Lessons from technology assessments, in Issues in the Dissemination of Biomedical Technology, Finkelstein S, Sondik E, and Roberts E, MIT Press 1981. In Press.

significant difference in length of time between onset of symptoms and death.

This study, which involved a review of several hundred charts, was inexpensive and could be done retrospectively because it involved a single technology rather than a comparison of two technologies, such as computed tomography and ultrasound.

Although the impacts of new technologies on health are difficult to measure directly, we sometimes can use mathematical models to project the kind of effects a new diagnostic technology would be expected to have on long-term health outcomes. The following example illustrates the use of prospective and retrospective data bases for this purpose.

A number of investigators have been interested in determining the value of the intravenous pyelogram and a radionuclide study called the renogram in the management of patients with hypertension. Hypertension is extremely common, affecting about 15 percent of the population in this country and between 5 and 10 percent of these individuals have kidney disease as the cause. This kidney disease can frequently be detected by a series of radiographic tests and if surgically corrected, cures or improvements in hypertension may result.

Over approximately five to seven years, the National Institutes of Health supported a study of the detection of surgically correctable hypertension at more than a dozen hospitals.(3,4) All 7000 patients in the study received radiologic examinations, all types of which were shown very effective in identifying those patients with renal disease amenable to surgery. In particular, the intravenous pyelogram found eight out of the ten potential surgical candidates; one type of renogram identified found nine out of ten such patients; and another located six out of ten. The cost of identifying these patients was about two thousand dollars per patient found.

However, costs can vary considerably depending upon how testing is done. This study showed that if one tries to find every single patient with the disease in question, rather than, for example, 80 percent or 60 percent, the costs rapidly escalate.

Hypertension, of course, leads to many serious complications, including stroke and heart disease. No long-term followup data are available on the outcome in hypertensive patients who undergo surgery for radiographically shown kidney disease, and the sequalae of hypertension manifest themselves over many years. Therefore, to determine what improvement in health might have resulted from treating these patients surgically, a modeling experiment (3,4) was done using data from the Framingham Study on heart and lung disease (5) in which risk factors were assessed prospectively in all residents of one small town in Massachusetts. Subjects were followed for about 16 years, and their incidence of side effects was evaluated in terms of a number of factors relating to blood pressure. Thus, we were able to estimate what percentage of the population with surgically treatable hypertension would do better if treated medically and never evaluated by intravenous pyelogram or renogram, and what percentage would do better if the renal disease were sought and surgically removed.

The results show that the limiting factor is not the quality of the radiological tests, but rather the extent to which patients take their blood pressure medication. If people take their medication only 50 percent of the time, we should use the expensive radiographic modalities, because surgery is better. If, however, people take their medication regularly, we should abandon the radiology and just treat them medically.

Thus, by integrating prospective data from a radiographic study with risk factor data from a study on heart disease, we were able to predict the impact of a diagnostic test. Our conclusion is that outcome in this case is primarily influenced not by the test itself but the extent to which patients take medication.

Collection of data on the marginal information that new diagnostic technologies provide in diagnosing uncommon diseases, such as those of the pancreas, often is slow. A key question in recent years is how good computed tomography is relative to ultrasound in detecting pancreatic disease. We have now obtained data indicating that for any true positive rate, computed tomography has a lower false positive rate than does ultrasound and thus is superior.(6) Establishment of this statistically significant result entailed the collection of 220 cases during a 17-month prospective study conducted by two large institutions, the Harvard and Johns Hopkins medical schools. The protocol required $100,000, excluding charges for professional time and the examinations themselves.

Cooperative studies between or among institutions of different types--primary care institutions, secondary care institutions, and tertiary centers--are likely to be extremely important in the future. One such study was designed to search for evidence of overutilization of computed tomography of the head.

Although much is said about overuse of diagnostic x-rays, its existence is extremely difficult to prove. After collecting detailed data on about 6000 patients at two hospitals, the Peter Bent Brigham Hospital and the community hospital in Springfield, we were unable to find any evidence for overutilization of computed tomography of the head. In fact, had the number of exams been reduced to 74 percent of the total, only 82 percent of the diseased patients would have been identified. (7) Thus this large-scale study, which involved two hospitals and required about two years, approximately $100,000, and an enormous amount of data collection on many patients, was unable to document overutilization.

My final example relates to a topic likely to be of increasing concern--the differences in outcome of treatment at various centers. Such differences distinguish good hospitals from bad and aid in deciding whether some technologies should be regionalized instead of used everywhere. In terms of data collection, the best study on this subject was done by Luft, Bunker, and Enthoven at Stanford. (8) These investigators obtained discharge summary data from the records of hundreds of thousands of patients undergoing surgical procedures over a several-year period and compared the observed to expected death rate in hospitals performing low and high numbers of various procedures per year. For some procedures, operative mortality was considerably higher at hospitals where they were relatively rarely performed. This study was retrospective and fairly inexpensive but came up with convincing results.

In conclusion, I would like to reemphasize

two points. First, in evaluating new diagnostic technologies, prospective studies usually are necessary, cooperative studies between institutions are helpful, and uniform data collection across institutions will become mandatory over the next few years. Conversely, retrospective data on new diagnostic technologies generally are of limited value. Second, overutilization of diagnostic technologies is very difficult to prove. Documentation will require obtaining comparable data in a large number of different health care settings.

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ECONOMIC ASSESSMENTS OF HEALTH CARE TECHNOLOGIES

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With national expenditures on health care in the vicinity of $200 billion per year, government officials, insurers, providers, and even patients are asking more earnestly than ever before whether the benefits offered by medical technologies justify their costs. This concern applies not only to new and sophisticated technologies such as computer-assisted tomography and radionuclide scanning but also to established procedures such as the routine chest x-ray and tonsillectomy.

The objective of economic evaluations of medical technologies is to measure the resource costs consumed in relation to the health benefits provided by a technology in its various clinical uses.

Two analytic frameworks have been applied in evaluating medical technologies: cost-effectiveness analysis and benefit-cost analysis. As their names imply, both approaches entail assessments of health effectiveness, or benefit, as well as of cost; it is, therefore, impossible to divorce completely the problems of economic evaluation from those of efficacy assessment. The practical difference between cost-effectiveness and benefit-cost analysis is that cost-effectiveness analysis requires commensuration of outcome measures within the major categories of resource cost and health effectiveness, but not between costs and health effects; whereas benefit-cost analysis requires that costs and benefits all be valued in the same units, usually monetary. Later on, I will point out how the implications for data collection and measurement differ between the two approaches.

As a general principle, neither costs nor benefits should be defined so narrowly as to exclude what may be the most important economic or health consequences of a technology. On the cost side, for example, the costs of procedures induced by the use of a technology, especially a diagnostic technology, may be more important than those of the technology itself. For example, electronic fetal monitoring is not an extraordinarily costly procedure, but if its use results in an increased probability of cesarean section, then the induced costs of surgery may be the major health care resource cost attributable to the technology. One estimate, in fact, is that the costs of cesarean sections attributable to electronic fetal monitoring are nearly three times as great as those of the monitoring itself (Banta and Thacker, 1979). It would remain, of course, to evaluate the health benefits to the fetus and mother derived from these procedures.

On the health effect side, the importance of quality of life as an attribute of outcome should not be ignored. Many surgical procedures, for example, are performed primarily to relieve symptoms or improve functional status, and not to prolong life (Bunker, Barnes, and Mosteller, 1977). I shall comment later on some of the techniques available for evaluating effects on the quality of life in the context of cost-effectiveness or benefit-cost analysis, and on the data requirements that they present.

It should be understood that any evaluation of a technology can only be based on the best information available at the time at which the evaluation is performed. There will always be uncertainty, gaps in the data, and disagreements among studies and among experts. The problems are especially severe for new or rapidly changing technologies, since the assumptions that underlie the analysis can be expected to remain valid for only a short time. These problems do not vitiate the enterprise of economic evaluation; they do, however, endow the analyst with a responsibility to keep the structure of the analysis flexible and sufficiently transparent to permit modifications as new information becomes available or as the characteristics of the technology change.

I should like to turn now to a brief overview of the basic principles of cost-effectiveness and benefit-cost analysis. I then will try to identify the data requirements for such analyses and the limitations of many of the available sources.

Cost-Effectiveness and Benefit-Cost Analysis: Basic Principles

Cost-effectiveness analysis. The purpose of cost-effectiveness analysis is to assess the efficiency with which limited resources are being allocated to achieve the desired benefits. The implicit assumption is that the objective is to maximize the aggregate benefits, or effectiveness, obtainable from a given level of expenditures, or cost. This approach leads to the use of a cost-effectiveness ratio--net cost per unit of net effectiveness--as a yardstick for ranking alternative uses of resources.

Typically, a cost-effectiveness analysis assumes the perspective of society at large in evaluating costs and health effectiveness. Thus, the cost of a CT scan would include the costs of capital, labor, and materials needed for the test, regardless of who bears them. Similarly, health effects are measured in aggregate terms such as numbers of cases of disease found or cured or numbers of years of life saved. Other perspectives may, however, be accommodated within the general framework. For example, a cost-effectiveness analysis might be done from the viewpoint of the Federal government, in which case only reimbursable costs might be considered, or from the viewpoint of a particular hospital, in which case the difference between costs and revenues might substitute for resource costs in the analysis.

Health effectiveness may be measured in any of several units; the only requirement in a cost-effectiveness analysis being that a single measure be used so that alternative uses of resources may be compared. Occasionally an intermediate measure, short of a final health outcome, is used, such as the number of cases of disease found by a diagnostic test. Such measures have the advantage of being easily quantified but the disadvantage of limiting the usefulness of the analysis to comparisons with other technologies with the same endpoint. It is more desirable to measure health effectiveness in more transferable units, such as the numbers of years of life saved. Longevity may not be the only outcome of importance, however; effects on the quality of life, including symptoms and functional status, may be of concern. Because cost-effectiveness analysis requires a single measure of health effect, measures that combine these multiple attributes of outcome into

a single measure have been developed. These methods, involving so-called health-status indices and grounded in multi-attribute utility theory, lead to measures such as quality-adjusted life years (QALY's) (Weinstein and Stason, 1977; Patrick, Bush, and Chen, 1973). Inevitably, the more comprehensive a measure of benefit is desired, the more value judgments enter into the analysis in the process of commensurating diverse outcomes. However, to omit quality-of-life considerations because of difficulties in measurement would be irresponsible if those considerations are central to the physician's and patient's concerns.

When based on suitable measures of resource cost and health effectiveness, the ratio of cost unit of effectiveness--for example, dollars per year of life gained--provides a yardstick that can be used, in principal, to guide the setting of priorities for resource allocation.

Because it avoids the problem of assigning economic value to health benefits, cost-effectiveness analysis does not provide an unambiguous basis for concluding that a technology is or is not "cost-effective." Such a determination would have to depend on the judgment as to whether the calculated cost-effectiveness ratio exceeds an appropriate cutoff level. Neither does cost-effectiveness analysis permit comparisons with non-health expenditures, since the units of effectiveness are not comparable. Benefit-cost analysis, by introducing monetary valuation of health effects, overcomes these limitations, but at the same time it introduces monetary valuations that are controversial and even distasteful to some.

Benefit-cost analysis. The goal of a benefit-cost analysis is to develop a single measure of net value for the technology in question. This measure is invariably monetary, although it need not be so in principle. The difference between the economic value of health benefits, however defined, and the economic costs represents the net economic benefit of the technology.

Not surprisingly, much of the methodologic research in benefit-cost analysis has centered around the question of how to assign monetary value to human life and health. Measures based on economic productivity, measured by earnings, have been most commonly used (Rice, 1967), but recently economists, troubled by the limitations of such human capital measures, have sought to develop measures based on direct assessments of willingness to pay for reductions in mortality and morbidity (Acton, 1973; Jones-Lee, 1976). The latter, while theoretically appealing, have had only limited practical applications.

Data Requirements in Cost-Effectiveness and Benefit-Cost Analyses

Now let us consider the data required in a cost-effectiveness or benefit-cost analysis. These data may be grouped into four categories: (1) data needed to estimate the consequences of intervention in terms of event rates with and without the intervention; (2) data needed for measurement and valuation of resource costs; (3) data needed for measurement and valuation of health effects; and (4) data to permit extrapolations of economic and health impacts from the individual to the national scale. Here "measurement" refers to quantification of the outcome in question in physical units (e.g., hospital days, years of life saved), whereas "valuation" means quantification in the final units required, such as dollars or quality-adjusted life years.

Estimation of event rates. A number of probabilities, or rates, are required in performing an economic evaluation of a technology. These probability estimates are needed not only for the evaluation of health effectiveness but also for the measurement of costs subsequent to the initial application of a clinical procedure. With regard to electronic fetal monitoring, for example, the expected induced cost of cesarean section depends on the difference between the proportion of women who undergo cesarean delivery with monitoring and the proportion who would undergo the procedure in its absence. These proportions depend, in turn, on the prevalences of different indications for cesarean section in the monitored population, as well as on other variables.

The kinds of probabilities, or event rates, that are often needed in economic evaluations include: disease prevalence; test sensitivity and specificity (or the possibility space as described by an ROC curve); mortality and morbidity, over time, directly associated with the procedure; mortality and morbidity, over time, without the procedure; incidence of side effects and complications of the procedure or of induced procedures; mortality and morbidity consequent to these side effects and complications; mortality and morbidity associated with interventions undertaken as a result of disease or morbid events either induced or averted by the procedure; and so on. Any or all of the above may have to be estimated separately for each patient category (e.g., by age, sex, and pre-intervention status), and for each variant of the use of the technology (e.g., using the procedure either alone or with other procedures, or using a test with different combinations of sensitivity and specificity). Decision trees can be very useful to the analyst in keeping track of the probabilities needed and the relationships among them.

There are many potential sources for these probability estimates, and their relative importance varies from one technology to another. Health surveys, either population-based or institution-based, can provide estimates of the prevalence and incidence of disease and of mortality, symptoms, and disability resulting from diseases. For example, in a study of the benefits and risks of estrogen treatment, I used data from the Third National Cancer Survey (NCI, 1975) to estimate the incidence of endometrial cancer at then-current levels of estrogen use and then applied relative risk estimates from case-control studies in the literature to estimate cancer rates with and without estrogens. Longitudinal, population-based studies such as the Framingham Heart Study (Kannel and Gordon, 1974) can provide valuable data on incidence of disease and disease-related mortality over time. For evidence regarding the effects of treatments on mortality and morbidity, controlled trials provide the best qualitative evidence but are seldom useful in a quantitative analysis because of the small sample sizes and insufficient disaggregation by patient category. For example, in our cost-effectiveness analysis of high blood pressure control, the quantitative estimates of event rates as a function of blood pressure levels were derived from the Framingham Heart Study but bolstered qualitatively by the finding in a controlled trial by the Veterans Administration that treatment does,

in fact, reduce the risk of cardiovascular death and disease.

Observational studies, including case-control and cohort studies, provide another important source of data. Lack of comparability across studies can, however, be a serious problem. Provider-based data banks can also be helpful, adding detail not often found in particular observational studies, but the information from either source might not be validly generalized to other populations.

Finally, as a last resort, the cost-effectiveness analyst must often rely on subjective assessments of unknown probabilities or rates. It is here that sensitivity analysis is most essential. In this context, sensitivity analysis involves varying these soft estimates over their plausible ranges in order to determine the effects on the results (such as net health effectiveness) and on the conclusion. If results are particularly sensitive to an estimate, clinical investigation may be called for; if they are robust with respect to the softest of the data, one gains confidence in the conclusions despite the lack of objective data.

The cost-effectiveness analyst often finds the most difficulty in locating data on the course of disease without intervention (that is, the natural history) or on the course of disease with the most frequently used alternative intervention. Where controlled studies are not available and longitudinal studies of untreated populations do not exist, there is no satisfactory solution. This problem arises particularly when a technology becomes adopted nearly universally and quite rapidly and ethical concerns preclude withholding intervention, such as has been the case with the Papanicolaou smear for cervical cancer.

Measurement and Valuation of Costs. The costs of producing a unit of service with a technology (e.g., a test or an operation) include direct and indirect costs. The direct costs are those attributable only to the procedure in question and not shared with other services. These include costs of acquiring and maintaining equipment; of labor, both professional and nonprofessional; and of materials (e.g., x-ray film, reagents, surgical instruments). Indirect costs, or overhead, include rent or building depreciation, space preparation and upkeep, utilities, support services, and other administrative services (e.g., laundry, cafeteria, hospital management). Each of the induced costs or savings would have a similar breakdown.

Ideally, in an analysis from the societal perspective, all of these costs should be measured as the value of real resources actually consumed, irrespective of the amount of money that changes hands as reimbursement. This value would be determined as the value of these inputs to the production of alternative services--what economists call their "opportunity cost." Economic theory tells us that in a perfectly competitive, unencumbered marketplace, the price of an input reflects precisely its opportunity cost. However, the health care sector does not have this property. Prices charged for services do not always reflect their true cost. In a hospital, some services, such as laboratories, often set charges above costs in order to subsidize other services, such as maternity and emergency, which frequently are priced below cost in order to extend coverage. The existence of third-party coverage makes it possible for providers to set price above cost for insured services, because the price actually paid by the patient is below cost, or even zero.

Data on true costs of particular procedures are rare indeed, although the literature contains a few resource cost studies. An analyst who wants to know the true opportunity cost of a procedure must generally perform an independent cost study by monitoring resource consumption, including personnel time, in a variety of settings. Such research usually is not feasible during a technology evaluation. Hence, the analyst is forced to rely on charges as proxies for cost, despite the errors introduced. Even charge data, however, are not uniformly available. Sources include billing rates for individual providers, allowable charge and fee schedules set by fiscal intermediaries, and relative value scales set by fiscal intermediaries for professional services. Unfortunately, all of these items tend to vary from State to State, or even from provider to provider, and are not generally available to researchers. Relative value scales, it should be noted, would have the potential of approximating opportunity cost if they were designed to reflect the time and skill required.

Even the use of data on charges and fees is not possible without estimates of the number of actual units of service required for the application of a particular technology. For example, one needs estimates of the number of days spent in a hospital for a surgical procedure or the number of office visits required to monitor drug therapy. Length-of-stay data are available from various sources, among the most useful in my experience being the reports of the Professional Activity Survey (Commission of Professional and Hospital Activities, Annual).

It should also be noted that, on occasion, an analysis does not take the societal perspective but rather that of a particular fiscal unit such as Medicaid or Medicare. In that case, cost might appropriately be measured by charges, which would reflect the opportunity cost to the agency, although not to society at large.

Another methodologic issue in collecting cost data concerns the appropriate use of incremental rather than average costs. Ideally one wishes to measure the added, or incremental, cost resulting from a technology or its use. The definition of incremental cost depends on the stage at which a technology is being evaluated. For an existing technology for which facilities are already in place, the costs of research and development would be excluded; facilities and the production of equipment would be excluded in a short-run analysis but included if the time frame were long enough to encompass the need to replace or add to the equipment. For a new technology, the incremental costs might well include costs of development and marketing, as well as those of producing and operating the equipment. Moreover, the question of how to attribute overhead costs, or costs shared by many technologies or services, is thorny and can be resolved only by arbitrary accounting conventions in any particular analysis.

This discussion of cost data would not be complete without reemphasizing the potential importance of induced costs, especially for diagnostic procedures. The example of electronic fetal monitoring illustrates the potential economic impact of this phenomenon.

Finally, although the problems of valuation are not as serious for costs as for health effects--because costs are quite naturally valued in monetary units--two valuation issues should not escape attention. One is the aggregation of costs that occur at different points in time. This process is usually accomplished in two steps: first, adjusting all costs for inflation, and second, discounting future costs at an appropriate interest rate, usually between 5 and 10 percent after inflation. The rationale for this procedure is beyond the scope of this presentation and is discussed elsewhere (Klarman, 1974). The second issue is the aggregation of costs into a single number regardless of who pays the bill. This practice raises the problem of equity in the distribution of resources, and the only resolution is for the analyst to take note of any clear inequities in the distribution of payments in relation to health benefits received.

Measurement and Valuation of Health Effects. The data required for measurement and valuation of health effects depend on the units to be used. In a cost-effectiveness analysis, years of life saved and quality-adjusted years of life saved are most commonly employed. In benefit-cost analysis, all outcomes must be valued in monetary terms.

When years of life saved are the units of measurement, life tables are required in order to transform age-specific mortality rates into years of life expectancy. One must always be on guard for the possibility of competing risks and other sources of over-estimation of the gain in life expectancy. When using life expectancy as a summary measure, incorporation of personal or social preferences--with regard, for example, to the risk of death in the near future versus diminishing incremental value of additional years of life--is not possible. However, in an analysis of treatments for lung cancer, McNeil, Weichselbaum, and Pauker (1978), have suggested empirical survey methods to elicit such preferences and to incorporate them into an appropriate utility function for survival.

When effects on the quality of life are to be incorporated into the measure of health effect in a cost-effectiveness analysis, problems of both measurement and valuation arise. Measurement problems arise because of the difficulty of defining symptomatic and functional States and of ascertaining the probabilities with which each of these States is realized, over time, following a medical intervention. Even when these measurement problems are overcome--as in some clincial studies that measure quality-of-life outcomes and in some health surveys (although the latter rarely give procedure-specific data)--the problem of valuing these changes in commensurate units remains. Theoretical methodologies, many of them founded in multi-attribute utility theory, do exist, but empirical applications are rare. For the most part they rely on surveys of patient preferences for different health States and yield numbers between 0 and 1 to use as weights in calculating quality-adjusted life expectancy. These weights may be based on subjective category scaling (Patrick, Bush, and Chen, 1973), time-trade-off questionnaires (Weinstein, Pliskin, and Stason, 1977), or lottery techniques. Inevitably, the analyst who chooses to include quality-of-life effects explicitly in the analysis must rely on sensitivity analysis to explore the implications of alternative preference weights, since valid empirical estimates of these weights are costly to obtain.

In benefit-cost analysis, the common unit of value is monetary. Hence, the benefit-cost analyst must rely on one of several methods for assigning economic value to years of life saved or disability averted. The oldest and most widely applied method involves the use of economic productivity, measured by earnings, as a proxy for the value of life and freedom from disability. I shall not go into the arguments for and against this measure, except to point out that one of its major advantages is its ease of application, largely because of the availability of data on age- and sex-specific earnings (Cooper and Brody, 1972) issued periodically by the Social Security Administration. The method currently favored by many economists because of its theoretical appeal, however direct assessments of personal willingness to pay for reductions in the probability of death or disease. These methods have found few applications (Acton, 1973; Jones-Lee, 1976), perhaps because of the subjectivity and inherent instability of the data required.

Other issues that arise in the valuation of health outcomes in both cost-effectiveness and benefit-cost analysis parallel those that arise in connection with the costs. These include the question of how to weigh present and future years of life saved, or even future generations of life affected (Weinstein and Stason, 1977). They also include the question of aggregating benefits to diverse individuals--the issue of equity (Fein, 1977). Most analysts today handle the temporal problem by discounting it and the equity problem by ignoring it; these practices require further examination.

National Economic and Health Impact. For many purposes, estimates of economic and health impact at the national level are desired. To that end, the analyst requires estimates of the numbers of persons who are actual or potential recipients of the intervention under evaluation. Deriving such estimates may entail little more than determining the population in a particular cohort defined by age and sex, which can be done easily with census data. Alternatively, candidacy for a procedure may be defined by the presence of a particular condition or disease state, such as high blood pressure or symptomatic coronary heart disease. For the needed incidence or prevalence figures--the choice between the two depending on whether one is interested in transient impacts or the steady state--health surveys such as the Health and Nutrition Examination Survey and the Health Interview Survey--are often helpful. For less well-defined indications, however, such survey data may not be of use. For existing procedures, sources such as the Professional Activity Survey may aid in deriving estimates of current utilization patterns, in spite of the problems in interpreting the denominator for that source.

Future Directions

Both the technology of economic evaluation and the data available to its practitioners are still in a relatively primitive state compared to their potential. Among the most pressing methodologic issues are the measurement of health outcomes other than mortality, the evaluation of the effectiveness of diagnostic technologies, and the measurement of the true cost of a technology in

practice. Efforts to address these issues will, if anything, only add to the demands now being placed on the available data for evaluation. Clearly, new and innovative sources of data and methods for achieving uniformity, consolidation, and availability of existing data are needed. These new directions may involve providers of care more directly in the data collection process, perhaps by using the reimbursement mechanism to provide incentives for uniform data reporting.

In any event, cost-effectiveness and benefit-cost analysis, while they ought never be used as the sole basis for a physician's decision or a regulatory action, have an important role to play in clarifying the issues surrounding medical technologies, both new and existing. By forcing explicit assumptions but permitting sensitivity analyses to explore the implications of those assumptions where the data are least secure, such analyses can have a desirable impact on the processes, if not the outcomes, of health care policy making and medical decisionmaking.

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SOCIAL AND ETHICAL ASSESSMENTS OF HEALTH CARE TECHNOLOGIES

John C. Fletcher, National Institutes of Health

I would like to begin my remarks on ethical and social assessments of health care technologies in a historical perspective by noting that bioethics and technology assessment share common roots. In the emergence of bioethics in the mid-1960's, individuals from many disciplines--including anthropology, biology, economics, education, history of science and medicine, law, medicine, nursing, political science, psychiatry, psychology, public policy sciences, social work, and sociology--joined together in increasing numbers out of a concern that the success of science and medicine might be subverted by a neglect of the values that made them possible: values such as justice, freedom and respect for persons. Technology assessment originated at a similar time in a similar manner, largely out of recognition of the need to restrain the costs and the social effects of the rapid assimilation of new technologies in our society.

Bioethical issues have a history. First there is a threshhold, at which the conditions for conflict are present and forerunners or forecasters note that trouble exists. Next comes a stage of conflict, at which famous cases occur; the atmosphere is emotional; and the public, the scientific community, or both may be polarized. Ideally, a period of debate, characterized by ethical arguments and attempts to build consensus and test solutions, follows. If all goes well, the final phase is that of public policy, including the application of legislative, legal or administrative remedies.

Among the first bioethical issues to be of concern to our society was the protection of human research subjects. This topic has received attention since World War II, formally entered the fourth stage in 1966, and still is being addressed.

Throughout recent years, technology has grown rapidly, as has the popular belief that citizens deserve to participate in public policy decisions, particularly those that affect their physical or emotional well-being or ethical beliefs. Like technology assessment, bioethics, once a multidisciplinary movement, has assumed some characteristics of its own and has become in some ways a set of disciplines or an organized activity; some persons like myself even try to practice bioethics in public life.

"Bio" comes from the term "bios" or life, encompassing the life sciences. Ethics comes from the Greek word for ethics, "ethiké." Warren Reich has defined bioethics as "the systematic study of human conduct in the area of the life sciences and health care, insofar as this conduct is examined in the light of moral values and principles." K. D. Clouser has described it as a type of activity involving "not a new set of principles or maneuvers, but the same old ethics being applied to a particular realm of concerns."

Bioethics involves: first, systematic study of the issues; second, attempts to apply ethical and cultural traditions to a new situation; and, third, and of most immediate interest in the context of this presentation, attempts to institutionalize ethical concern. It is one thing to state an issue and analyze it. It is quite another to try to apply cultural and ethical conditions to that new situation. And it is still another to establish some tangible way of institutionalizing ethical concern--in other words, to influence public policy.

Thus, technology assessment and bioethics merge and converge. Both can be viewed either as arms of public policy or as practices unto themselves, but I tend to see them more as the latter.

Let us consider again the example of policy on the protection of human subjects. First came a pre-implementation stage of the public policy, where the concern was to seek a significant concensus on the values at stake and their relative priority. Debate had long been emerging, but in the mid-1960s, a few cases precipitated a sense of crisis. The public policy process that ensued led the Surgeon General of the United States to issue the first public policy order tying grant-making in the Public Health Service to peer review of protocols or studies involving human subjects. In the post-implementation stage, the contribution of ethics has been to ensure that the policy and the procedures are implemented in a way that does not violate or seriously compromise the values that brought the policy into being in the first place. Thus, specifically, we must take care not to compromise the values that led to our policies about protecting human subjects.

Having provided historical background, I would like to look at the need for social and ethical assessments. These assessments are necessary because new technologies effect social change; sometimes create sharp ethical and social conflicts regarding their application and distribution and the uncertainty of their long-term consequences; and perhaps most important and most difficult, raise questions about the meaning of human life. For example: What does it mean to use psychotropic drugs in increasingly new ways to change mood, to try to control behavior? What does it mean to use psychosurgery? What does it mean to your concept of human nature? What would it mean to use knowledge of human genetics to correct genetic defects at their source?

The need for social and ethical assessments arises especially from the most difficult question to answer empirically: Will the new technology really be a benefit? Will it bring about more good than harm in the long run? Just because something can be done does not mean that it "ought" to be done. What goes into the ought side of the equation?

The first formally organized technology assessment that took the social and ethical aspects into consideration was the artificial heart assessment panel of the National Heart, Lung, and Blood Institute at NIH. This panel deliberated on whether a totally implantable artificial heart ought to be developed and whether it should be distributed widely in our society.

Technology assessment may be viewed, perhaps simplistically, as having six steps, the last four of which are the main stages for ethical analysis and ethical reflection. First, those that are charged with performing the assessment must decide what the scope of the inquiry will be and identify the questions to be addressed. Second, they need

accurate state-of-the-art descriptions of the technology being considered. They then must develop state-of-society assumptions. For example, if the technology is emerging and is likely to be used for a long time, they must ask: In what kind of society will it be used? What are that society's values, and will they affect the way that the technology is likely to be applied? Fourth, they must consider what impacts the technology will have. What social groups will it affect the most? How will it affect their values and beliefs? Will they receive it warmly or as a threat to their most cherished convictions? Next comes a very precarious and delicate stage of the assessment, the development of action options about how the technology might be used, how its impacts might be modified, how negative consequences can be reduced or eliminated, how research and development funds might be allocated, and how financial incentives might be employed in order to use it to the best advantage. Finally, the analyzers must come up with a set of recommendations, which inevitably reflect their own ethical beliefs. In short, technology assessment, policy, and ethics are highly interrelated.

In my opinion, the most controversial technologies are those that relate to reproduction, to saving and prolonging life, to controlling behavior, and those that are very expensive.

Social and ethical assessments draw on at least four sources of data: relevant studies of attitudes and beliefs; studies of trends, which are derived from records and statistics and can be used in prediction or forecasting; existing authoritative views in the literature; and contemporary views on all sides of the question. One usually obtains contemporary views by inviting papers or testimony from those who have studied the various ethical and cultural traditions in our society and are prepared to report on their relationship to the question at hand.

Let me now provide an example of how the use of records and statistics relates to an ethical dimension of a technology assessment. Alternative forms of caring for the dying, or what is popularly known as the hospice movement, are now undergoing evaluation. A major question is: To what extent should our society invest in these modalities? To have a perspective on this question, one needs to know the economic costs of dying, and particularly of care during the last year of life in the United States. Thomas Hodgson of NCHS, David Monsees of the National Cancer Institute, and I have been trying to obtain this information.

What is known about the cost of dying? In a 1967 study, Piro and Lutkins determined that 22 percent of all reimbursements under Medicare were made for those who died in the year being considered. Two smaller studies documented the very high medical cost at that time of dying in the hospital. By using the Medicare study sample, which consists of 5 percent of all enrollees, for 1974 through 1976, we reconfirmed the 22 percent figure originally found by Piro and Lutkins. Of course, the gross expenditures had risen tremendously, and one may expect a tremendous increase in dollars in the future, although the percentage of the payout is likely to remain about the same.

Unfortunately, we were unable to study these costs on a disease-by-disease basis or even by cause of death. Because of restrictions on the use of social security numbers as identifiers, we were unable to link data from the Health Care Financing Administration to those from the National Center for Health Statistics; and we did not have enough money to go to each State to establish the cause of death of each person.

I think that the most important challenges to records and statistics relate not only to dying but also to effects of technology on the unborn, the newborn, and the young child. For example, followup information is needed on amniocentesis and sonography, electronic fetal monitoring, neonatal intensive care of low-birth weight infants, and aggressive treatment of infants born with open neural tube defects. Data also are needed on the incidence of childbirth following prenatal diagnosis and termination of pregnancy and on other topics in prenatal, perinatal, and neonatal care.

What we do with the unborn and the newborn speaks very loudly for the values that our society actually practices. In no area will our public ethics be under more careful scrutiny in the next few years or will the need to base decisions on strong evidence be greater.

In the next 20 to 25 years, we may approach a perfect contraceptive society. In vitro fertilization techniques will be possible. If animal experiments show that gene therapy works and is not deleterious to the offspring, there may well be attempts to cure genetic defects in an embryo prior to implantation in the mother. Having an embryonic or fetal patient from the earliest days of life adds new dimensions to the longstanding question of a consistent ethic toward the fetus and the newborn. And so technology will, once again, challenge our policies.

But is technology assessment modern? Not really in spirit. Dr. Mortimer Lipsett, of the NIH Clinical Center, has called my attention to a quotation from Shakespeare that seems to contain the main aspects of technology assessment: "There is a history in all men's lives, figuring the nature of the times deceased, the which observed a man may prophesy, with a near aim, the main chance of things as not yet come to life, which in their seeds and weak beginnings lie entreasured. Such things become the hatch and brood of time." [Henry the IV, Part II, Act III, Scene 1.]

THE USES OF RECORDS AND STATISTICS IN THE ASSESSMENT OF HEALTH CARE TECHNOLOGIES
Panel Discussion

Robert J. Flanagan, Jr., American Hospital Association

I would like to offer several observations and suggestions regarding technology assessment from the perspective of the American Hospital Association (AHA).

The NCHCT has been emphasizing sophisticated methodologies for technology evaluation. Dissemination of more practical and useful information for technology purchasers, especially hospitals, should receive greater emphasis.

- The private sector needs to know what technologies are moving into the market and what impact they will have on utilization and clinical practice.
- Full multifaceted studies are estimated to take 18 months to complete and to cost $300,000 or more. Some of our scarce resources should be spent on the basic information needs of decisionmakers.
- The AHA has developed this kind of practical information for several technologies, including arrhythmia monitoring devices, automated infusion devices, and mass-spectrometry respiratory monitoring systems.

Rather than developing national go/no-go recommendations for specific technologies, we advocate disseminating information that would improve hospital-based decisionmaking on technology.

- Hospitals need basic information relating to effectiveness.
- Questions to be addressed include: (1) Is this service at the current state of the art or is it just one step beyond the experimental stage? (2) What are the clinical indications for use? (3) Are the expected patient outcomes significantly better than those from our existing procedure or service? (4) Does this innovation have spinoff effects that will require expansion or contraction of other services? (5) What are the risks for patient and staff?

This information is currently available in a fragmented and piecemeal fashion. Much of it is presented promotionally and lacks complete objectivity. Hospitals need to know the facts as they relate to different patient populations and facility sizes. The marketplace could make better decisions if better informed.

We would urge the NCHCT to avoid recommendations that would lead to rigid guidelines too early in a technology's evolution.

- Ultrasound is an example of a technology that probably would have appeared cost ineffective if subjected to formal analysis early in its development. Through refinements, it now is rapidly gaining acceptance as an invaluable diagnostic aid.
- If research and development in promising areas are to be encouraged, researchers and investors need assurance that innovation will not be stifled.

The state of the art in cost-effectiveness analysis is still primitive. This procedure is most appropriately used to structure the problem, not to arrive at a bottom-line figure to make policy.

- The valuing of benefits and the aggregating of benefits over time, people, and uncertainty are unresolved problems. Dr. Weinstein points out these difficulties in his talk, and, as he suggested, these problems become even greater when considering diagnostic technologies with multipurpose capabilities.
- The relative benefits of a technology are dependent on the patient population, the health-care setting, and the care capability of the individual institution. It is therefore most appropriate for the individual decisionmakers involved in technology acquisition to weigh the costs and benefits in their unique situation.

The rapid diffusion problem so often cited would be lessened if the marketplace were informed.

- The health care field needs timely information to make intelligent decisions.
- The AHA is developing hospital-based evaluation skills for decisionmakers through the Technology Evaluation and Assessment Manual (TEAM).
- The most direct manner in which to improve the mix of new technologies and eliminate waste is to provide useful information to decisionmakers, monitor experience in the field, and synthesize this experience with ongoing evaluation research in an interactive loop.
- This broad-based approach, involving both the private and public sectors, brings together the potential for information gathering in close contact with actual medical practice and the evaluative expertise being developed through NCHCT. Emphasis should be on facilitating assessments that are already being done.

THE USES OF RECORDS AND STATISTICS IN THE ASSESSMENT OF HEALTH CARE TECHNOLOGIES
Panel Discussion

William H. Kincaid, Case Western Reserve University School of Medicine

We are very shy about defining what we mean by quality in health care. Practicing physicians particularly are quick to remind us how complicated the whole question of quality is. Among the general definitions of quality in medical care I like best the one by Donabedian, who says "quality is the appropriate application of medical knowledge with due regard to the balance between the hazards inherent in every medical intervention and the benefits expected from it" and relegates the question of cost to a secondary position with the idea that wasteful activities of any kind are of reduced quality. We all know that the trouble with these general definitions, no matter how good we consider them, is applying them to the individual case--for example, the 78-year-old patient with arteriosclerotic heart disease, angina, diabetes, and developing cataracts, who has just fractured her hip. We are always plagued with defining the definition. What do we mean by appropriate? What is a medical intervention? What is a hazard? What is a benefit? What is a balance? And, of course, what is medical knowledge?

The general guideline can very quickly become lost in the maze of specifics. In the end, our operating definition of quality becomes, "Quality is what we agree it is," and its corollary is that "without agreement we cannot identify quality." The extent of our agreements is based on the objectives and values we have in common, together with whether and how we communicate with each other. Also, because our objectives, our values, and our communication patterns change, the definition of quality changes. There was a time and place where it was considered excellent quality in health care to put grandmother on an ice floe and set her adrift, but things have changed (although I am sure that some among us might say the change has been only superficial, because today we may put grandmother in a nursing home and set her adrift). We reach new agreements, and we expand the areas of old agreements, principally as we accept some kind of authority, ranging from the martinet medical school professor who says only his way is the right one, all the way to the other end of the scale where we voluntarily accept the authority of consensus for whatever reason, and including along the way the authority of persuasive evidence arrived at through application of the scientific method.

I dwell on these simple concepts because we so much take them for granted that we tend to lose sight of them, and we look forward to finding the key to quality in our next chi-square test or regression analysis, when many of our agreements on quality have little or no basis in scientifically proven fact. We may ask ourselves, "How many of our medical investigations and therapies would we have left if we were confined to using only those that have been proven efficacious through incontrovertible scientific evidence?

Thomas Dawber, in an article in the New England Journal of Medicine two years ago, reminded us of the unproved hypotheses which, depending upon the shifting consensus of agreements, have influenced our ideas of quality in medical care. The relationship of sodium intake to hypertension, tonsillectomy as a prevention of respiratory disease, alcoholism as a disease, and the relationship of dietary fat to atherosclerosis are examples of hypotheses for which the scientific method has not yet been able to yield incontrovertible evidence. Yet in spite of the controversies in these areas, there is widespread agreement, or patches of agreements, about the factors to be considered in the treatment of patients in those categories. In spite of the real and apparent complexity of the problem of defining quality, we are often surprised by the relative ease of agreement among physicians when they are faced with the need for defining criteria for such things as medical care evaluation studies in hospitals. They are able to do it. It is reasonable to suggest that there is far more agreement on what quality in health care is, on the detailed specific level, than physicians like to admit. We can theorize that the expansion of the definition of quality is hindered not so much by the difficulty of reaching agreement on criteria, as imperfect as the agreement may be in many cases, as by our reluctance to put forth the real effort to reach agreement.

Expansions in the definition of quality in health care are made in many ways, and in the coming of technology assessment we have for the first time a method attempting to embrace all the social, economic, ethical, and political issues of both the near and the far term in a way that we have not been able to approach until now. I am optimistic that technology assessment will give us new, although sometimes frightening, insights into the nature of quality. Because of technology assessment's enormous dependence on agreement on values, however, we must continue to search for other ways to increase our agreements.

As far as hospital care is concerned, probably the most important agreements on the definition of quality are found in the medical care evaluation studies required by the major agencies. Here physicians agree together on the minimal criteria for good care of a certain class of patients, for example, those with urinary tract infections, and then study medical records to see if all the criteria were met. Medical care evaluation studies are not meant to be scientific evaluations, but rather management evaluations, that is, studies that answer the question, "Are we in actual practice living up to the standards of quality we believe in?" In almost no cases, however, does the hospital follow up this kind of management study with mechanisms that will assure the application of these agreed-upon criteria concurrently with the actual treatment of patients, even though Sanazaro's report has shown that such kinds of concurrent quality assurance are both practical and acceptable. In most cases, the medical staff of one hospital neither knows nor cares what criteria have been set for the same kinds of patients in a neighboring hospital. Here again we have opportunities for expanding the definition of quality that have yet to be explored. It is very much an enlightened and innovative PSRO that has found mechanisms for communicating these differences and establishing methods for dealing with them through such techniques as areawide audits.

A key consideration in expanding our agreements on the definition of quality is discovering where the disagreements exist. Out of the identification of differences can grow the discussions that lead to increased understanding of the problem and eventually increased agreement on what quality is. Early in the development of the Professional Activity Study (PAS), we discovered that hospital and physician profiles showed differences in such things as average length of stay for similar patients, rates of cesarean section, uses of transfusions and antibiotics, and so forth. We found wide variations among physicians treating the same kinds of patients--variations stemming from the physicians or institutions, not the patients. Study of why the variations occur, and which of them are consistent with the definition of quality, is, in my opinion, just as great a problem today as in the mid 1950's.

Just like the patient who is concerned about knowing what to do until the doctor comes, I think physicians and the rest of us involved in defining quality of health care must find better ways to figure out what to do until the irrefutable scientific evidence comes.

Edward S. Mills, Blue Cross and Blue Shield Associations

Several weeks ago, I attended a regional meeting of Blue Cross and Blue Shield plan employees. As is the custom, the host plan--in this case New Mexico Blue Cross and Blue Shield--arranged an optional event for the benefit of the visitors. As also is customary, this event related to a special local institution, event, or resource.

The Albuquerque plan staff arranged for those of us who were interested to visit the Los Alamos Laboratories, which are near Albuquerque. At that time, we were given an opportunity to learn something about the medical work being done there. Our tour began with a view of the linear accelerator, which had been constructed to accelerate subatomic particles to very high velocities. This device consists of more copper than one can readily imagine. It is about a half-mile long and, of course, is buried under cement and dirt. Located at the end of the accelerator proper is a "switchyard," which separates the various particles and directs them to particular applications.

We were shown a medical application of what was termed "pion particle irradiation." Certain patients with inoperable types of cancer are exposed to a stream of pion particles in a fashion analogous to that in conventional radiotherapy. The work which is being conducted by the medical school at the University of New Mexico began, I think, five or six years ago, and thus no "cures," according to the usual definition of the term, have yet been demonstrated. Clinical trials are underway, and if the current success rate continues, this technology will "cure" 80 percent of these cancers. In the past, only about 4-5 percent of similar tumors have responded to more conventional therapeutic regimens.

This technology has, in my mind, some very important implications for the discussions heard today. As Dr. Fletcher pointed out, there are immediate ethical questions. They concern not only human experimentation, but also such matters as: If this is as successful as it appears to be, who should have the benefit of such treatment? How would we select those persons?

As Dr. Weinstein indicated, there are significant cost and benefit implications, and it would be important to collect appropriate data. The data in this case are in part readily available. The number of patients and perhaps the costs of alternative treatment can readily be determined, but the total costs of this treatment are probably difficult to define at this point, for the original accelerator cost over $100 million.

The question then arises: If this technology is successful, what should the course of its dissemination be? Suppose that the cost of building the accelerator can be cut by a factor of 5 or 10 or 20 or even 100. We are still speaking of technology that might cost $1 million or $2 million per site. If the technology is as effective as it now seems, many institutions in many parts of the country would seek such facilities for the treatment of their patients.

I would suggest that in the case of a technology of this apparently extreme cost, we might take as an instructive model a benefit applied by the Hawaiian Blue Shield plan, which recognized the unusual geography of the State of Hawaii and the need to provide a financial mechanism to make comprehensive care available to all of its subscribers. For many years the plan has offered a transportation benefit. In other words, if a subscriber has a medical condition that requires a particular treatment unavailable on his or her island, a Blue Shield benefit covers transportation costs to a site of treatment. Such a technique might be applied if centers for pion radiation therapy are set up on a regional basis. This approach might be more cost effective than building the technology everywhere.

My observations reinforce the point that Dr. Perry made, that technology is pervasive. The introduction of new technology has been going on for many years. The technology may be, by today's standards, as unsophisticated as the stethoscope, or it may reach as far as the device I have described or, theoretically, even further.

This example illustrates the role of Blue Cross and Blue Shield in techology assessment. First of all, please note that Blue Cross and Blue Shield do not undertake technology assessments. However, their financing role is a key element in the adaptation, and particularly in the dissemination, of new technologies. Very simply stated, if a new technology cannot be funded, either by government or one of the third-party carriers, it is unlikely to be disseminated broadly, particularly if it is a high-cost technology such as computerized tomography.

Importantly, Blue Cross and Blue Shield seek no decisionmaking role in technology assessment. Rather, on behalf of its 70 million subscribers, Blue Cross and Blue Shield insist that new technologies be cost effective or have a positive cost-benefit ratio. Such an approach is taken because resources are scarce and our plans are responsible for allocating them carefully. More directly relevant in some cases is the fact that Blue Cross and Blue Shield plans are in a keenly competitive market, and the premiums that they charge must reflect all of the costs of care incurred by their subscribers. If these premiums become too high because of technology payments or other factors, a share of the market is lost. The market is truly competitive, and we can certainly cite some recent numbers that will suggest how competitive.

As Dr. McNeil pointed out, the last 10-20 percent of effectiveness of a technology is the most costly. This matter related to the issues of ethics raised by Dr. Fletcher and raises the question "How far can we go; how far should we go in exploiting some technologies?" I think that there is an interesting parallel to the work of the Environmental Protection Agency, many of whose research reports indicate that removing the last one or two percent of pollutants from the air or the water is most expensive. This situation raises very significant cost-benefit questions.

A further example of the role of Blue Cross and Blue Shield in technology assessment is the medical necessity program which was relatively recently undertaken by the plans. This program recognizes

that technology in fact marches on and that there are changes in the best way to accomplish certain clinical objectives. In other words, some diagnostic tests and therapeutic procedures become obsolete or redundant, and periodically we should examine their efficaciousness. Thus, in conjunction with professional medical societies and hospital associations, Blue Cross and Blue Shield plans have defined a list of procedures that are, in the best clinical judgment, deemed inappropriate in today's context of medical treatment. We pay for these possibly redundant or obsolete procedures only if we receive an explanation of the medical necessity of their use in the particular case. In effect, Blue Cross and Blue Shield have performed a kind of "retro-technology assessment."

Thus, in technology assessment, Blue Cross and Blue Shield have a role that was not sought but which has been thrust upon us by both the pressures of the market and our concern for securing and financing the highest quality and most cost-effective medical care for our subscribers.

THE USES OF RECORDS AND STATISTICS IN THE ASSESSMENT OF HEALTH CARE TECHNOLOGIES
Panel Discussion

Stanley Reiser, Harvard Medical School

Self-conscious, direct attention to the medical record as an important agent for medical advance first occurred in the early twentieth century. The source of this interest was a growing litany of new purposes the document had come to serve and a recognition that its structure was inadequate to sustain its assigned tasks.

During most of the nineteenth century, medical records were, essentially, personal notes of doctors to themselves. In many hospitals and private practices they were unsystematically kept, conveyed little to anyone but the writers themselves, and sometimes failed even in that purpose. In the early twentieth century, clinical records gained new functions. As physicians became research-conscious, they recognized that accurate depiction of clinical events could serve the cause of medical science. Science proceeds on the dual path of careful documentation of observed events and unbiased evaluation of their significance. Records were improved to the extent that some clinicians transferred this scientific ethos to the bedside, viewed clinical events as potential keys to research progress, and used the medical record not only for patient care but to generate knowledge as well.

A second major need for which good records become crucial was evaluating the performance of doctors and hospitals. In 1917, the newly formed American College of Surgeons, devoted to improving surgical practices, launched an effort to upgrade hospital work through a series of standards against which hospital performance would be measured. A year later they began to publish an annual list of hospitals meeting the standards. The College considered good records not only significant in evaluating a hospital's work but also an index of adequate care by doctors. The record was seen as a test of whether the work of doctors and hospitals justified the increased levels of public support they now requested. As one observer wrote: "Full records, complete records, genuine, true, scientific records... are the pledge to the patient of what the hospital had done.... Records are absolutely essential. Any hospital that does not keep records or any medical man who does not keep records is derelict in duty to the patient, to the public, to the profession."(1)

Others joined the efforts of the American College. Notable among them was the Boston doctor E.A. Codman, who advocated the use of records to test the efficiency of care given by physicians and to assign responsibility for medical error. He believed that well-kept records would show what was wrong with patients; what therapy they received; its results; and if they were unsatisfactory, whether the fault resided in doctor, patient, disease, hospital, or equipment. He wrote: "Heretofore in hospital organization there has never been a bona fide attempt systematically to fix the responsibility for the success or failure of each case treated. I claim that our record system should enable us thus to fix responsibility, and that it should be used for this purpose."(2) Such records would advance the care of patients, contribute to science, and deal with the legal liabilities that physicians and hospitals increasingly assumed.

The early part of the twentieth century was also a period when medical specialization began to flourish. By the late 1920's, one doctor in four was a specialist. Essential to the success of a medical practice divided into compartments of knowledge are agencies of coordination. Growing numbers of physicians recognized the medical record as a crucial instrument for integrating evidence gained from multiple specialists and technologies now dominating clinical medicine. Thus, attention to its form and quality became essential.

Of the reforms suggested in the first quarter of the twentieth century to improve the organization of evidence in the record, the two most significant concerned the unification and standardization of the record. In most hospitals of the period, patients attending more than one clinic had the record of their encounters separately kept within each department. The result was that often only a partial account of the total medical situation was available to a given physician treating a given patient. The concept of the unit record, worked out in the Presbyterian Hospital in New York in the 1910's, required all data gained about a patient to be entered in a single record, which was recalled whenever the patient visited the hospital. The idea gained rapid approval in hospitals throughout the United States.

A second reform involved the mode of writing the individual case history. Some believed that without a uniform method for doctors to follow in gaining and recording data, the clinical case history could never achieve its potential usefulness. Physicians often failed to note in it such basic data as the sex or age of the patient. The proposed remedy was standardized forms that required doctors to note certain basic facts about illness but allowed them to make individual comments about the case as they saw fit. Unlike the unit record, this idea has remained controversial, some arguing that gaining data using a rigid format stifles the doctor's individuality of evaluation and expression.

Such were the controversies and reforms of the 1910's and 1920's. Today several more functions have been given to the clinical record. One is to provide patients with data about the course of their illness; laws passed in several States permit patients to read their records whenever they request. Doctors must now write records knowing they will be seen by the eyes of both colleagues and patients-no easy task.

A second function is the use of records to evaluate the medical and social impacts of health care technology. Although, as in the past, we are concerned with how and why doctors choose the tests and procedures they order, we now seek to learn also whether their techniques and technologies per se are useful, useless, or harmful in clinical, ethical, and economic terms.

The medical record in its present form cannot bear the weight of the diverse and multiple burdens placed on it during this century. It is a critical item on the research agenda of medicine to determine what changes are necessary to allow the record to accommodate our expectations for it. At present, as every clinician knows, it is an unwieldy document. The medical record has become the dinosaur

of medicine--encumbered by proportions and uses grown too large, facing collapse from its failings, leaving us puzzled, anxious, and intrigued about what sort of creature it should evolve into next.

NOTES

1. Charles B. Moulinier, "A Review of Progress Presented at the Clinical Congress of American College of Surgeons," Bull. Amer. Coll. Surg., vol. 4, no. 3 (1919), pp. 6-7.

2. E.A. Codman, "The Value of Case Records in Hospitals," The Modern Hospital, vol. 9 (1917), p. 427.

THE USES OF RECORDS AND STATISTICS IN THE ASSESSMENT OF HEALTH CARE TECHNOLOGIES
Panel Discussion

Eleanore Rothenberg, New York County Health Services Review Organization

Several of the previous presentations have emphasized the role of the National Center for Health Care Technology in sponsoring or conducting assessments of new or emerging technologies.

In the following presentation, I will describe a study, conducted by physicians in New York County (under the auspices of the Professional Standards Review Organization), that I believe addresses some of the NCHCT's concerns regarding assessment of existing technologies. Specifically, the study meets the following criteria recommended by the NCHCT for identifying areas for technological assessment:

1. It is expected to make available new knowledge about an existing technology, in this case a frequently performed surgical procedure.
2. The procedure under study involves high total costs to the Medicare program because of the high volume.
3. Variable utilization rates exist, suggesting possible inappropriate utilization in some hospitals where the procedure is performed.
4. Variable sequelae (post-operative complications as well as those at surgery) are thought to exist; thus, the study has been carried out vigorously in several stages.

Background

Before describing the specific assessment undertaken, I shall briefly describe the review activities currently mandated under the PSRO program.

Hospital review under the PSRO program involves two types of review activities which, although distinct in focus and methodology, are meant be integrated into a unified system. The first, concurrent review, consists of: (1) admission certification (review of the appropriateness and medical necessity of admission to a hospital), and (2) continued stay review (review of a hospital stay longer than expected, based on established norms where available or on explicit criteria predetermined by consensus of a PSRO Criteria Committee).

The second component, based on retrospective evaluation of care provided in PSRO area hospitals, includes: (1) profile analysis (a statistical analysis of aggregated data involving patients, practitioners, and institutions and derived from various sources including concurrent review activities described above), and (2) Medical Care Evaluation studies (MCE's) (relatively short-term indepth studies that focus on specific problems or diagnostic categories).

The following is an example of one of these PSRO approaches to assessment, namely, the MCE study.

In 1978, the New York County Health Services Review Organization (NYCHSRO), a PSRO in New York City, selected cataract extraction as the topic for a multi-hospital medical care evaluation study for the following reasons. First, for each year since the PSRO commenced its hospital review activities, cataract extraction had been the most commonly performed elective surgical procedure for the Medicare beneficiaries served in New York County hospitals. Second, the average length of stay for cataract extractions had consistently exceeded regional and national norms.

The multi-hospital MCE study on cataract extraction had two objectives:

1. To identify areawide patterns of practice, and
2. To determine the reasons for long lengths of stay.

The screening criteria and the MCE study protocol were developed by NYCHSRO's task force on ophthalmology, which is composed of board-certified ophthalmologists. The study parameters included men and women ages 45 or older who underwent cataract extractions during 1977. The PSRO's biostatistician determined that 1,321 cases in 17 participating hospitals would be selected randomly for review. The study protocol was sent to the hospital administrators and chairmen of MCE committees for review, and NYCHSRO held a workshop to aid the hospitals' health record analysts in performing data retrieval. The data were compiled and subsequently analyzed by members of the task force on opthalmology, as well as by PSRO staff.

Results of Areawide MCE Study on Cataract Extractions

The study findings raised issues concerning both utilization and quality. Bilateral cataract extraction cases appeared to have had substantially higher complication rates than did unilateral extraction cases. Moreover, the average length of stay for bilateral extractions was considerably more than twice that for unilateral extractions. The multi-hospital MCE study also revealed that bilateral cataract extractions represented more than ten percent of the cases in 1977. In addition there was great variability among specific hospitals, with the percentage of cataract extractions that were bilateral ranging from 0 to 60 percent. After careful deliberation, the NYCHSRO ophthalmology task force members determined that bilateral cataract extractions should be performed rarely, and then probably only under special circumstances.

Actions Taken Based on Results of MCE Study

After the results of this study were compiled and analyzed, patterns of practice became apparent. The NYCHSRO therefore instituted a system of physician review of unilateral, bilateral, and other cataract extraction cases. Hospitals selected for inclusion in this peer review were those whose complication rates in the MCE study exceeded 50 percent. Actually, the "complications" did not exist in many instances because the health record analysts had not been properly instructed: they interpreted expected minor conditions to be complications. Upon peer review, it was agreed that the criteria lacked specificity and should be refined.

Following this peer review activity, further review of two physicians practicing at different hospitals was thought to be warranted. An ophthalmology quality review team was thus established to review cataract extraction cases of these two physicians in greater detail. The

results of this indepth review prompted NYCHSRO to schedule meetings between its ophthalmology quality review team and the two physicians in order to focus on quality issues and/or documentation problems.

On June 1, 1980, NYCHSRO undertook a special followup study involving bilateral cataract extractions. The study is being conducted at 21 area hospitals in order to address the problem of potentially unnecessary and inappropriate procedures. The study calls for ophthalmologists to perform reviews on all such cases. Physician reviewers are using a data collection instrument devised specifically to capture relevant information regarding the justification for performing the bilateral procedure. In addition, data on associated complications and lengths of stay are being collected. Compilation of this information and analysis of the results will assist NYCHSRO in developing future hospital review program policies and objectives, including possible second-opinion programs, if deemed necessary and appropriate.

Preliminary Results

In order to gain a clearer understanding of, and to better assess existing hospital practices in New York County with respect to cataract surgery, NYCHSRO's records and statistics were reviewed. They showed (Table I):

1. In 1978, of the 6,103 cataract extractions performed in the hospitals then under the PSRO review system, 537, or 8.8 percent, were bilaterals.
2. In 1979, shortly after the MCE study was initiated, there were an estimated 7,281 cataract extractions, of which 559, or 7.8 percent, were bilaterals.
3. During the first quarter of 1980, 1,286 cataract extractions were performed in hospitals under the PSRO review system. Only 75, or 5.8 percent, were bilaterals.

Table I

Number of Cataract Extractions
1978-1980

	1978*	1979*	1980 (1st quarter)**
Unilaterals	5566	6722	1211
Bilaterals	537	559	75
Total	6103	7281	1286
Bilaterals as % of Total:	8.8%	7.8%	5.8%

*Based on 95% of the expected discharge abstracts
**Based on 80% of the expected discharge abstracts
Source: NYCHSRO discharge abstract masterfile

Thus, the bilateral cataract rate apparently has declined by nearly half, from over ten percent in 1977 to under six percent in 1980.

More remarkable, perhaps, is the following change in hospital practices. In 1978, there were two hospitals (out of a total of 17 then under the PSRO program), in which no bilaterals apparently had been performed (Table II). In another six hospitals, bilaterals represented less than five percent of the total. At the other end of the spectrum were five hospitals where bilaterals represented at least 10 percent of the total number of cataract extractions. In one hospital, the figure was greater than 20 percent.

By 1979, these statistics had changed. Three hospitals (out of 21 then under the PSRO program) showed no bilaterals, and another five showed that bilaterals represented under five percent of the total. In only five hospitals was the figure above 10 percent and one it exceeded 20 percent.

For the first quarter of 1980, these statistics changed again, more dramatically than in the year before. According to the PSRO profile for this time period, no bilaterals were performed in eight of the twenty hospitals for which data were available. The ratio was under 5 percent in another six and exceeded 10 percent in only two.

Table II

Bilateral Cataract Extractions
as a Percent of
Hospital's Total Cataract Extractions

	Number of Hospitals 1978*	1979*	1980 (1st quarter)**
0%	2	3	8
1 - 4%	6	5	6
5 - 9%	4	7	4
10 - 14%	4	4	1
15+%	1	1	1
Total Hospitals:	17	21	20

*Based on 95% of the expected discharge abstracts
**Based on 80% of the expected discharge abstracts
Source: NYCHSRO discharge abstract masterfile

Another finding is worth noting. Based on data from its 1978 masterfile, the PSRO analyzed practice patterns by physician (Table III). This profile analysis revealed that in 1978, of the 410 physicians performing cataract extractions, only 149, or 36 percent, performed bilaterals. Of those 149 physicians, 57 performed bilateral extractions in less than 10 percent of cases, and 92 did so in more than 10 percent.

Table III

Physicians Performing Cataract Extractions
1978

Bilateral Extractions as Percent of Total	Number of Physicians
0%	261
1 - 9%	57
10 - 19%	43
20+%	49
Total Physicians:	410

Clearly the 92 physicians (approximately 22 percent) who performed bilaterals more than 10 percent of the time represented a subset of the practicing physicians in the New York County area.

In addition to conducting the special follow-up study now in progress, the PSRO has referred

this information to the continuing Medical Education Committee of the New York County Medical Society.

Summary and Conclusion

The PSRO case study that I have described is one example of how New York's physicians, through their PSRO mechanism, have used records and statistics to examine and assess an existing technology. The use of powerful tools such as data analysis, combined with record review by a peer group, has led to substantial changes in the behavior of the physicians providing care locally. The followup study now in progress is expected to shed light on the excess risks and costs that may be associated with performing bilateral cataract procedures during the same hospitalization. If the initial findings (namely, that the complication rate is significantly higher and the length of hospitalization is considerably greater than for unilateral extractions) are confirmed, the PSRO will be in a position to set appropriate criteria for when and under what circumstances bilateral extractions should be performed.

Closing Session

DIRECTOR'S REMARKS

Dorothy P. Rice, National Center for Health Statistics

Welcome to the Closing Session of the 18th National Meeting of the Public Health Conference on Records and Statistics. I know that all of you agree that it has been a most interesting, stimulating, and challenging three days.

I wish to take this opportunity to thank the people who organized and participated in these sessions. We worked hard--as I am sure you will testify--in developing the program.

Our concurrent sessions centered on four themes: New Uses for Traditional Records; Methodological Issues; Applications in Occupational and Environmental Health; and Applications in Health Promotion. Within each of these thematic groups was a concurrent session representing one of our four tracks: Vital Records, Health Records, Manpower and Facilities Statistics, and Costs and Expenditures Statistics. Our Closing Session speakers are here to briefly relate the essence of the presentations within those tracks, to summarize the discussions of the current challenges to records and statistics, and to convey their ideas on implications for the future.

A final note: I would like to give special thanks to the Executive Secretary of this Conference, Mr. James Smith. Jim is Chief of the Conference Management Branch of the National Center for Health Statistics. He and his staff, as well as the registration desk assistants and session monitors, have done an outstanding job in providing the services that have made the 1980 PHCRS an effective, successful Conference.

VITAL RECORDS

Joseph Carney, Oregon Department of Human Resources

If you let your mind go back to just a little before 11:00 on Monday morning, you will recall the presentation given by Dr. Lester Breslow on "The Challenge to Health Statistics in the Eighties." Within that presentation was a statement which, if I were asked to summarize what has been said here in ten words or less, would be the statement I would select to do so. It was Dr. Breslow's point that the challenge to health in the eighties is "adding life to years rather than adding years to life."

Garland Land picked up on this theme in his presentation "New Challenges to Vital Records." He pointed out that health planners, epidemiologists, and social planners are utilizing vital statistics data to answer questions regarding facility planning, health status, health effects of environmental exposures, and the health status of special interest groups. These uses of the vital statistics data are aimed at "adding life to years." They are uses concentrating on the issues of a living society.

Garland pointed out that these new uses of the data from vital records place new requirements on the source document and the collection process. New questions are being added to the documents and new quality control procedures are required to insure that the quality of the data is sufficient for the use to which we intend to put it.

Another key point in Garland's presentation was that not only do the new uses of the data create new demands on vital statistics systems, but also the new users create an additional demand. Much of the analysis of vital statistics data is now being performed by users who are novices in the use of vital statistics. It now becomes incumbent upon the statistician to become an educator to help prevent the misuse of the data.

Fred King's presentation on "Current Issues in Vital Registration" made the point that the vital statistics system is a pyramid with vital records as its base. He sounded a warning that the increased use which is being and will be made of the vital statistics system places a strain on the vital records base at a time when funds to improve the registration system are being denied. Some of the problems which Fred pointed out were:

--demands by genealogists to make vital records public and to be allowed physical access to the records;
--the opposite perception by other groups that some of the items on vital records are an invasion of privacy;
--storage and retrieval problems;
--fraudulent use of vital records; and
--pressure to open adoption records.

In the face of these added problems, Fred warned that vital records systems are being faced with doing with less staff and with budget cuts.

Fred suggested that the National Center for Health Statistics, working with the American Association for Vital Records and Public Health Statistics, should develop a mechanism to provide technical assistance in helping States meet these new challenges. In the discussion following Fred's presentation, the VISTIM (Vital Statistics Improvement) Program of the Center's Office of International Statistics was suggested as a possible model to be used for offering technical assistance to the States. The AAVRPHS now contracts with NCHS to offer a roster of vital statistics personnel with various specialties and expertise to be used in technical assistance to developing countries throughout the world. It was suggested that a similar contractual agreement for inter-State exchange of expertise might be a way of offering technical assistance to the States without the need for the highly unlikely increase in Center staff.

In her presentation on "Meeting New Challenges With Vital Records Data," Trish Potrzebowski delved further into a problem first delineated in Garland Land's presentation. Trish pointed out that because of the expanding scope and use of vital records data, the need for evaluation of the quality of these data on a regular basis is becoming increasingly apparent. Although the general assumption is that vital records data are of acceptable quality, Trish warned that this assumption is all too often based on little or no hard data and the need for either ongoing or periodic evaluations of data quality from vital records at the State level does not receive adequate emphasis. Trish reviewed several evaluation techniques including:

--linkage studies using other data sources;
--followback to the original data sources;
--internal monitoring and computer edits; and
--verification techniques for coded items.

Trish recommended the uniform adoption of specific evaluation techniques and the further development of innovative methods for measuring data quality. She recommended in particular the adoption by States of the Moshman evaluation questionnaire for vital records.

John Wilson's presentation on "Improvement of Vital Records Data" was an excellent followup to the points which Trish had raised. John reviewed in detail several programs and activities designed to improve the quality of vital records data. Included in his review were:

--the employment of field representatives;
--the use of query programs;
--application of timeliness studies;
--use of cross checks;
--followup on late certificate filings;
--followback studies on certificate data; and
--the birth notification programs.

The lively discussion which followed John's presentation on methods seemed to underline the importance which both his and Trish's presentations had placed on today's need for improved quality control of vital records data. The assortment of pro and con experience with some of the methods that became evident in this ensuing discussion had to bring to mind Fred King's earlier plea for an organized method to supply technical assistance to the States in the vital records area.

Charles Rothwell's presentation on "Expansion of Scope and Usefulness of Vital Statistics" added substantially to the theme being developed throughout the vital statistics sessions. Vital statistics data are growing in use and importance, but vital statistics offices must be ready to face the changes which this growth implies. Vital statistics offices cannot remain compartmentalized, but, rather, must relate to other health statistics areas. In this vein, Charley emphasized:

--relationships between occupational health and vital statistics;
--EPA-sponsored environmental health statistics systems; and
--use of vital statistics in small geographic areas as sentinel events.

Indeed, many of the areas of possible expansion of the scope of vital statistics data were illustrated in more detail during the second day of presentations in vital statistics. Concurrent sessions I and M presented an excellent series of presentations indicating specific research uses of vital statistics data.

I have tried to summarize into only a few moments many hours of strong, substantive presentations--not an easy task. The job that each of us must now do is harder still. Summarize for yourself what you have heard and encapsulate it into a few phrases, a few conclusions that can stay with you and affect your decisions in the future--a tough job, but to not do so would be to waste the power in the ideas presented during these vital statistics sessions.

James P. Cooney, Jr., Office of the Assistant Secretary for Health

My assignment at this concluding session is to summarize from and prognosticate about sessions that focused on products of "close encounters of the medical kind," specifically the health record.

During the conference, under the general rubric of "new challenges," data, information and intelligence compiled from the health record were examined in four theme areas: new uses for traditional records, methodological issues, applications of the record in the area of environmental and occupational health, and the use of records in health promotion efforts. Specific subjects of examination included: relationships between hospital patients and institution cost; family medicine information bases; record-based data for long-term care; measures as indices of severity of illness; discharge records for occupational health surveillance; acute hazards measured through emergency room use; medical record audits and health promotion; health record information and planning decisions; and finally, from a variety of health record sources, costs and benefits of prevention, economic benefits of prevention, and excess mortality.

To attempt to summarize the rich content of these sessions in a few minutes and do them appropriate justice would be perhaps the most foolish move I have made on a public platform. Therefore I elected to avoid that superlative except to say the presentations I feel convincingly demonstrated that:

1. There are indeed a wide variety of challenges to the health record. The list of the past days is certainly not complete, nor was it intended to be. All items may not be new but they are deservedly and currently popular and important.

2. Observing "challenges" to the health record over the past twenty years, one can see the record increasingly becoming a very central tool of both health statistics and research. The impact of the tool on health policy is increasing and is being recognized. Parenthetically, with such impact and recognition it is hoped fiscal resources will grow, at least slightly, to assist all of us in meeting the challenges and to expand utility.

3. Finally, the quality and quantity of individuals working with the record's statistical products is a rare vintage of imaginative and perceptive people. We have only seen a small sample of such people in the past few days, but it is representative of a cadre of effort that is unique and has been a long time coming.

However, before we become too comfortable with accomplishments in statistics stemming from the health record, we must remember that for all our new challenges, our present productivity and future potential--we still have a traditional problem: the adequacy of the health record as a statistical resource for multiple uses and users. We must recognize and work on the resolution of this traditional problem; otherwise our potential will be severely limited. In reality, we have been fortunate in the past--we have worked around the problem. However, given new and increasing challenges, I do not feel that the type of "treating the symptom rather than the disease" solution will stand us in good stead for our future and necessary statistical endeavors.

The health record was historically created and is even today maintained for one basic purpose: a chronology of significant events of a health care encounter, events that required recording for individual medical care and medical-legal purposes. The document, at least in the traditional mold, was not created to serve the multiple purposes we are using it for today and in fact will not, with a high level of precision, serve those purposes. It is a very slender reed to support the growing number of challenges to which we are attempting to force the record to respond. We have some options through which the problem could be resolved: the organization and content of the record must change to assure adequate responses, or we must explore data resources supplementary to the record, or we must lower our sights and hedge on a few challenges.

In my final few minutes, I do not propose to resolve the traditional problem of the health record or definitively explore our options, but I will at least explore the edges of both.

1. There are given characteristics of a health record, at least in the traditional mold, and these must be understood in terms of their impact on our statistical products:
   - The health record content is basically prepared by a variety of health professionals (physicians, nurses, social workers, etc.). The items they record are dictated by their professional training and individual patient needs--but not statistical requirements. Often the twain do not meet in terms of content, definitions, and/or certainly uniformity.
   - Health records are generated in a broad range of institutional settings (hospitals, nursing homes, HMO's, practitioners' offices, emergency rooms, industrial health clinics, etc.). There are obviously many thousands of the settings in which many more thousands of health professionals are making notations which accumulate into what we term euphemistically a health record.
   - The results of the proceeding are a highly variegated crop of health records which serve as the primary source of our uniform health statistics.

2. Seldom do we in our statistical applications use the health record directly. Rather we rely on material abstracted in a variety of manners by individuals, often less than qualified for such an effort, from highly variable records in terms of both organization and content.

3. The abstracted data are further massaged before analyses by encoding and classification methods and preparation for computer processing. All these efforts are often far removed from the original record and recorder.

I am told a few problems for statistical purposes result from the preceding--I am surprised we do not have more. Given the odds, the wonder often is not that our statistical analyses

from health records are well done, but that they are done at all.

With the new challenges facing us in the area of health records source statistics, (and I think especially of the ambulatory and long-term care patient subject areas), there are challenges of the record as a primary source document that must be faced and ameliorated before our new subject area challenges can be acceptably attempted.

Certain solutions are possible that will partially assist. Most of these have been around so long they border on conventional wisdom. Briefly and without great exploration they include, first, the promulgation--not the development--of the concept of uniform health data sets. They have already been developed, but now it is necessary to promulgate the uniform items and definitions in the settings where professionals are recording the information.

Secondly, at least one section of the health record should be dedicated to the uniform minimum health data set items; one place in the record for the centralized recording of at least minimum data sets in the defined uniform terms. Again, not a new idea, but if it were implemented in a variety of settings, it would significantly reduce the recurrent problems of accuracy.

Thirdly, education and training on a continuous basis of any and all professionals who record the data items is a necessity. This is an obvious solution, but one that is often overlooked. When education is attempted, the physician is often bypassed. I do not believe we can afford this kind of oversight in the future if we are going to be responsive to our new challenges.

Fourth, we need consistent, continuous, and economical quality controls on both the recorded items and the abstracted items. The three Institute of Medicine studies provided excellent guidance toward this direction in terms of sensible, economical quality controls. Clearly these are necessary on a continuing basis, but again, they are too frequently overlooked.

And finally, a concept of reciprocity is essential. At the 1974 PHCRS, I commented that the one thing that would improve quality and usability of information--and this was in a hospital context--was a concept of reciprocity established among providers, processors, and users of data. It is very difficult to increase the quality of information when the individuals that provide the information see no utility for their own purpose.

We must establish the concept of reciprocity. It is workable. I think that was observed in the difference between the studies of the quality of abstracted information undertaken in the early 1970's and those done by the Institute of Medicine in the late 1970's. There have been significant improvements, and I would cite that the PSRO and planning programs came to being during that period. I believe these and other related "use" programs have had an impact in terms of creating useful, high quality information.

Most of the preceding are rather pedestrian, certainly not glamorous and certainly not innovative, at least in concept. Operation of the concept, however, is another matter. The theory has seldom been put into practice. Nevertheless, these points have demonstrated selectively positive impact and they must be put into wider use.

These suggestions have the potential to resolve some of our current problems with statistics abstracted from health records. However, even with consistent and widespread application, they will not transform the traditional health record into a single valid and reliable data source to meet all of our new challenges. In terms of validity and reliability, we will never achieve 100 percent acceptability, partly because of the nature of the health record itself, and partly because we do not have the fiscal resources to afford the level of effort required for such accuracy.

The function of the health record will mitigate against its use as a total resource for all our required health encounter data. To transform the record into a central resource distorts, if not destroys, the purpose of the record. We must accept that, and seek some other options in addition to the record to meet our statistical demands.

FACILITIES AND MANPOWER STATISTICS

Paul Gunderson, Minnesota State Department of Health

The comments that I have recorded for exploratory discussion with you this afternoon will, to some extent, attempt to summarize certain observations from the concurrent sessions devoted to health manpower and facilities statistics . . . an area traditionally entitled health resources statistics.

The task for me is frankly a fascinating one, because the manpower and facility statistics area reflects quite a diversity of effort. I suggest that it is fascinating due to the advent of the national Cooperative Health Statistics System (CHSS). Through the CHSS, a considerable amount of effort--at least at the State level and, of course, at the Federal level--got underway.

Before proceeding, however, I thought it would only be fair to share with you my perspective concerning these data areas. This perspective has been colored by my experience in working at the State level as well as by my work with some issues that emerged as we attempted to assemble a basic capacity to monitor and evaluate the delivery of health services.

The collection and analysis of health resource data has traditionally been fielded from the viewpoint that basic intelligence about the geographic dispersion and the service characteristics of these resources is essential for planning and managing selected aspects of the health care delivery system.

I think this perspective makes as much basic sense today as it did 15 or more years ago, and certainly makes as much sense as when the initial design of the Cooperative Health Statistics System began to unfold. I add parenthetically that this perspective is still very sensible, in spite of the actual performance record of that "thing" some of us refer to as the Cooperative Health Statistics System.

The impetus for the collection of these data has shifted, however. I think many of us will recognize that initially our concerns as a Nation as well as our concerns as State jurisdictions focused prime attention on fostering access to primary health care resources.

In particular, as a speaker in one of our sessions noted rather eloquently, the poor and the medically underserved were uniquely singled out and informed repeatedly that they did not avail themselves of enough primary care. They were further informed that if they used these services, their health status should ultimately be raised to what was deemed to be a more acceptable level.

I suppose it is no surprise to most of us today that merely increasing the access of various sectors of our population to these resources has not resulted in a significant improvement in the health status of these populations. In fact, in recent years these same populations have been repeatedly informed that they used too much service, hence the emphasis on cost containment.

I mention this matter as a context for the assertion which I would leave with you: That we exercise considerable care when deriving or when determining the actual reasons for continuing or instituting basic data collection systems that attempt to monitor the character of our health resources.

It seems to me that the major reason we collect these data is to enhance the overall welfare of our citizenry by providing timely, adequate, but uncluttered information to those reponsible for the Nation's health.

Therefore, the immediate reasons why we collect these data today may selectively flow and ebb. They certainly have in the past, as many of us recognize. But the most basic and fundamental reason remains -- these statistical resources and the information they contain represent what economists have termed the "public good." These data are a public good in and of themselves.

Now I direct our attention to some observations which I thought were worth repeating in our Closing Session since not all of us had the opportunity to involve ourselves in each concurrent session.

Sessions on manpower and facilities statistics spanned quite a continuum--from outright use and application of these data, to their relationship to new public health statistics thrusts such as those of health promotion, and to monitoring the environmental insult suffered by the citizens of particular geographic areas in the Nation.

On occasion it was not always clear just what the relationships were, but I think that some do exist, particularly on the facility data side. It seems to me that the planning function--and particularly that planning function which is focused on trying to derive a better match between the capacity of our educational training system to produce categories of health personnel and the perceived need for these categories--has developed considerable sophistication in the use of these kinds of data. In fact, it appears to me that use of these data is frequently more sophisticated in educational system planning than it is in health planning.

It is fascinating therefore to hear of the New Jersey and Washington State experiences with use of these data. For instance, in New Jersey response rates dropped as professions developed considerable reluctance to provide needed data voluntarily.

In the inpatient facilities area, we learned of the newest phases of planning associated with the Health Care Financing Administration's Annual Hospital Report, including projected roles for Federal, State, and private data processing centers. Speakers representing environmental health programs reminded us of numerous other health service facilities that are not traditionally a part of Cooperative Health Statistics System data sets. These facilities easily qualify as essential health services and are regularly inventoried as a by-product of regulatory activity.

Two presentations focused on data quality issues, some of which can be vexing. It is heartening to learn that now underway are recommendations of the Expert Panel to Evaluate the Cooperative Health Statistics System. The recommendations pertain to the need for assessment of data provided by all partners in the system, both public agency and private. We need to review periodically our performance and isolate those areas needing improvement. By way of example, it was noted that we do not suffer from lack of data analysis techniques--

rather analysis sophistication has outstripped our conventional data collection capabilities in the health resources area.

The future? Let me reiterate . . . we must not lose our capacity to track health fundamentals, because a contemporary society cannot function long without a basic intelligence of its health care resources. That question therefore is not whether, but how can we preserve the basic capacity to collect and analyze data pertaining to the character of our Nation's health care resources.

COSTS AND EXPENDITURES STATISTICS

Paul Densen, Harvard Center for Community Health and Medical Care

I would like to share with you a story that seems to epitomize the path in front of all of us for health records and statistics in the 1980's. I will not vouch for its truthfulness, but it is certainly a good story within this particular context. One of our senators who was noted for his lack of patience held a hearing on the energy problem. Testimony was given by a man who spoke in convoluted technical jargon. As the presentation wore on, the senator's blood pressure rose higher and higher as he became frustrated at not being able to understand. Finally, the senator interrupted, saying, "Young man, stop right there. You make me feel like a mushroom--you keep me in the dark and you feed me you-know-what."

I think our job in the 1980's is to keep people from feeling like mushrooms, not to keep them in the dark, to feed them some honest-to-goodness solid facts about the state of the health system and the impact of various programs on the health status of the Nation.

If we are going to do this, there are some challenges in the 1980's that we must face up to, and these challenges were brought out in various ways by the papers that I listened to in the sessions on costs and expenditures.

The first paper concerned the costs of evacuation of the area surrounding Three Mile Island. The basic data came from a household survey. What interested me is that as we get into the area of costs and expenditures, we find that if we really want to understand the forces that result in particular trends, we move away from costs and expenditures in the direction of understanding how people utilize the health care system. It is the utilization that results in the costs and expenditures and the more we understand this, the more likely we are to understand why expenditures and costs are going in a certain direction.

The second presentation I heard delineated the impact of regulation on safety in industrial plants. The data for this came largely from information collected on industrial accidents and absenteeism. The point was made that these data tend to be rather subjective, consequently mortality data was used as well.

One presentation concerned attempts to estimate the effectiveness of ambulatory care, not in a controlled situation but in the way the population actually received its ambulatory care. The information for this comes from several of the surveys of the National Center for Health Statistics.

Another speaker in the Costs and Expenditures Track discussed the issue of where Health Service Agencies should concentrate their energies in planning for the future. In addition, Monroe Lerner presented a paper on excess mortality in the city of Baltimore, which was an interesting use of vital statistics data.

In these and other papers some data comes from surveys, while other information comes from ongoing record keeping systems.

I wish to make an economic forecast. It seems to me that if I am assigned to the sessions concerning costs and expenditures, I should at least be allowed to make an economic forecast like anyone else does. The accuracy of my prediction is probably of the same order as those I have seen in the past.

I make the prediction that we are going to have a tough time in the 1980's. There are going to be more and more calls on limited resources. One of the places we may suffer the most is in the area of health surveys, because they are not directly related to service programs.

Consequently one of our challenges for the future is the relationship between survey data and ongoing data from service programs. A lot of improvement is needed in the data from service programs. At this time, you cannot find out how many people are served by these programs. You can find out how many services are rendered and what the volume of visits is, but information on the number of people involved is another question.

If we want to relate survey programs and ongoing service statistics, we must find a way to count people as well as volume of services. Until we do, we will find it very difficult to measure the impact of the ongoing service programs on the health of the population.

I think we need to move back and forth from survey data to ongoing service program data. One could generate questions for the other. We should think of these as a continuum, rather than dichotomizing them, keeping surveys over here and service program data over there. This is one of the challenges for the 1980's--looking at the relationship between these two ways of gathering information.

A second challenge we need to address concerns a fact noted by people in all of the PHCRS sessions: the health picture of the population has changed. We now have an aging population, and we have much more chronic disease.

From time to time, the National Center for Health Statistics, the National Center for Health Services Research, and now the National Center for Health Care Technology, present us with data showing trends in utilization and health status of the population. One of the problem areas for the further development of health data, however, is that of chronic disease. One speaker emphasized that in an aged population, people are often afflicted by more than one disease at a time, and it is very hard to separate one from the other. In fact, one begins to wonder whether you ought to bother to try to separate them.

I believe we need to move toward discovering how the population uses the health care system--how a person moves from being a perfectly well individual to becoming ill to becoming hospitalized to moving into home care or a nursing home.

At this time our health programs are categorized, but that is not the way people have problems. In planning for the 1980's, we must start thinking along the lines of longitudinal studies that show how people move through our health care system.

If you will recall Dr. McGinnis' presentation in the Second Plenary Session, the emphasis of the Surgeon General's report was on prevention. Prevention is, by definition, a question of incidence,

which brings us back to the longitudinal aspect.

My last point concerns both the Surgeon General's report and the costs and expenditures issue. In reading the Surgeon General's report, you will notice that one of the 15 goals is that of developing statistics appropriate to promoting health and preventing disease.

Here we have a curious situation. Trends have revealed improvements in many areas of the health of the population, and at the same time we have seen some areas where we need to move in terms of improved programs. What concerns me is the proportionate amount of the health budget that goes toward statistics. While the programs have been increasing, I suspect that the proportionate amount of the budget for health statistics has been going down.

I think it will be very bad for society if we do not find a way to make the size of the statistical budget reflect the importance of providing the facts that prevent people from feeling like mushrooms, being kept in the dark. In some kind of proportionate way, the statistical budget must be linked to the size of the health activity as a whole. That, I believe, is one of the major challenges for the future. I leave it to you people who will be concerned with it much farther into the future than I will to figure it out.

Stand-by Presentations

"THE ROLE OF THE FIELD REPRESENTATIVE IN IMPROVING THE QUALITY OF VITAL RECORDS"

Edward J. Brogan, New Hampshire Vital Records

It is a pleasure to address you today. To my knowledge this is the first time that a Field Representative has been so privileged. My subject according to the program is "The Role of the Field Representative in Improving the Quality of Vital Records" - which is very impressive sounding and covers a wide territory, but it does not exactly get you all charged up and anxious to listen to my remarks.

So I'm going to present this portion of the program under a slightly different title. Let's try this. "Rely on Your Rep for a Quality Product."

With this as a theme, I'm going to approach the subject from the viewpoint that the Field Representative is the "Sales Rep" for the Bureau. The product being promoted is HQR, a high quality record. Let's examine this idea for a few minutes to see if it has merit.

Admittedly, my frame of reference gives me a certain bias, since the greater part of my business career has been spent in sales work. I'm convinced that many of the attributes that make a good salesman will automatically be most applicable to the role of the Field Representative. Naturally, I mean salesperson, whenever I inadvertently use the chauvinistic, masculine version of that word salesman. I want you to know in advance that I am very conscious of the rights of both sexes as I have had some very good training along these lines, by an expert - my wife.

What are some of the qualifications that would be considered desirable and important if you were hiring a person who was going to sell a product for you? This person would be expected to present your viewpoint and philosophy, as well as your policies and ideas in a positive, forceful, and effective manner.

That job needs a SELF-STARTER - a person capable of operating independently with a minimum of direction and supervision, able to schedule time and appointments to best advantage and to approach job situations as a problem solver with a POSITIVE ATTITUDE.

This person must be FLEXIBLE AND AMENABLE TO CHANGE, a most important qualification. There was once a Greek philosopher who said "There is nothing permanent except change." Consider how true this still rings when we look around at our jobs, our environment, our social customs, our conventional beliefs. For example, who would have said a few years ago that in our conservative state of New Hampshire, proud of its Puritan ethic, we would now have on the statute books what we call "A 3-Way Affidavit of Paternity" specifically designed for the married mother whose husband is willing to agree that the boyfriend is really the father of the new arrival - a far cry from the "Scarlet Letter."

The work assignment of the Field Representative will be best accomplished when he or she is able to approach the daily job routines with an open mind. This would be ideally combined with the ability to analyze and evaluate using traditional values and basic tenets but realizing that we surely must "stay loose" in today's rapidly evolving, everchanging social structures.

So the SELF-MOVER is needed. A positive attitude that will be resistant to negative thinking is desirable. The realization that nature itself is in a constant state of flux; and, therefore, that it's very natural for us to encounter changes in our daily job routines as well as our personal lives. Surely these would all be desirable traits in a salesperson. Definitely, these very same traits would be most desirable in your Field Representative.

This job of Field Representative and how it can affect the quality of those records that represent the central reason for this convention provides many interesting phases and facets for exploring. The idea of using a Field Representative as a part of the vital records system to represent the Registrar and the other members of the "home office" staff out in the various communities is not new among some of the states. A certain small nucleus of the present group has been in the picture for many years. This is a handful compared to the present numbers and the current trend which now shows a total of 53 Field Representatives from 37 registration areas. With 57 registration areas there is obviously a large percentage of the group that have yet to adopt the concept of using the Field Rep in their organizational structures.

This idea of encouraging the use of field people has been recommended by the National Center since the early 70's at which time provision was first made for funding such field positions. The number of Field Reps increased rapidly when money became available for this purpose. It soon became evident that such positions could increase the effectiveness of Bureau activities in an entirely new area. And now, a decade later, special meetings for the Field Rep have been held on a regional basis around the country in Orlando, Salt Lake City, and Cleveland as an indication of the programs success.

What are some of the ideas that were discussed at these meetings and how can they be implemented to affect the quality of your records? Do the results of such programs allow for measurement? These are two questions that can be addressed today. There are some answers that can be proposed based on the experience of a small New England state.

A comment would seem indicated here based on the size of New Hampshire when compared to the other states represented here today. Because we are truly a low population state covering a comparatively small area in square miles. On a recent trip to California I noticed that the population of San Diego was roughly the same as that of the state of New Hampshire - not quite 900,000. The size of New Hampshire at its widest point east to west is less than 100 miles and it's less than 200 miles from north to south, typical of New England? Such factors must be considered and it is recognized that what will work in N.H. might not apply elsewhere unless adequate adjustments are made to reflect local conditions.

When making plans for a program that will improve the quality of the vital records it is important to determine what part of the system is most in need of improvement. Where are the

problems occurring? Should efforts be concentrated on the birth certificate because a large number of queries are being generated? Does this indicate the need for more training at the hospital level? What is considered a large number of queries? What would be considered a normal situation? Are there any national standards showing what percentage of total certificates are being queried in an average hospital situation?

A system of evaluating the performance of the hospitals within your own state could be considered. We have just completed a study of the queries processed in 1979 which will enable us to make some valid conclusions on deciding which hospitals need attention in this area.

It is safe to say that the Field Representative will rely on a variety of EDUCATIONAL TOOLS as programs are designed and implemented to improve the quality of records. This process of education is never really completed because of the personnel turnover factor and because of the various changes in policies, regulations and statutes that seem to occur so often. Meetings for groups of new officials should be encouraged if they are subject to election or appointment. In New England we still have town meeting day in March when many new town clerks are elected. Shortly after election a meeting is arranged for these new clerks. They are invited for an all-day session in Concord where the Field Representative and other Bureau personnel have the opportunity of providing them with instructions and general information concerning their job as it relates to the Bureau of Vital Records. This is now scheduled regularly each year. The comments have been most favorable, and it provides an opportunity for the new people to meet Bureau people personally.

This is a good example of an educational activity directed by the Field Representative. Those who are not able to attend the meeting for one reason or another are visited in the field either individually or in "mini-meetings" whenever possible. In any case, this follow up becomes a priority. As soon as possible every new clerk has been briefed in their duties.

It is generally agreed that whenever possible a program intended to improve the quality of the records should be designed so that the results are measurable. In this way goals can be set, progress monitored, and accomplishments measured. A program developed in New Hampshire to improve the promptness of reporting birth certificates illustrates several of the above points.

The state law concerning the birth registration requires that the hospital will report the birth to the local registrar within 6 days of the event. Three years ago a program was started to concentrate on improving this registration process which was not operating in a satisfactory manner. A year earlier a change had been made in the statutes which for the first time imposed a time limit on the physician. It required that the physician would sign the birth certificate within 72 hours. Until then the hospital had used the physicians tardiness as a very legitimate excuse for not reporting births promptly. Now that was no longer a valid excuse. There were certain salient features to this program that deserve emphasis since they illustrate quite well several of the points that have been mentioned earlier as being desirable.

1. It was a long-range proposal - allowing a year for the individual hospitals to reach their goal.
2. The results of the program would be measurable. We knew the percentage of attainment for each hospital at the beginning of the year, and we would know each month the standing of each hospital individually and also as they related to each other.

The program was successful. By December of 1978 every hospital in the state had met the 90% goal. Some did not maintain this standing month after month. Fluctuations did occur. A surprising number were able to maintain a consistent 100%.

Regular attention to a great many details was necessary. A system was introduced requiring each hospital to maintain a birth log. This birth log proved to be a most valuable tool. It enabled us to monitor the efficiency of the hospital's procedures.

New priorities had to be established in many places. Sometimes two or three meetings were necessary to locate the reasons for slow reporting. These were often high level meetings, including the administrator, the chief of obstetrics, and the director of medical records. Prior to these meetings the Field Representative prepared a set of current figures and facts to pinpoint certain items of information. Were the physicians signing promptly? This could be very quickly determined. The chief of the OB group could see at a glance if his men were cooperating or not. His assistance could then be solicited and in no case was it ever refused.

Or it might be shown that the physicians were signing promptly and the problem could be traced to faulty administration. Again, when prepared ahead of time with the facts and able to pinpoint the root of the problem recommendations could be made, cooperation solicited, and results obtained. Very seldom was it necessary to use the back-up of state law as the operating leverage, but it was always very important to know it was there to refer to if needed. It was very interesting to follow this program month by month and to see the improvements that took place. It was highly gratifying to see the attainment of the 90% goal.

We then turned our attention to several new programs for 1979 blithely assuming that the birth reporting program was firmly established and that it would now continue to operate at a satisfactory level. And that was a mistake. In the later part of 1979 when we checked on the birth reporting results for the year to that point we had a rude awaking. The reporting had once again fallen off - not to the previous low point, but enough to indicate that an ongoing program was necessary to keep the subject in the forefront.

A new program was reactivated at the beginning of 1980 that would provide for such attention and we can see the reporting process once again improving monthly because it is receiving regular attention. That's the key - regular attention. If a program is going to be successful it can't be expected to look after itself.

This provides a very good example of some of the benefits that a Field Representative can bring to

a Bureau. It's a type of special activity that would be very difficult to consider without a field person. The hospital visits and meetings were most necessary as a means of directing proper attention to the program, analyzing problem areas, and coordinating plans.

Let me cite another program that can be studied for its value and how it will affect the quality of our records. In this instance the death certificate is involved.

This program is a presentation on the preparation of the death certificate that has been certified by the AMA as part of their Continuing Education Program. It is offered to the physician through the hospitals and those attending receive a one-hour course credit in Category I.

It has been well received. Since January it has been presented to several hundred physicians in 13 hospitals throughout the state. The course is designed for a one-hour presentation. We use the film strip supplied by NCHS on the preparation of the death certificate by the physician. A portion of the program deals with N.H. statutes and the physicians responsibility under the law in regard to our area of vital records. Copies of the Physician Handbook are distributed.

At the present time we are preparing a fall and winter schedule for this presentation. By the end of the year it will have been presented to every hospital in the state and to a majority of the physicians who prepare death certificates in New Hampshire.

Measuring the results of this program will be difficult but we feel confident that it will result in noticeable improvements in the quality of the death certificate, particularly in the cause of death section and the other areas where the physician is responsible for completion.

In the past we have attempted to communicate with the physicians concerning this subject in a variety of ways - usually in the form of a letter or some other written communication. We were never sure whether such information was ever read.

In the current program we have personal contact for an hour. This is a terrific improvement in our communication method insofar as the physician is concerned. It's bound to have beneficial results - measurable or not.

It turns out to be a "good Yankee trade" - that is to say - each party in the transaction thinks he is getting the best part of the deal, and that is not bad.

These are two particular programs designed for use in New Hampshire which have worked very well for us. The results have been most satisfactory. They lead very directly to an improved quality of the birth and death registration process. For all intents and purposes they would not be workable unless a Field Representative was available.

It may be prejudiced, but I feel it is a fair comment, that a Field Representative can be a valuable and useful addition to the staff of any Bureau of Vital Records. The Field Rep can make a significant contribution to improving the quality of your vital records.

"A STATEWIDE PATIENT ORIGIN STUDY--A NECESSITY TO INSTITUTION SPECIFIC AND POPULATION-BASED PLANNING"

Elliot M. Stone, Massachusetts Health Data Consortium, Inc.

Commensurate with the rise in hlth care costs in recent years has been the increase in the number of professionals involved in the planning, organization, delivery and payment for health services. In Massachusetts members of these professions have spent considerable time formulating objective standards and critiera. That process has been severely hampered by the lack of comprehensive, uniform patient data which describe existing patterns of health care delivery and utilization. Such baseline data will enhance the standards and criteria to measure change, describe trends over time, and evaluate the need for and impact of new services or changes in patterns of delivering care to the 6,000,000 residents of Massachusetts and those attracted to its exceptional medical facilities from other states.

Today I would like to discuss the political and technical obstacles overcome by the major health organizations in order to design, develop and distribute a statewide Patient Origin Study. In 1979, the Massachusetts Health Data Consortium conducted a one year retrospective Patient Origin Study of in-patient discharges from over 120 Massachusetts short-term general hospitals including several facilities in bordering states. In July of 1980, that document was adopted by the State's Health Planning & Development Agency which has responsibility for Certificate of Need.

Data were collected on the total population of discharges rather than on a sample population, to assure maximum flexibility for those concerned with planning, regulation and administration at the institution-specific level. The Consortium's Study represents actual use patterns for over 900,000 in-patient discharges rather than from inferential estimates. I would also like to discuss the basic methodology for preparing that Report and describe the specific uses of the Patient Origin Report.

Patient origin data play an important role in to the planning and administrative process. Considerable effort has been expended on the development of standards and criteria used to evaluate proposals for expansion or change in health service delivery programs. These standards and criteria depend upon the availability of descriptive utilization data: without the data, the standards cannot be applied. Once all parties to the planning process have access to the same high quality, uniform data, the focus of attention can shift from the issue of "whose data are right" to the substantive issues of health service delivery.

Let me give you some idea of how the Consortium's statewide Patient Origin Study is being used in Massachusetts.

1. Designation of Hospital Service Areas A hospital service area is that geographic area from which the majority of a hospital's caseload originates. Once defined, the service area is used to measure the total population likely to utilize a particular hospital. The service area standard developed by the Department of Public Health in their Certificate of Need program, states: "Projection of service-area population for medical/surgical, pediatrics and obstetrics will be based on such factors as community dependency on each facility; hospital dependency on each community by individual service; and the 1985 population projections for the relevant communities (by the appropriate age groupings."

The Standard is defined by measures that establish hospital dependency as "...communities which, ranked ordinally, account for cumulatively 90 percent of the facility's service specific annual admissions. Community dependency is defined as"...those listed communities which sent five percent or more of their service specific in-patients to the service of the particular facility."

Clearly, the hospital service area is not necessarily restricted to the hospital's immediate geogrphic neighborhood. Patients may come from neighboring cities, noncontiguous areas of the state, or out of state. Migration may be a function of ease of transportion to a particular area, lack of availability of services in the patient's own area, physician referral patterns, or availability of specialized or tertiary care.

Patient origin data are the primary source of information for determining hospital service areas. They indicate which communities constitute the majority of a hospital's caseload("hospital dependency") and where the majority of patients from a given community go for their hospital care ("community dependency"). The data reflect in-state migration patterns; i.e.,whether patients seek care where they live or whether they go out of their community for care.

In addition to identifying in-state migration patterns, some data on out-migration are included which identify Massachusetts residents seeking care in neighboring states. The inclusion of these data allow hospital administrators to identify penetration of border state hospitals in Masschusetts communities.

2. Bed Need Projection To help direct state and areawide health planning agencies, the Department of Health, and Human Services (DHMS) has identified national health priorities and has attempted to develop quantifiable standards and criteria by which to measure attainment of these goals. One such standard is the call to reduce the number of hospital beds to four or less short stay beds per 1,000 population, with certain exceptions. The Massachusetts Department of Public Health, as the designated state health planning agency, has adopted this priority of reducing beds but has a more flexible formula for determining bed need.

The service area concept is a crucial component of the bed need formula, because it is the service area that defines the population denominator to be used in calculations. Patient origin data have been cited in the State Health Plan as the source for obtaining service area and dependency information. The four elements of the bed need formula as stated in the State Health Plan are :

1.The patient origin study used to determine

community and hospital dependency and primary service area;

2.a population projection for 1985 used to quantify the number of people in each service area .

3.a use rate or number of patient days of acute care to be used by each age group of the population; and

4.an occupancy rate to be applied to the patient days to yield number of beds needed.

The bed need projection formula is:

$$\text{Beds} = \frac{\text{Population X Use Rate}}{\text{Occupancy Rate X 365}}$$

3.Identification of Hospital Market Share

Typically, each hospital conducts its own "patient origin study" to determine where its patients are coming from. Historically however, it has been very difficult for hospitals to share data and determine what proportion of patients from a given community utilize one particular hospital (i.e., that hospital's "market share") compared to other hospitals in the area or outside the area.

Using the Patient Origin Report with data from all acute care hospitals in the state, one can determine each hospital's market share (by specific service categories) in any given community. This information allows hospital administrators to identify overlapping service areas and competing services, or areas in which merger or consolidation with another facility might be both feasible and economically advantageous. The Massachusetts Hospital Association (MHA) has proposed a program goal for encouraging the development of multi-institutional systems . Patient Origin information will assist MHA and others in that catalytic role.

Market share information can also be used to identify areas which are underserved for particular services and areas which might be appropriate targets for the expansion of hospital services.

Patient origin data are also useful for long range planning. Both the Department of Public Health and the Rate Setting Commission now require one and five year plans from hospitals. The patient origin data provide important information to the hospital administrator to evaluate the hospital's long range goals in light of the existing picture. When conducted periodically, a statewide patient origin study will indicate trends in utilization. Knowledge of these trends is useful for setting goals and evaluating progress toward achieving those goals.

4.Evaluating the Impact of Hospital Closures

Patient origin data can also be used to evaluate the impact of proposed hospital closures on other health service facilities within an area and on patient migration patterns into and out of the service area. Specifically, the data can help provide answers to the following questions:

- Has short-term inpatient utilization increased?
- Have facility use patters been altered?
- Have changes in patient mix occurred?

The answers to these questions are particularly important in the area of mental health, where the emphasis is on deinstitutionalization, closure of outdated state and county facilities and integration of mental health services in general health care delivery programs .

The success of this approach depends upon the existence in the community of alternative sources of care and their capacity to absorb a larger caseload. Analysis of patient origin data within a service area could provide such crucial information prior to hospital closures, thus enabling more thoughtful planning.

Now I would like to outline the technical considerations that went into the Study's Hospital Universe. All public and private short-term general community hospitals in Massachusetts are included . A short-term hospital is defined as one in which the average length of stay is 30 days or less. Border state hospitals serving approximately 95 Massachusetts residents whose data were available on magnetic tape are also included. Only data for Massachusetts residents are displayed for those border state hospitals. Two VA hospitals met this criteria and they were included even though they do not come under the state or HSA planning laws. One hospital was open in 1978 but then closed and its data was unavailable.

Patient Universe All inpatient discharges during the study year are included, with the exception of live births, fetal deaths and discharges from an identifiable Extended Care or Skilled Nursing Facility within the hospital.

Study Year October 1, 1977 - September 30, 1978 was selected as the study period year as this was the most recent complete year of data which could be obtained from the majority of hospitals. However, due either to different fiscal year or some other problem, some hospitals were unable to provide this exact time period. Any deviations in the study year were noted in the Study:

Data Set Included

- Patient Code Identification
- Date of Birth
- Sex
- Zip Code of Residence
- Hospital Name
- Admission date
- Discharge date
- Diagnoses (principal specified)
- Procedures (principal specified)
- Expected principal source of payment
- Service at discharge

Service Categories . While hospitals provided the data item "service at discharge", these services are not consistently or uniformly defined by all hospitals. In this study, in order to make the data more comparable, patients were allocated to services by the Consortium according to a standard set of criteria described below.

- Obstetrics/Maternity. This service included all cases with a principal obstetrics diagnosis including children under 15, regardless of which service code the hospital assigned. Thus hospitals which provide isolated examples of obstetric care but do not have a discrete unit may nevertheless have been assigned obstetrics/maternity cases in the Patient Origin Tables.

The following diagnostic codes are included:

ICDA-8	H-ICDA-2
630-678	631-678.9
Y06.0	Y06.0-Y06.4
Y07	Y07.0-Y07.1

It should be noted that some diagnoses are included which might have been assigned by a hospital to a medical or surgical service for treatment, e.g.:

a. Abortions (spontaneous and induced)
b. Complications and infections of pregnancy and childbirth.

Gynecological cases not related to pregnancy or childbirth are excluded from the obstetrics/maternity category. These cases have been assigned to the medical/surgical category in the study. However, any patient under 15 years of age with a gynecological diagnosis was assigned to the pediatric surgery.

Live births and fetal deaths were excluded to avoid double county and to conform to methodologies used in other patient origin studies.

●Psychiatric This service includes all cases with a principal psychiatric diagnosis including children under 15, regardless of which service code the hospital assigns. Thus hospitals which provide psychiatric care but do not have a discrete unit may nevertheless have been assigned psychiatric cases in the Patient Origin Tables. The following diagnostic codes are included:

ICDA-8	H-ICDA-2
290-302.9	296.0-301.9
305.0-309.9	304-312.9
	315.0-318.9

Cases which have a principal psychiatric diagnosis as well as a surgical procedure are included in psychatric. For example, it is the practice of some physicians to assign a principal psychiatric diagnosis (anxiety neurosis) to individuals receiving sterilizations.

In order to conform with the State's Acute Psychiatric Standards and Criteria, the following diagnostic categories are excluded from the psychiatric service category and are allocated to Medical/Surgical:

Category	ICDA-8	H-ICDA-2
Alcoholism	303.0-303.9	302.0-302.9,313.0-313.9
Drug Dependency	304.0-304.9	303.0-303.9,314.0-314.9
Mental Retardation	310.0-315.9	290.0-295.9

Due to the different coding conventions used by the two diagnostic classifications systems, more codes have been excluded from the psychiatric category for hospitals using the H-ICDA-2 system than for those hospitals using ICDA-8 system.

●Pediatric This service includes discharges under the age of 15, except those with a principal obstetric or psychiatric diagnosis, regardless of which service code the hospital assigns. Thus hospitals which treat children under 15 but do not have a discrete unit may nevertheless have been assigned pediatric cases in the Patient Origin Tables.

Newborn babies who are transferred to a hospital after birth elsewhere are included in the pediatric service.

●Medical/Surgical This service includes all discharges not falling into once of the above categories. Medical/Surgical also includes all discharges for whom principal diagnosis had not been determined at the time the data were transmitted to the Consortium, provided the proportion of such cases fell within tolerance limits sets for missing data in the diagnostic field.

Identifiable outpatient surgery was excluded. It should be noted, however, that similar surgical cases may be treated by some hospitals as outpatients and at other hospitals as inpatients. Therefore, any significant variations in the number of surgical patients reflected in the Patient Origin Tables may be due to these different practices.

Out-Migration of Massachusetts Residents Only border state hospitals identified as serving 95 or more Massachusetts residents whose data were available on computer tape are included. Since data are excluded rom hospitals serving fewer Massachusetts residents or for whom data were not computerized, residents seeking care out of state are underrepresented.

Data for Massachusetts residents utilizing Rhode Island hositals were obtained through the cooperation of Rhode Island Health Services Research, Inc. (SEARCH). Due to geographic coding conventions used at SEARCH, only 13 Massachusetts cities/towns have been specified for patient's residence.

Caveats The Patient Origin Report was derived almost entirely from discharge data originating in hospital medical record rooms. The data in the Report are therefore potentially subject to the problems identified by the Institute of Medicine (IOM) in their study of the quality of discharge abstract data . This study singled out diagnostic data as having the lowest level of reliability of all abstracted data items for a variety of reasons including:

1.assignment of inappropirate diagnoses because of third party reimbursement policies or potential social stigma;
2.inability to identify a single principal diagnosis;
3.diagnostic sequencing errors in the chart;
4.disagreement over appropriate codes;
5.coding errors.

Hospitals which provided their own computer tape to the Consortium may have used billing data as the source for diagnoses. Typically, billing data are based on information generated at the time of the patient's admission rather than discharge and these data are sometimes found to vary . However, it is unlikely that a change in diagnosis would be so drastic as to necessitate a change in one of the four service categories to which the patient was allocated in the Patient Origin Study.

The reader should also be aware of potential limitations of using zip codes to identify patient residence. Some hospitals may use a guarantor zip code rather than the zip code of patient's residence. The extent of this practice is unknown and beyond the scope of this study to determine. Also, it is difficult to control for vacationers, students, and part-time residents of the state who give a Massachusetts address. These problems

may be of greater magnitude at the hospitals which used a document other than the medical record as the source of zip code.

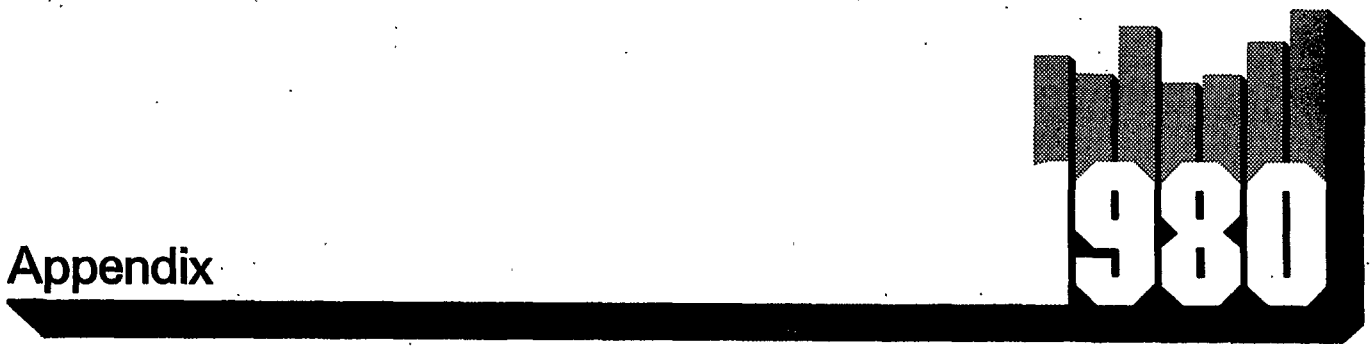
The Politics of Statewide Data Collection

The data for the statewide study were collected from over 120 hospitals voluntarily. Each hospital entered into a contract with the Massachusetts Health Data Consortium and agreed to share their data. The Consortium agreed to honor a specific confidentiality policy, to review subsequent requests for these data and to provide a detailed methodology for the Patient Origin Study as well as other subsequent uses of the data. State agencies agreed to coordinate their data requests through the Consortium.

While there was not uniform agreement on all the possible uses of the total data base, there was agreement that the Patient Origin Study was the most pragmatic initial application of such a large data base. Hospitals, regulators and planners all need patient origin data updated for Certificate of Need and other planning applications. Naturally the Patient Origin Study will not satisfy all of the needs of the regulators and planners and in some respects it merely "whets" their appetite for more specific data analyses which the Consortium will supply. The interaction of all of the major holders and users of data continues to be played out by the Board of Directors of the Massachusetts Health Data Consortium. The politics of statewide health data collection can best be addressed in a separate presentation. Suffice it to say, however, that since the health care system is highly charged with politics, the Consortium is generally the most acceptable forum for all groups involved.

We are committed to the theme addressed by Dr. Kerr White that, "What is needed is not more 'data' but better 'information' and usable 'intelligence' that will improve the climate of all decision making".

Appendix



Of the 785 attendees at the 1980 Public Health Conference on Records and Statistics, 169 or 21.5 percent returned evaluation forms. Because of the relatively small number of forms returned, the following summary presents the major findings in general terms. Anyone interested in receiving a copy of the full report may write to the Conference Management Branch, NCHS, Center Building, Room 2-12, 3700 East-West Highway, Hyattsville, Maryland, 20782.

Profile of Respondents

The occupational area most widely represented by the 169 respondents was statistics, (49 percent) followed by registration (14 percent), health planning (11 percent), and data services (9 percent). The category "other" accounted for the remaining 17 percent.

Of the respondents, 38 percent were employed by State governments, 31 percent by the Federal government, 13 percent by private organizations, 6 percent by universities, and 2 percent by local governments. The remaining 10 percent had "other" employers.

Overall Assessment

The vast majority of the respondents stated that the Conference gave them new information that they can put to practical use in their work. The emphasis on Federal programs, a factor that must be carefully considered by program planners, was thought by most respondents to be "about right." Interestingly, the small number of respondents who felt there was "too much" emphasis on Federal programs evenly balanced those who believed there was "not enough."

Almost half of the respondents stated that they ran into schedule conflicts when deciding which sessions to attend. Most stated that they wished to attend more than one of the four concurrent sessions within a given theme, such as the Environmental and Occupational Health theme. Attendees remarked that they simply could not be in two places at once.

Evidently the vertical themes for the four sets of concurrent sessions were more apparent to many attendees than were the four horizontal tracks: Vital Records, Health Records, Manpower and Facilities Statistics, and Costs and Expenditures Statistics.

Most of the respondents felt that the allotment of 30 minutes for audience discussion was "about right." However there were several comments that the allotted 30 minutes was sometimes preempted when presentations ran overtime.

The Conference exhibits provided by seven Federal agencies were rated favorably. Nevertheless, the majority of respondents believed there is a need for exhibits from groups other than Federal agencies. Among the most requested groups were professional associations and organizations such as the American Hospital Association and the American Cancer Society; commercial vendors of data-base support systems; State centers for health statistics; health insurance companies; and a wider range of health-related Federal agencies such as OSHA, NIOSH, NIH, NIMH, FDA, and USDA.

Session Evaluations

For all sessions, the vast majority of the respondents stated that the content was relevant to their work and will be useful to them; and that the presentations were well organized, clear, and understandable.

GENERAL COMMENTS AND RECOMMENDATIONS

The following is a summary of the most frequent comments and most constructive suggestions for improving PHCRS content, format, and presentation.

Content: Many topics were suggested for the 1982 agenda. The most often cited was the need for presentations given by data users about the actual applications of data. The second most popular request was for more emphasis on State and local systems. Thirdly, several people wanted to see more stress on methodological issues.

One participant, who remarked that most attendees are already familiar with the more basic data found in such publications as Health, U.S., suggested that it would be more beneficial to discuss unpublished data and potential studies. Another attendee suggested that NCHS invite a limited number of foreign dignitaries to participate as speakers. A third respondent stated that the data collected by health insurance companies could be used to achieve health care goals, therefore the PHCRS would benefit from presentations by these data experts.

Format: The most common suggestions for changes in format were requests for workshops where attendees could discuss preliminary studies, papers, and subjects needing professional exchange. Two similar suggestions were for luncheon roundtables for small interest groups, and reserved rooms for general discussions on pre-determined topics without formal presentations. One participant mentioned that when sessions were scheduled back-to-back, attendees often left early to attend the next session. This could be alleviated by ending sessions 5 or 10 minutes before the next sessions begin.

Presentations: An overwhelming majority of respondents stated that in general, 1980 PHCRS presentations were well organized, clear, and understandable. However, two complaints were frequently cited: (1) A number of speakers read their papers word-for-word, which was not considered stimulating; and (2) Slides and overhead transparencies often contained too much detail or were otherwise difficult to see. To solve the visibility problem, several attendees suggested that speakers rely more heavily on handout materials. The Conference Management Branch plans to give the 1982 PHCRS speakers and monitors detailed guidelines that reflect the comments from the 1980 evaluations.

Meeting Room Arrangements

On the topic of session meeting rooms, two comments were prevalent: (1) Many attendees felt that no smoking should be allowed during the sessions of a public health conference, especially in the smaller meeting rooms, and particularly by

speakers. (2) A common request was that coffee be sold outside the rooms of the morning sessions. A less frequent request was for long tables or chairs with arms in the meeting rooms.

* * *

The staff at NCHS greatly appreciates the time and effort that Conference attendees put into the evaluation forms. The 1980 Conference received a great many compliments--vastly outweighing the complaints.

All feasible suggestions will be carefully considered, and in fact, one has already been acted upon: It was a 1980 PHCRS attendee who, on an evaluation form, recommended that the evaluation results be printed in the Proceedings.

The Conference Planning Committee will study all comments, positive and negative, in an attempt to make the 1982 PHCRS even better.

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