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JOURNAL OF THE MISSOURI STATE MEDICAL ASSOCIATION

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Missouri Regional Medical Program

An Overview

DURING THE LAST YEAR AND A HALF numerous articles have appeared attempting to explain the role of the Missouri Regional Medical Program and its relationship to the physicians in the state. The most recent appeared in *Missouri Family Doctor* in April and May and are recommended for detailed statements of goals and philosophies. The purpose of the present paper is to clarify those points which seem to be most often misunderstood and to propose a basis for productive endeavors during the next several years. In its future development, the Missouri Regional Medical Program is expected to continue its goal to facilitate communications between the physician who cares for patients and the sources of information that can help him provide the best possible care for those patients.

Elsewhere in this issue the various projects which are presently underway in the Regional Medical program are identified. All but two of the projects which have been operational during the past year are so-called "core activity projects." These were designed to provide assistance to any physician who desires them, anywhere in the state. Their purpose is to assist the physician in selecting from the great array of scientific advances, which continue to become available, those parts most applicable to his patients in his community.

The Smithville and Springfield projects are demonstrations of this approach in action. All new projects for which applications have been at least tentatively approved are similarly community-based. In every instance, the project capitalizes on close communication with the University and the central staff of the RMP program.

A comprehensive description of the Missouri Regional Medical Program, its purpose, its community-based projects and its goals for the future. Doctor Wilson speaks of the University's involvement in and attitudes toward the Program and this unique effort to facilitate communications between the physician and the vast sources of information now available to assist him in providing best possible patient care in the area of heart disease, cancer, stroke and related diseases. He states that the ultimate success of the Program depends entirely upon the initiative of the physicians of the state and their response to this challenge to participate in the design of improved health care patterns for the future.

Perhaps a good subtitle for this article might be "This Is Your Life," borrowing from the recently-popular radio and television program. Regional Medical Programs are a congressionally-implemented, but physician-guided, national expression of the growing public demand to have the advantages of the latest technologies brought to the community, wherever its location. More importantly, however, it is the one large, clearly visible and genuine effort on a nationwide basis to place the responsibility for health planning squarely in the community with the physician in the key leadership role. It has as a running mate the comprehensive health planning endeavor, which, at least in Missouri, thus far has had minimal participation by the medical profession in the design of its policy or in the implementation of early planning. Comprehensive health planning here has been structured to give the consumer and the supporting groups the major role in the design of health care. This difference in posture and plan is of crucial importance.

Regional Medical Programs at present are by far the most favorably financed for planning and demonstration. Nevertheless, MRMP will fail or succeed as a result of the support it receives from the practicing profession rather than the amount of finances poured into it. Insofar as MRMP activities are the result of initiative taken by local physicians who exert their interest and energies in their behalf, they will fulfill the dreams of those who brought this program into being. If this is misunderstood, opposed or simply ignored, the program will play into the hands of those who have always believed that improvement must come from a central direction for the enlightment of those on the periphery. Competition of ideologies is always a sound basis upon which to initiate change. The ideology of RMP is clear, namely, that the medical profession has been in a leadership role and deserves to continue in that role.

From the beginning, the Missouri Regional Medical Program has been based upon grass roots participation. Its Advisory Council is composed of citizens from outside full-time state divisions and the University and includes six physicians. Members of the Council are appointed by the Governor, serve rotating terms and formulate the policy upon which the program is based. Their continued insistence has been that all projects undertaken at the community level should ultimately develop economic self-sufficiency and that any changes in the health care system should be of an evolutionary nature. This is in accord with the original intent of the national act.

The presently-operative programs are dedicated to a number of relatively simple objectives utilizing known but too infrequently applied principles. First, they are based upon the assumption that there is a considerable body of health care need as yet undiscovered by the formal health care system. The Regional Medical Program within heart, stroke and cancer concerns has dedicated itself to finding an improved way to get patients to physicians and into proper and ethical health-care systems.

Secondly, these projects are directed toward finding ways of improving resources available to the physician. These range from a handbook of resources to development of new techniques and distribution of new methodologies. They include improved training for ancillary groups and some types of "automated consultation."

The latter involves back-up for physicians in communities which do not have access to up-to-date or comprehensive medical center resources. Such techniques include "dial-a-lecture" series, automated computer interpretation of electrocardiograms and the computer fact bank. Each is designed to provide for any individual with a telephone the opportunity to obtain pertinent information immediately. While such "automated consultation" is still a research endeavor, its enthusiastic reception suggests an active future. In general, these kinds of activities first will be tested internally and then with medical students and faculty of The University of Missouri Medical Center. Following this they will be tested in hospitals affiliated with the University's School of Medicine. Afterwards, such programs can be tested in the offices of preceptors throughout the state and in demonstration areas, such as Smithville and Springfield. They then will be available for those who have an interest in trying such devices "on the firing line" without the protection of prearrangement. We believe that this type of assistance will be particularly useful in such places as poison control centers, but that it also has applicability far beyond such highly specialized needs.

Other resources which will be made available to physicians include improved postgraduate education programs through leased telephone-teaching circuits originating at the University of Missouri Medical Center. The "dial-a-lecture" program will be designed to provide immediate and direct response to needs as defined by local medical staffs. Initial lectures will be developed around questions asked most often. While this is

a more traditional approach, by its very nature it is more easily handled and helps to fill in the spectrum of aids which are easily accessible for the physician's continuing education.

One might appropriately ask why a university and its medical center should have this kind of involvement in improvement of health care. Certainly those of you who are acquainted with the tradition of land-grant colleges will have no difficulty in perceiving the relationship between this kind of medical experiment station and the types of activities conducted for many years in the agricultural and engineering experiment stations. These stations have been established to respond to needs as perceived by the community. Their purpose is to rapidly translate techniques and research results, available through the university, into action in behalf of communities in the state. In the medical experiment station concept, as conceived through the Missouri Regional Medical Program, the intent is to provide similar assistance primarily through the practicing physician, giving to him these advantages and hopefully helping him to understand at the earliest possible date the potential of newly discovered techniques.

One of the responsibilities agriculture and engineering have always had in relationship to these activities now shared by Regional Medical Programs is that of measuring and demonstrating the positive or negative impact of these activities. While no one as yet has measured nor, in fact, defined "good health," a substantial effort in the Missouri Regional Program is dedicated toward evolving such a definition so objective measurement can be carried out in a manner helpful to all concerned.

Meanwhile, traditional approaches are being utilized to help set up standards that can measure to some degree the impact of changes now being proposed and tested. One such activity is "Operation Icepick," which was initiated by the Missouri Hospital Association in cooperation with the Division of Health and is now cosponsored by MRMP. This program provides for the collection of statistical information from hospitals throughout the state and will make possible compilation of baseline data. In terms of disease incidence, it will indicate how many people receive care, for what reasons and where they receive that care. Other basic quantitative information about the state's population and present health patterns and habits is being obtained through surveys conducted by the Population Study Group of MRMP.

Perhaps the most troublesome responsibility of Missouri Regional Medical Program has been its effort to achieve a balance between resources dedicated to central or supporting facilities and those used for field activities, as in Springfield and Smithville. A few principles of approach regarding this division have now been accepted and implemented. The University provides only those service activities which cannot be performed by others or those in need of immediate and intimate research which can be carried out only in the University with its multiplicity of faculty and facilities. Each time the University takes on a service activity, it does so with the intent of working itself out of business so far as service is concerned.

However, a strong central resource unit is important for a number of reasons. It can provide unique assistance, such as prompt access to information not otherwise available, research capability in problems of interest to those in the field and coordination of effort which cannot be provided from the periphery. This kind of unit also furnishes highly sophisticated equipment and personnel, which are needed only rarely but can be found in a university community because their time can be divided between several departments. The unit also serves as a link between the local regional medical program and similar programs being conducted in conjunction with universities elsewhere in every section of the U. S.

Obviously, the most important activities in the Missouri Regional Medical Program are those which take place at the bedside or in the physician's office in Smithville, Springfield and the many other communities to be included in these activities in the future. Quite as important will be the maintenance of some kind of central service and coordination so each of the projects can proceed with full knowledge of lessons learned elsewhere and of new information being assembled. Certainly, at the present time, no one would claim to have discovered what the optimum balance will prove to be. It is our intent, however, to continue the majority of activities at the bedside, while maintaining strong central services at a level necessary to provide response to needs found in the field, and to provide a stable and desirable basis for communication between the field and the University, as well as between the several units within the field.

SUMMARY

We have attempted to answer two or three issues now before the medical profession and to

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GEORGE E. WAKERLIN, M.D., *Columbia*
Director for Planning, MRMP

Planning for the Missouri Regional Medical Program (MRMP)

THE PRIMARY GOAL of the Missouri Regional Medical Program (MRMP) is to facilitate fulfillment of the promises of modern medicine for all people of the Missouri Region with particular reference to bringing the newest and most competent services in heart disease, cancer, stroke and related diseases as geographically close to the patient as possible. The final focus is on optimum health for the individual citizen of the Missouri Region with emphasis on assistance to the local practicing physician who is strategically situated to provide medical care and health guidance to his patients and to the community.

Planning for MRMP is directed by the Advisory Council and its committees and by Arthur E. Rikli, M.D., MRMP Program Coordinator. It is staffed by the MRMP Planning Division. Doctor Wilson, formerly Coordinator and now Vice-President for Academic Affairs for the University of Missouri, still maintains an active interest. MRMP is one of the responsibilities of his new office.

The Planning Division Staff of MRMP includes the Director; Warren P. Sights, M.D. and Yeu-Tsu N. Lee, M.D. of Columbia, Associate Directors; Richardson K. Noback, M.D. and Mr. Albert P. Mauro, Associate Director and Assistant Director for Planning, respectively, in metropolitan Kansas City; Stanley S. Peterson, M.D. and Mr. Bacil Steed of Springfield, Consultant and Administrative Assistant, respectively, for Southwest Missouri; and Mr. Lee G. Cochran of Jackson, Consultant for Southeast Missouri.

The Program Evaluation Center of the University of Missouri School of Medicine, directed by David J. Jones, M.D., is responsible for gathering data regarding health and health-related resources of the Missouri Region and for developing methods for evaluating the effectiveness of MRMP in achieving its goals and objectives.

An overall Plan for MRMP was prepared in 1967 and thoroughly revised in early 1968. The Plan was approved by the MRMP Advisory Council and its Committees with the understanding that it will be continually revised and updated. Copies of the Plan have been sent to the Division of Regional Medical Programs and distributed to the coordinators of all RMPs. The essentials of this document, as summarized below, describe the current state of planning for MRMP.

COOPERATIVE ARRANGEMENTS

In keeping with one of the prime purposes of the RMP Law, MRMP has effected cooperative arrangements among the University of Missouri School of Medicine, other University of Missouri schools and colleges, other educational and research institutions of the Missouri Region, hospitals (including community hospitals), practicing physicians, health profession organizations, appropriate voluntary health agencies, official health agencies and consumer groups. Through representation on the MRMP Project Review and Liaison Committees, 30 Missouri organizations, institutions and agencies have an active role in the MRMP planning and operation.

MRMP leadership and staff regard cooperative arrangements as a long term, continuing responsibility and a *sine qua non* for success of the Program.

HEALTH RESOURCES AND NEEDS

In order to facilitate planning and later evaluation of the Missouri Regional Medical Program, the Program Evaluation Center is gathering information regarding health and health-related resources of the Missouri Region, as well as morbidity and mortality figures for heart disease, cancer, stroke and related diseases. Moreover, five MRMP pilot projects now in operation will directly produce important information relative to health resources and needs of the Missouri Region and, at least, five other projects will tangentially supply helpful information. As more data become available, MRMP will be able to plan, implement and evaluate on an increasingly firmer basis.

PRIORITIES

Since the primary focus of MRMP is on the delivery of optimum health care to the patient as close to home as possible, top priority is given to pilot projects which will directly strengthen the health care system of the Missouri Region. Prevention and early detection, continuing education and public education-information may be looked upon as parts of the health care system. They also are given high priority by MRMP.

Increasing attention is given to rehabilitation, ambulance services, school health, home care and rheumatic fever prevention as well as to manpower, health careers and emergency medical and dental services. Indeed, when they are part of a proposed comprehensive health care project, they are given high priority by MRMP.

MRMP leadership holds all areas of concern under continual scrutiny and subject to change in priority as the Program unfolds.

CONTINUING EDUCATION

The University of Missouri Medical Center recently initiated an MRMP-supported telelecture project for continuing education of physicians and allied health professions. MRMP also encourages other organizations active in these fields to submit project proposals, particularly ones involving cooperative effort. One MRMP project now under way—the Computer Fact Bank—is primarily concerned with continuing education for physicians, and eight other operational projects include important continuing education components for physicians.

Continuing education for the allied health profession *must parallel in coverage and effectiveness programs for physicians.* Six pilot projects now in operation provide important continuing education for nursing and other allied health professions.

MRMP encourages continuing education project proposals for physicians based in community hospitals, as well as similar efforts for the allied health professions. MRMP also encourages project proposals for the retraining of allied health professionals reentering the health field.

MRMP projects are ordinarily of a developmental and experimental nature and, therefore, supported for a limited period of years with the understanding that those proving successful will be continued under local or other funding and, hopefully, implemented in other communities.

PREVENTION AND EARLY DETECTION

As biomedical knowledge advances, primary prevention of the various forms of heart disease, cancer and stroke will become increasingly effective. In the meantime, increased prevention and early detection require more continuing education for physicians and allied health professions and more public education. Thus, in the Missouri Region, full application of present knowledge would mean a yearly saving of 250 lives from death by rheumatic heart disease, 1,000 from cancer, possibly as many as 2,000 from coronary heart disease and an undetermined number from stroke and from hypertension.

Early detection of heart disease, cancer and stroke will be facilitated by the findings of six MRMP pilot projects now under way.

MRMP will assist communities of the Region in developing screening project proposals when requested by local physicians and other health leaders. Such project proposals should preferably include a new or unusual feature such as custom-designed screening or an innovative approach to more effective follow-up.

Ultimately, every physician's office should become, in part, a prevention and early detection center for heart disease, cancer and stroke.

HEART DISEASE

There is need for wider application of knowledge about the surgical correction of congenital heart disease, rheumatic heart disease, peripheral vascular disease and cerebrovascular insufficiency due to extracranial arterial disease, as well as for knowledge relative to diagnosis and treatment of hypertension and follow-up of congestive heart failure patients. An estimated 1,000 lives could be saved per year in the Missouri Region by prompt application of cardiopulmo-

In summarizing the overall Plan for MRMP as prepared in 1967 and revised early this year, Doctor Wakerlin explains the need for and development of cooperative arrangements with involved groups throughout the state, the priorities extended when considering new project proposals and the guidelines that have been developed to assist local physicians and groups in submitting proposals to MRMP. He also discusses such pertinent subjects as planning for the future; MRMP and continuing education; prevention and early detection of heart disease, cancer and stroke; community health services; and public education and information.

nary resuscitation and by making intensive cardiovascular care or coronary care units available in community hospitals for all heart attack patients in need of such care.

Accordingly, MRMP emphasizes the need for additional intensive cardiovascular care and/or coronary care units in Missouri Region hospitals including community hospitals, as well as for establishing training centers for such units. At least ten MRMP projects now under way relate to the care of heart disease patients. They include an intensive cardiovascular care unit in one community hospital (Springfield), a coronary care unit in another (Smithville) and a coronary care unit at the University of Missouri Medical Center. MRMP also is authorized to initiate a programmed cardiovascular care unit at Kansas City General Hospital and Medical Center (KCGHMC). Three of these also will serve as training centers.

STROKE

The great majority of strokes involve either hypertensive cardiovascular disease or atherosclerosis or both, but data are still imprecise and more long term studies of etiology and pathogenesis are needed. Identification of the stroke-prone individual offers increasing promise, but much remains to be done. The MRMP Bioengineering project and the Ultrasound-Radiology project offer prospect of detecting altered blood flow patterns. The MRMP-sponsored Intensive Care Stroke Unit at the University of Missouri Medical Center is concerned with improved diagnosis and treatment of stroke and will provide training for the staffs of other medical centers and hospitals. The Northeast Missouri Cooperative Stroke Project centered at Kirksville emphasizes rehabilitation and its early implementation. A number of other MRMP pilot projects also assist in providing better care for stroke patients.

MRMP encourages the submission of project proposals for two or three innovative community stroke programs. The programs may be hospital-centered, based on home care or traveling clinics or a combination of these as determined locally and should give appropriate emphasis to long term treatment.

CANCER

The Missouri Cooperative Tumor Registries project is supported jointly by the Bi-State (St. Louis-Southern Illinois) RMP and MRMP. The project will provide centralized information about cancer patients from hospitals and clinics which diagnose and treat such patients in Missouri.

Elimination of cigarette smoking will significantly reduce the incidence of lung cancer. The effectiveness of public education toward this objective is expected to be advanced by MRMP Communications Research Unit project findings and by increased utilization of University Extension Division facilities, including 4H clubs.

Early detection of cancer will be facilitated by such MRMP pilot projects as Multiphasic Testing, Mass Screening-Radiology and Automated Patient History, as well as several project proposals now under consideration (if implemented).

MRMP places strong emphasis on more effective prevention of early detection of cancer in the Missouri Region and pledges wholehearted cooperation with efforts directed toward this objective.

COMPREHENSIVE HEALTH CARE

The most important MRMP project involving comprehensive health planning now in operation is the Comprehensive Health Services Program at Smithville, since it exemplifies in microcosm the essential aims of MRMP for communities of the Missouri Region and of all RMPs for communities of the United States.

MRMP encourages the development and implementation of a comprehensive health services program in two or three other communities of the Missouri Region. As steps in this direction, MRMP also encourages project proposals for (a) further improvement in the care of heart disease, stroke and/or cancer patients, (b) community health centers (preferably associated with community hospitals) and (c) coronary care unit demonstrations pointed toward solution of the problem of such units in smaller community hospitals.

All MRMP projects now under way ultimately relate to comprehensive health care and several involve collaboration with the Smithville project.

RELATED DISEASES

The Regional Medical Program Law specifies heart disease, cancer, stroke *and related diseases*. MRMP interprets the last to include diabetes mellitus, renal disease, precancerous conditions and pulmonary diseases producing cor pulmonale.

During its regular 1968 session, the Missouri Legislature voted an appropriation of $100,000 to be utilized by MRMP during 1968-1969 for the development of a chronic renal disease-renal

dialysis program. This is the first appropriation by a state legislature to an RMP for operational purposes. At a special meeting on July 1, 1968, the MRMP Advisory Council approved an award of $60,000 to the Kansas City General Hospital Medical Center to help finance its chronic renal disease program. The remaining $40,000 will be allocated at a later time.

Project proposals aimed at the foregoing "related diseases" are invited by MRMP.

Community Health Services

Community health services considered in this section include rehabilitation, ambulance services, school health, home care and rheumatic fever prevention.

There is need in the Missouri Region for several demonstration rehabilitation units in appropriate community hospitals. When necessary, every physician in the Region should be able to refer his cardiac patients to a reasonably accessible work evaluation unit. Also, the benefits of rehabilitation for heart, stroke and cancer patients must be repeatedly emphasized by continuing education of the health professions and by health education of the public.

One community of the Missouri Region is developing an ambulance service project proposal which may well serve as a model for other urban-rural areas.

With reference to school health, the Missouri Heart Association has submitted a pilot project proposal involving early detection of heart disease in school children.

Home care services need strengthening in metropolitan areas of the Missouri Region, but especially in rural areas. Such programs are best developed in relation to community hospitals. Home care also is an important component of several current and pending MRMP projects.

Rheumatic fever prevention and the need for more continuing education of physicians and other health professions as well as more public education have already been emphasized. Recently, the Missouri Heart Association implemented a pilot project which will enhance rheumatic fever prevention in the Missouri Region.

Public Education and Information

Despite the excellent efforts of the Missouri Division of the American Cancer Society, Missouri Heart Association, Missouri Tuberculosis and Respiratory Disease Association, Missouri Society for Crippled Children and Adults, Missouri Division of Health, Missouri State Medical Association and Missouri Interagency Council on Smoking and Health, much remains to be done through public education toward achieving maximum application of existing knowledge regarding prevention, early detection and care of heart disease, cancer and stroke. Thus, one third of current cancer deaths could be prevented if the seven danger signals of early cancer were better known and heeded promptly. The public needs to be more aware of the importance of self-examination of the breast, Papanicolaou smear and other procedures for early cancer detection. Likewise, the carcinogenic effects of cigarette smoking, especially for lung cancer, require continued emphasis. There also is great need for more public knowledge of the benefits of rheumatic fever prophylaxis, stroke prevention, control of asymptomatic hypertension and reduction of the risk factors of coronary heart disease. Indeed, reduction of these risk factors (dietary saturated fat, obesity, cigarette smoking, physical inactivity and hypertension) has more potential for reducing morbidity and mortality in the United States than any other health measure now available.

To facilitate cooperation of official, voluntary and professional organizations active in public education-information in the Missouri Region, MRMP established a Public Education Committee consisting of representatives of these organizations which recommended that initial health education emphasis through University Extension be given to smoking and health.

MRMP now supports a Communications Research Unit-School of Journalism pilot project which aims to increase the effectiveness of health education materials and procedures.

For many years, the University of Missouri Extension Division has emphasized nutrition and home economics and one of the 4Hs is "Health." The Extension Division and MRMP look forward to significant collaboration in pioneering effective health education about heart disease, cancer and stroke via Extension facilities.

MRMP welcomes health education project proposals particularly when they involve collaboration of voluntary, professional and official Missouri agencies already active in this field.

Manpower

The subject of Health Manpower is significantly related to every phase of MRMP. There will always be a relative shortage of health personnel which precludes waste of this resource due to insufficient information or lack of under-

standing of the skills and abilities of professional groups.

MRMP, through the Program Evaluation Center, has begun a Health Manpower Study which should continue throughout the life of the Program. Material from previous studies is being collated to provide a baseline upon which to build a new methodology for the approach to health manpower data. Such data stored on magnetic tape will be essential in establishing a continual communication network with the various health professional groups.

MRMP encourages the development of training courses and programs for all levels of health care and public health management personnel and would cooperate with academic public health and medical care administration programs of the University of Missouri and other graduate schools by serving as one of the in-service training sites for such programs.

HEALTH CAREERS

The Missouri Council on Health Careers, Missouri Hospital Association, Missouri State Medical Association, Missouri Nurses Association, Missouri League for Nursing, Future Nurses of Missouri, Women's Clubs and Rotary are active in recruitment for health careers in the Missouri Region. The Missouri Health Council has prepared a Manual on Health Careers in Missouri under MRMP auspices. The Missouri Council on Health Careers and Missouri Hospital Association are developing a recruitment project proposal for MRMP consideration.

MRMP encourages all organizations of the Missouri Region with health careers potential, including the University Extension Division, to strengthen their efforts and collaboration in recruitment of young men and women.

EMERGENCY MEDICAL SERVICES

Heart attack, stroke and motor accident patients are most acutely in need of emergency medical services. Hence, the concern of MRMP for such services.

INFORMING THE HEALTH PROFESSIONS AND THE PUBLIC

All but four county medical societies of the Missouri Region have been directly informed of MRMP. The remaining societies will be informed during the fall of 1968. Osteopathic physicians have been informed, as have members of the nursing profession. All health professions, health related agencies and interested lay organizations of the Missouri Region not yet informed are invited to request speakers from MRMP.

This information task is open-ended since, once the health professions and the public are informed about MRMP, they must be kept appraised of progress to stimulate development of new pilot projects and to insure understanding and full utilization of health care advances catalyzed by MRMP.

INTERREGIONAL COOPERATION

The Kansas RMP and MRMP already are engaged in joint planning and operation with regard to Metropolitan Kansas City, as well as on Regional bases. Appropriate interrelations have been developed with the Memphis Regional Medical Program and the Arkansas RMP, and cooperative arrangements are under way with the BiState (St. Louis-Southern Illinois) Program. Negotiations are in process for more active cooperation with a number of other RMPs, particularly the remaining six RMPs bordering on the Missouri Region.

DEVELOPMENT AND SUBMISSION OF PILOT PROJECT PROPOSALS

MRMP believes that all health and health related institutions, agencies, organizations and leaders of the Missouri Region should be aware of their opportunity to develop and propose projects to MRMP for the benefit of their respective communities.

Guidelines have been prepared to provide communities, organizations, institutions and other groups with information concerning benchmarks used by the MRMP Advisory Council and its committees in judging the merits of proposed pilot projects and determining priorities for transmittal to the Division of Regional Medical Programs.

Inquiries may be addressed to Dr. George E. Wakerlin, Director for Planning, Missouri Regional Medical Program, Lewis Hall, 406 Turner Ave., Columbia, Mo. 65201. The MRMP Planning Division Staff will be pleased to advise with reference to the preparation of project proposals. Indeed, early involvement of the Staff in project planning is likely to facilitate development of the project proposal and formal submission to MRMP.

Inquiries from Metropolitan Kansas City, Southwest Missouri or Southeast Missouri may be addressed respectively to Dr. Richardson K. Noback, Medical Director, Kansas City General Hospital and Medical Center, 24th and Cherry Kansas City, Mo. 64108; Dr. Stanley S. Peter-

son, 1835 South Stewart, Suite 105, Springfield, Mo. 65804; and Mr. Lee G. Cochran, Jackson, Mo. 63755.

FUTURE

The national climate is increasingly favorable to RMP. Thus, in January, 1967, Charles L. Hudson, M.D., now a Past-President of the American Medical Association, urged practicing physician concern with prevention and early detection, health team leadership, community health services and community health planning.[1] In January, 1968, Dwight L. Wilbur, M.D., now President of the AMA, stated that RMP "can make a real contribution to personal health services if it continues to pursue what appears to be its main thrust today—to serve as catalyst for and to facilitate those winds of change which blow in the right direction."[2]

Achievement of the primary goal of MRMP over the next decade (as stated in the first paragraph) will require continued and effective cooperation and participation of the medical and other health professions, laymen and consumer groups, health and health related organizations and institutions, government agencies and communities of the Missouri Region.

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delineate the challenge which appears to exist. We believe that the University should be involved and that it has a specific and unique contribution to make in assisting the physician with the problems which confront him in his particular practice. We believe that the Regional Medical Program stands alone in offering the profession both the opportunity and the challenge to participate in the design of improved health care patterns for the future, even though the present area of activity is categorically limited to heart, stroke, cancer and related diseases. While we do not maintain that we have found the perfect balance between supporting service and peripheral activities, these relationships are under constant study and will be subject to continual revision as a great variety of individuals assisting us throughout the state bring to bear their advice, consultation and constructive criticism. The success of Missouri Regional Medical Program activities is totally dependent upon the initiative and the response of physicians in the state. This, we believe, is exactly as it should be.

The Advisory Council of the Missouri Regional Medical Program has awarded $60,000 to the Kansas City General Hospital Medical Center to help finance its chronic renal disease program.

These funds are part of the $100,000 appropriated by the Missouri Legislature last March to MRMP to initiate patient care and research in kidney disease in the state. The remaining $40,000 will be allocated at a later time, according to Nathan J. Stark, Council Chairman of Kansas City.

The Kansas City Program began its second year of decreasing Federal support on July 1. The U. S. Public Health Service is providing $287,000 of a $359,000 total budget for the program of the remaining $72,000, KCGHMC is providing $12,000 and the balance was made up by action of the MRMP Council.

ARTHUR E. RIKLI, M.D., *Columbia*
Director for Operations, MRMP

Operational Program for Missouri Regional Medical Program (MRMP)

The Operations Division of MRMP is responsible for implementing more than 20 projects developed by the Planning Division. Doctor Rikli reports that the three basic types are (1) projects that define heart, cancer and stroke problems and evaluate impact of MRMP; (2) projects that assist in preventing or detecting these diseases; and (3) projects that aid physicians in providing diagnoses, therapy and preventive measures.

THE MISSOURI REGIONAL MEDICAL PROGRAM seeks to provide optimum health for the greatest number of people by accelerating the application of effective preventive and therapeutic measures for heart, stroke and cancer patients or those with related diseases.

The Missouri Regional Medical Program Operations Division is responsible for implementing those activities that have been developed by the Planning Division through the Missouri Regional Medical Program review groups and is given financial support by the Regional Medical Program National Advisory Council.

These financially-supported projects may be divided into the following three groups:

1. Projects that define the nature of the heart, stroke and cancer problems and the effect of the Missouri Regional Medical Program.
2. Projects that aid in bringing heart, stroke and cancer suspects into the health delivery system.
3. Projects that aid physicians in providing effective diagnostic, therapeutic or preventive measures to those who need them.

It is the Missouri Regional Medical Program plan to help close the time gap between discovery and application by introducing innovations into the Missouri health delivery system on a demonstration basis and, in this way, aid heart, stroke and cancer patients in receiving better diagnostic and therapeutic measures from their traditional sources of health services.

DEFINING AND MEASURING

The first group of projects defines the nature of heart, stroke and cancer problems in Missouri and seeks to measure the effect of the Missouri Regional Medical Program upon these problems. For any health program to be effective, it is essential to know who has or is prone to have a disease. In what kind of an environment are they living, what health services do they need and which ones are they demanding and receiving? The "Population Study Group Surveys" represents Missouri Regional Medical Program's effort to determine the nature of the heart, stroke and cancer problem in this region. This project will be supplemented by the "Automated Hospital Patient Survey" when we find appropriate staff to assist Missouri hospitals in assessing the services used by heart, stroke and cancer patients.

The physician's office is where most patients gain access to the services of health workers and related resources that make up the health delivery system. Analysis of this system to aid in determining rational innovation is the responsibility of the "Operations Research and Systems Design" project. This project is using its skills to analyze the forces at play within the Missouri Regional Medical Program and is proposing more effective use of resources.

As we acquire information germane either to a specific problem or to a solution, we attempt to simulate the anticipated effort through model development and testing. This work is carried out by the "Data Evaluation and Computer Simulation" project.

The most difficult task in introducing an innovation into the health delivery system is to foretell the effect or value of the innovation. Today's health delivery system is the product of innumerable variables that have been introduced

by both the consumers and producers of health services. Most changes have been made upon an empirical basis rather than upon a carefully calculated cost-benefit basis. As therapeutic measures develop (such as renal dialysis and organ transplants which can prolong a productive life at costs that no individual or his family can afford), there arises a critical need for methodologies to evaluate the practice of such extraordinary measures. This is one of the responsibilities of the "Program Evaluation Center" project.

The "Communications Research Unit" has set out to determine and measure the elusive factors in communication which cause people to react or not to react under varying circumstances. The medical profession has had little real success in "selling" the principles of well-being to the public. Our "Communications Research Unit," for the first time, is delving deeply into this crucial problem on a scientific and closely controlled basis.

Detecting or Predicting

The second group of projects involves our initial efforts to determine the most effective methods for detecting persons who either have or are prone to have heart disease, stroke or cancer. Although there are many forces that influence the ways by which a person may gain access to the health delivery system, the Missouri Regional Medical Program is directing its primary effort toward means of detecting signs of disease. The names of three of these projects are self-explanatory. They are, (1) Multiphasic Testing, (2) Mass Screening-Radiology and (3) Automated Patient History.

The fourth project, "Bioengineering," provides support to several projects through the development of new or different kinds of electronic and mechanical "packages." One such development, for example, has involved the design and building of a "diagnostic chair" that looks like an ordinary, comfortable reclining chair. In less than two minutes and without the need for attached terminals however, it can produce three-lead electrocardiograms. Other measuring devices are being built into it at present.

Closing a Gap

The third group of projects intends to stimulate the flow of information from its research source to the physician who needs it in order to provide the best possible diagnostic or therapeutic services to his heart, stroke or cancer patients.

Modern information storage and retrieval methods are being blended so that they will be readily accessible to the inquirer as he considers various diagnostic possibilities suggested by signs and symptoms in a patient. Physicians now may acquire answers to such questions by time-consuming inquiry into the medical literature. It is the mission of the "Computer Fact Bank" to provide this information much more rapidly and pertinently than would be available in any other way.

The second project in this group, and one of the best models reflecting the use of modern information-handling devices to serve the health needs of persons with heart disease, is the "Automated Electrocardiography" project. It is providing physicians with computer interpretation of electrocardiograms at six different locations. The system has been developed during the past ten years and is now being field tested by the Missouri Regional Medical Program. It is anticipated that, in the near future, computer interpretation of electrocardiograms will be as readily available to physicians in Missouri as their telephones. This method could be used with phonocardiograms, electroencephalograms and many other diagnostic signs. Computers are finding their place in the practice of medicine as a diagnostic aid to a physician.

Computers, however, are merely tools for helping the diagnostician or the practicing physician. They neither can, nor probably ever will, supplant the basically vital "doctor-patient" relationship that is the keystone of effective medical practice.

What we do with these machines, or, indeed, with any of the products of medical research is being studied with utmost care, and their applications are being introduced into Missouri's health delivery system with careful restraint.

We look upon all such activities as critical experiments and we are carrying them out in two carefully selected communities under limited, controlled conditions and only with the closest collaboration with professional and administrative personnel in those communities. We are proceeding with caution because we believe that the future of the Missouri Regional Medical Program depends upon our ability to learn how to carry out experiments like the "Smithville" project and the "Comprehensive Cardiovascular Care Unit" in Springfield in a way that will result in the heart, stroke, and cancer patients in these communities enjoying an improvement in their health services after these projects are completed.

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GAIL BANK, M.S. *and* WILLIAM D. MAYER, M.D., *Columbia**
Associate Project Director and Project Director, MRMP

Continuing Education for the Health Professions

ALTHOUGH THE LEVEL OF HEALTH CARE in the United States is considerably higher than that in many other nations, it has a potential of being even higher. How rapidly we approach this potential level will depend to some degree upon the extent to which provisions are made by educational institutions for continuing education for physicians and other health professionals. Even more important is the extent to which those currently in the health professions and those who will enter the professions will involve themselves in the process of continuing study of each other's professions throughout their years of practice. In these days of rapid growth in biomedical knowledge, continuing education becomes the bridge between what is known and what is applied.

It is estimated that knowledge currently applicable in medicine is twice as great as it was a decade ago and that it will double again in another decade. This staggering volume of information makes it impossible for a physician to learn during his professional education everything necessary for a lifetime of practice. Eliminating or even slowing down the development of new knowledge or lengthening the time requirements for professional school education are impractical alternatives. Thus, it becomes imperative for those in the health professions to take increasing responsibility for continuing study in their career lines and for educational institutions to provide increased opportunities for continual learning.

Since its beginning, the University of Missouri Medical Center has supported the view that continuing education needs to be an integral part of the day-to-day, week-to-week practice of health professionals. Present and future activities are directed toward making appropriate contributions to a totally integrated system of education based upon the premise that learning should be a lifelong activity, the ultimate goal being the improvement of health care. This concept envisions a time when health professionals will have at their disposal mechanisms with which to engage in learning activity at any time, at any place and at whatever breadth or depth desired for their own self-learning and for the needs of their patients. To help accomplish this, access to great libraries, other clinicians, researchers, teachers, consultants, teaching-learning materials and all manner of pertinent data and information will be immediately available. In this concept, continuing education is both a means to an end and an end in itself.

The concept of lifelong learning has brought about changes in educational activities for practicing professionals and also has been an influence upon the teaching programs within professional schools. There has been a shift from emphasis upon the acquisition of information to selection, organization and evaluation of information. At the Medical Center, for example, multidisciplinary laboratories and teaching-learning centers are being introduced. These facilities will make it possible for students to interact with the basic material and, also, with many additional sources of information. Students, thus, can progress as rapidly as they wish with the aid of texts, recorded lectures, films, video tapes, computers and other devices. Developing self-learning habits early in the students' professional education better equips them to direct their own continuing education activities following entry into practice.

There also has been a shift from isolated programs for different health professions to bringing the professions together in patient-oriented education activities. This reflects an increasing interdependency among the professions in the delivery of health care. It also prepares them for future participation in interdisciplinary continuing education activities.

* Mr. Bank is Executive Director of Continuing Medical Education and Associate Professor of Extension Education and Doctor Mayer is Dean and Director of the University of Missouri School of Medicine.

The University Medical Center, recognizing these needs, established an office of Continuing Medical Education to develop and carry out various educational programs. Faculty supervision is provided through the Committee on Continuing Medical Education and includes representatives from the clinical departments of the Medical Center, the basic science departments, and nursing, medical technology, physical therapy and other health professions. Liaison and advisory arrangements with various professional groups are actively maintained. Thus, the educational needs of many health professions are coordinated and the interrelationships of the various health professions are incorporated in the educational activities.

Many educational opportunities have been developed for different health professions. Conferences and workshops have been presented at the Medical Center, as well as at various locations in the state. Efforts are made to involve the audience in each of the conferences rather than to rely on lectures alone. Panel discussions, with opportunity for audience questions, are frequently employed. Other techniques include small group discussions; live case presentations; presentations directly from the clinical areas via closed circuit television with direct questioning from the audience; workshops in which the professional learns skills and techniques; extensive use of audio-visuals; and presentation of summary materials, bibliographies and reference materials.

Recognizing the difficulty professionals in the health care fields have in leaving their practices to engage in scientific programs at distant points, the Medical Center has helped to provide scientific programming at hospital staff meetings, at meetings of medical societies and other professional associations. This is accomplished through a Speakers' Bureau. Programs for meetings arranged through this service usually take the form of a single presentation with subsequent discussion about the materials presented. During the guest speaker's visit, he often provides consultation, makes rounds or discusses various facets of a particular problem with local professionals.

As important and extensive as these activities are, they fall short of involving health professionals in educational activities associated with day-to-day, week-to-week patient responsibilities. Since the majority of health care is provided locally, local health care facilities need to incorporate an educational function in their responsibilities. It can be the source of educational linkages with practitioners in offices, clinics or other local settings, and the Medical Center can assist and support the educational function of local health care facilities.

Continuing education contributes to the elevation of health care by reducing the time between biomedical discovery and its application. The authors also state that it should be an integral part of the day-to-day practice of health professionals who have educational linkage to practitioners in offices, clinics and other local settings through local health care facilities. They tell how, through appropriate cooperative arrangements, the Missouri University Medical Center can assist and support the educational function of local health care facilities.

An important start has been made in this direction. Regularly scheduled, illustrated lectures and discussions via amplified two-way telephones to a few hospitals in Missouri are being made on a test basis. Presentations are by Medical Center faculty and various practitioners in the state. The speaker is heard simultaneously at widely separated locations and his slides and other visual materials are projected locally for instantaneous viewing. Questions can be asked and answered, and discussion from many distant geographic points is possible. Programming is arranged at hours when most physicians are normally at the hospital and are not required to absent themselves from their patients and practice.

Telephone activities to date represent only a beginning in the development of this technique's potential activity. While programming has been limited to only a modest number of physicians, requests from physicians at other hospitals and from other health professions far exceed our current ability to respond. The major deterrent to expanding this technique to more hospitals and to other professions is the lack of funds.

Involvement of educational institutions in continuing education activities requires more than a recognition by individual faculty members of the value of continuing education in the process of health care delivery. It also requires a philosophical commitment and a demonstrated capacity of the institution to be of educational service to society.

The University of Missouri has a long history

of commitment to this educational philosophy as well as to educational service beyond the campus. The roots of this philosophical commitment go back to discussions prior to the establishment of the University in 1839. Further ideas stemming from this philosophy spring from the establishment of the University as the land grant institution immediately following the Civil War, the establishment of the Agricultural Experiment Station in the late 1800's to do research and devise ways of improving the state's economy and the establishment of the cooperative extension service in 1914 to help disseminate research findings.

The extension of the educational resources of the University from the campus to the citizens of the state is known as the Extension function of the University. This responsibility is now of such importance it warrants administrative responsibility by a vice-president of the University. The extent of the University's commitment to this educational function also may be judged by the fact that more than 700 persons are engaged in discharging this responsibility. There is at least one University Extension representative in each county.

No single organization has a corner on educational expertise or has sufficient resources to meet the continuing education needs of the present, much less the needs of the future. However, the necessary expertise can be made available by tapping the health manpower pool of the state. Financial resources are potentially available through federal legislation which created the Regional Medical Programs.

Regional Medical Programs originally were conceived as a means of providing health services through a system of complexes including regional centers and diagnostic and treatment facilities. Services grown out of recent research findings were to be made available to patients through these complexes. The original concept, however, was drastically modified to eliminate the regional center concept. Legislation finally enacted (PL 89-239) calls for "regional cooperative arrangements among medical schools, research institutions and hospitals for research and training (including continuing education) and for related demonstrations of patient care in the fields of heart disease, cancer, stroke and related diseases." Thus, continuing education became an important component of the law establishing the Regional Medical Programs; it assumes that same importance in the eyes of those implementing the Law at the national level.

At the local level, the framework of cooperative arrangements now established by the Missouri Regional Medical Program among the University, state professional societies, state health agencies, voluntary health agencies, the hospitals in the state and individual practicing physicians does, indeed, offer a superb base of interrelationships upon which to build meaningful programs in continuing education.

What educational opportunities might be possible through the University, Missouri Regional Medical Programs and other agencies if necessary cooperative and funding arrangements are made? The potentialities are impressive and exciting. Only a few of the ideas under discussion will be mentioned here.

The telephone lecture service is being expanded with MRMP support to include more hospital locations and educational programming in nursing, physical therapy, medical technology and other health professions. Presentations can be made by practicing professionals, Medical Center faculty and faculty of other institutions. The format can be extended to include case presentations, journal clubs, seminars and other activities. Programming might be presented in a time span so that health professionals on different work shifts can participate. Slides and other visual materials used in presentations and a tape recording of the presentations might be made available to each receiving point as a library resource. This initial educational communications network might well be the forerunner of more sophisticated systems involving FM broadcasting and two-way television. The latter system offers the potentiality of presenting patients for immediate consultation.

Establishing an educational communications system will enhance the capabilities of data transmission, rapid transmission of EKG's and their interpretations, access into vast medical library resources, rapid transmission of library materials and access to computers with their multitude of medical applications.

Regular teaching situations in hospitals, using local patients as teaching materials, might be arranged. Through this device, which is comparable to the "clinical clerkship" in medical schools, members of different health professions become directly involved in learning situations concerning their patients.

Opportunities might be provided whereby members of different health professions can return to a professional school to study some particular aspect of his or her profession in greater depth than possible locally. Instruction would be under the tutelage of a faculty member; pre-

sentation of materials to be covered would be worked into a time schedule compatible with the time schedule of the health professional. To the greatest extent possible, the health professional would be assimilated into the daily teaching and patient care activities of his faculty preceptor. The possibility of providing "locum tenens" coverage for the local practice should not be excluded.

Continuing education for the health professions is many faceted. The skills, energies, imaginations and financial resources of many individuals, agencies and organizations are needed to provide necessary opportunities for continuing education. However, dedication on the part of health professionals to continually learn and study during their years of professional activity also is required.

The combination of adequate resources for continuing education and increased involvement of health professionals in the processes of continuing education can only result in the constant elevation of levels of health care. The University of Missouri Medical Center has been and continues to be committed to significant efforts in continuing education. The framework of cooperative interrelationships of all the professions, agencies and institutions provided for by MRMP can only enhance the effectiveness of all as we strive to increase the quality and quantity of continuing education for all health professions in Missouri.

Operational Program (Cont'd)

At Smithville, which is, in effect, our "pilot" community, we are considering the whole person and the several factors which may have brought him to the condition of apparent illness at the time he seeks his doctor's help. Health care does not begin when a patient enters a doctor's office or a hospital, nor does total health care end when he is discharged. We need to be concerned with such matters as how to keep from becoming ill, the *best* care for a person who is ill and how to best readjust to normal living after medication has ended.

At Springfield, through the energetic efforts of a number of highly motivated physicians, the Missouri Regional Medical Program is acting as a powerful catalytic force in developing an ideal comprehensive cardiovascular care program. To this end, a model "cardiac hall" has been developed at St. John's Hospital where an entire area is devoted entirely to intensive, intermediate and recuperative care of heart patients.

A "Manual of Services," prepared by a Missouri Regional Medical Program team of researchers in cooperation with the Missouri Health Council, provides the first list and thorough description of all medical and paramedical services in the state. It soon will be available to every physician in the state, as well as to many other persons who are concerned with the well-being of our people.

Dr. Robert Q. Marston has been appointed to succeed Dr. James A. Shannon as director of the National Institutes of Health. He has been administrator of the NIH's Health Services and Mental Health Administration since April 1.

Dr. Marston joined the NIH in 1966 as the first administrator of the Heart Disease, Cancer and Stroke Regional Medical Programs. In accepting his new post, he listed knowledge and then money and manpower as the key factors in future improvements in the health of Americans.

LAWRENCE C. KINGSLAND, JR., M.D., *Columbia**
Project Director, MRMP

The Computer Fact Bank

A progress report on the developing Computer Fact Bank, which is an open-ended collection of biomedical information equivalent to several hundred thousand text pages. It will be rapidly accessible to physicians, medical students and other health professionals by means of local and remote terminals linked to a central computer and by microforms available through computer-oriented, automatic retrieval and display devices. Doctor Kingsland also discusses the Missouri University Medical Center's CONSIDER programs to which the Fact Bank continually adds current biomedical content.

THE PHILOSOPHY, PLANS AND CURRENT ACTIVITIES in developing a pilot-scale operational Computer Fact Bank designed to assist physicians throughout the state in their daily practice are described in this article.

In the smallest towns, as well as in the larger population centers, physicians would like to have almost immediate, carefully considered, concise answers to any one of millions of complex medical questions on diagnosis and treatment; this is almost impossible in today's world.

Versatile communications networks linking large computer-based informational systems and hundreds of remote display devices are becoming commonplace in the business world where individual items of information tend to be far simpler and answers more clear cut. In medicine, the bottleneck is not devices, but the primitive state of definition, standardization and synthesis of the medical knowledge and logic involved, plus the need for systems and programs tailored to meet specific medical needs.

"Wall-to-wall" money, in volumes to which the military and space industries have become accustomed, only could begin to make a dent in the formidable informational, logical and logistic problems involved in furnishing "instant medical wisdom" upon request. Even large, in-depth teams of medical and surgical specialists working in shifts around the clock, 365 days a year, would require versatile communication systems and an elaborate, continuously updated Platform of Organized Knowledge or Data Bank with most of the features of our pilot model from which to furnish instant expert advice. Moreover, most physicians, lacking detailed knowledge of other physicians' exact medical background and understanding of the patient's manifestations and problems, know that furnishing what amounts to "medical consultations" at a distance would be fraught with danger to all concerned.

Furnishing "informational consultation" on demand, however, is another matter. The busy physician wants specific answers, not long sets of bibliographic references. He knows from sad experience that the articles and texts he seeks, even if theoretically "available" in his vicinity, often will be "out on loan," "at the bindery" or lurking in some benighted faculty member's desk drawer or briefcase. The Missouri Regional Medical Program's Fact Bank is designed to allow the user to enter the system with his own chosen words and concepts and to help him to "negotiate his own" request for information. Requests can be made locally or on remote teleprocessing terminals. Some terminals will have cathode ray tube ("television-like") display features.

The Fact Bank is an open-ended collection of all kinds of biomedical information, equivalent to several hundred thousand text pages, and selected to contain appropriate current facts, definitions, basic science, clinical and research information. A small but exceedingly important and increasing proportion (now about 2,000 pages) of the Fact Bank will be in machine-readable form, i.e., on magnetic tape. The vast majority of the collection (now about 150,000 pages) is journal, monograph and textbook material on 16 mm microfilm in cartridges and on microfiche. Any one of these pages or any item in the machine-readable portion of the file can be displayed automatically within a half a

* Doctor Kingsland is Associate Professor, Department of Community Health and Medical Practice, University of Missouri School of Medicine. This investigation was supported in part by Public Health Service Research Grant GM 09907-03.

'CONSIDER' PROGRAMS DEVELOPED BY THE STAFF

OF THE

UNIVERSITY OF MISSOURI MEDICAL CENTER COMPUTER PROGRAM

The name "CONSIDER" was chosen for the program, or system, since it implies that if a patient has certain input findings, i.e., signs, symptoms, x-ray findings and so on, his physician should *consider* the possibility that his patient may be suffering from one or more of the diagnoses suggested by the program. The original programs were used on the IBM 1410 with printer and punch card outputs in early versions, and CDC or IBM 2260 cathode ray tube outputs in later (IBM 360-50) versions. During the past three years, both students and faculty alike frequently have used CONSIDER programs: students especially during the end of their second year when they are most active in learning varied clinical terminology or when studying unusual patients on the ward; faculty when seeking exhaustive suggestions for consideration in clinical-pathological conferences and even on clinical research projects.

Dr. Burgess Gordon of the American Medical Association Editorial Staff deserves great credit for developing the unique collection of condensed clinical information concerning several thousand diseases and conditions found in the present 1966 Third Edition of *Current Medical Terminology* (CMT) published by the American Medical Association. The entire 500 pages of text also are kept in machine-readable form on magnetic tape. A tape version constitutes the data base upon which, with certain additions, all University of Missouri Medical Center CONSIDER programs operate. A new, larger and much improved fourth edition of CMT is due early in 1969.

CONSIDER programs accept sets of signs and symptoms (e.g., pain or tenderness in various regions of the abdomen), X-ray findings (e.g., gaseous distention or changes in intravenous pyelography), or laboratory findings (e.g., increased white count or urinary changes). They then display or print out lists of diseases consistent with the input items, plus STANDARD NOMENCLATURE OF DISEASES AND OPERATIONS and INTERNATIONAL CLASSIFICATION OF DISEASES, ADAPTED numbers when available. One begins to appreciate the potential importance of such programs for clinical diagnosis and medical education generally when "Porphyria, Acute, Intermittent" and "Pancreatitis, Interstitial, Acute" appear along with the more usual diagnoses, "Pyelitis, Acute" or "Appendicitis, Acute" in response to input items. Much, of course, remains to be done in improving definitions, obtaining better synonym control, extending the medical content and improving the logic and arrangement. However, the system, as is, is highly useful.[1]

An interim program, available for use on IBM 360 systems, produces remote cathode ray tube displays on 2260 terminals and also has teleprocessing (IBM 1053) typeout capability. A much more elaborate and far faster program called EXPANDED CONSIDER is under active development.

minute by means of existing programs and equipment.

The key that unlocks the wealth of detail in the Fact Bank is the unique Depth Index or Thesaurus. Now under construction, the Depth Index will be kept entirely in machine-readable form. The Depth Index is based on the National Library of Medicine's MEDLARS Subject Heading Authority Lists merged with the College of American Pathologists' *Systematized Nomenclature of Pathology* and the Indexes and Tables of Contents of several representative important textbooks and monographs. It retains all important semantic and hierarchical relationships and eventually will total more than 100,000 clinically or biomedically important key words and concepts.

The user will enter the Fact Bank via the Depth Index with the key word or concept of his choice. He will be led rapidly to the preferred terms in the system and, in some cases, will be shown their definitions and the present word association map or "universe of discourse" now centering around these terms. This process will give him direct reference numbers to appropriate machine-readable output or, where this is not yet available, to selected relevant literature on microfilm.

Alternatively, the user may have access to condensed machine-readable clinical information via "CONSIDER" Programs developed by the staff of the University of Missouri Medical Center Computer Program under the direction of Dr. D. A. B. Lindberg. Messrs. Larry Rowland, Manager of Advanced Systems Planning; Charles Buck, Manager of Systems; Joseph Schroeder, Senior Systems Analyst; William

(Continued on page 737)

HUBERT J. VAN PEENEN, M.D. *and*
JAMES B. FILES, M.D., *Columbia**
Project Director and
Associate Project Director, MRMP

Laboratory Multiphasic Testing Today

AT THIS MOMENT, laboratory multiphasic testing is limited to 12 clinical chemistry tests and four hematology tests that can be performed on Technicon Corporation Sequential Multiple Analyzers. The tests are serum glucose, urea nitrogen, uric acid, total protein, albumin, calcium, inorganic phosphorus, total bilirubin, alkaline phosphatase, glutamic oxalacetic acid, lactic dehydrogenase, cholesterol and whole blood hematocrit, hemoglobin, white count and red count. The Analyzers make it practicable to do all these tests as a routine hospital admission battery. By making available sooner some of the results that would ordinarily be requested during hospitalization, it would be possible to discharge patients earlier to justify the extra cost of testing by decreasing total hospital cost.

The MRMP Multiphasic Testing Project is concerned with making available information that is useful clinically. The authors show that it has become practical to do a large battery of clinical chemistry tests as a screening device for the detection of disease. They state that with a computer even normal results can be interrelated mathematically and may offer clues to future disease before symptoms appear.

The test battery also should be useful in office practice[1] and as a health screening device in discovering unsuspected disease in patients who have not consulted a physician. As such, it serves to introduce patients into the health care system.

The multiphasic testing project of the Missouri Regional Medical Program is concerned with evaluating the presently available test battery for its diagnostic value, for deciding which tests should be excluded and which new ones added and for determining the interrelationships of test values which may be more meaningful than any one normal or abnormal test value by itself.

* Doctor Van Peenen is Associate Professor of Pathology and Doctor Files is Resident Physician at the University of Missouri School of Medicine. This investigation is supported in part by USPHS Grant CD-00235.

TEST BATTERY FINDINGS IN MISSOURI

To date, two Missouri subpopulations have been tested with a battery of tests similar to that performed by the Sequential Multiple Analyzers. The first consists of newly-admitted inpatients at the University of Missouri Medical Center and the second consists of long term inpatients of Missouri State Psychiatric Hospitals. The first group demonstrates the abnormalities caused by overt disease. The second group is supposedly free of serious organic disease but, nevertheless, harbors many patients who either have or are developing the degenerative diseases with which the Regional Medical Program is primarily concerned. More than 3,000 patients from each group have been tested to date. In the near future, a third population is to be added. It will consist of outpatients seen by the physicians of a representative Missouri community.

Preliminary results from patients of the State Psychiatric Hospitals were recently published in this journal.[2] Preliminary results from the inpatient UMMC population are now being processed. Our results and those from many other groups[3-10] confirm that a large number of obviously abnormal laboratory results can be found by screening supposedly healthy persons, especially those more than 40 years of age. Ninety percent or more of the abnormal tests are derived from only five tests in the 16 test battery. The five tests are serum glucose, urea, uric acid, cholesterol and hemoglobin. Characteristically, of course, a reduction in hematocrit and red count accompanies a reduction in hemoglobin.

COMMENT

Although only five tests provide most of the abnormal results, with the equipment available today it is actually easier and cheaper to do all 16 than only the five. Furthermore, interrelationships of the other "normal" values may prove

to be diagnostically useful in the future. Progress in instrumentation is rapid, and it is very probable that it will be easier to add new tests as they prove useful than to eliminate old ones.

Our concern is no longer that of providing large amounts of information about a patient. It is to make the information provided clinically useful. Laboratory data is now available. Soon, many parameters of physiological testing being studied in other projects of the Missouri Regional Medical Program also will be available, yet it has not been proven that the discovery of abnormal results in any way benefits the patient. Hopefully, demonstration of abnormalities can and will lead to preventive treatment.

Studies under way in this project coupled with the resources of the computer-based fact bank of the Missouri Regional Medical Program should make it possible to more specifically interpret normal and abnormal laboratory findings and so aid the physician in maintaining the good health of his patient. Conclusive studies along these lines will take many years but are in progress.

SUMMARY

It has become practical to do a large battery of clinical chemistry tests as a screening device for the detection of disease. A third of the tests yield most of the abnormalities, but interrelationships of normal values obtained for the others may prove diagnostically useful in the future.

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Computer Fact Bank (Cont'd)

Morse, Systems Analyst; and Mrs. Susan Morse, Programmer, are among others who helped develop the CONSIDER Systems Programs.

In summary, the Fact Bank and associated Depth Index will enable the User (1) to choose material hopefully containing answers to his specific questions at the time of his greatest interest and clinical need; (2) to become aware, at the same time, of the availability of additional new information, some of which, perhaps, he was not consciously seeking; and (3) to reestablish active contact with an ongoing information system designed to challenge him and promote habits of lifelong learning in his chosen profession.

Due to the categorical nature of our grant, we are concentrating on heart disease, cancer, stroke and related diseases, but, also, are including much additional material of direct interest to physicians everywhere.

This fall, we begin our first real-life trials of the system on medical students, friendly colleagues and captive audiences. When suitable feedbacks have been received and evaluations, necessary revisions and improvements have been made, we will be ready "to go on the air" throughout the state. Meanwhile, we will be glad to demonstrate the system as it evolves to interested physicians and would welcome their comments and suggestions.

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PETER L. REICHERTZ, M.D., *Columbia**
Project Director, MRMP

Mass Screening Radiology

This MRMP Project aims at developing radiological techniques for mass screening and at improving the accuracy of radiological diagnosis for heart disease, cancer and stroke. Doctor Reichtertz explains how computer-assisted diagnosis is being made available to hospitals in Missouri as well as in the University of Missouri Medical Center. He indicates that ultrasound techniques and thermography also are being investigated as a means of detecting arteriosclerotic disease and cancer.

THE OBJECTIVES of the Mass Screening Radiology Project are to develop radiological techniques for mass screening and to improve the accuracy of radiologic diagnosis in the areas of heart disease, cancer and stroke by making computer-assisted diagnosis available to other hospitals as well as to the University of Missouri Medical Center. Furthermore, ultrasound techniques and thermography are being investigated in order to provide a means for the early detection of arteriosclerotic disease and cancer, with special emphasis on cerebral circulation and brain tumors.

In order to attain these goals, the acceptability and efficiency of various electronic communication media are being tested. Previously developed techniques of computer-aided diagnosis are being expanded and perfected. The full range of application of ultrasound in the diagnosis of neoplastic and vascular diseases has to be determined, and techniques must be developed to apply ultrasound and thermography to mass screening situations.

"RADIATE" is a computer-oriented part of the project. A system has been developed for the synthesis, standardization, formatting, coding and transmission of radiology reports. The radiologist using the system to describe his findings is interfaced with the computer by means of television-type terminals on which are displayed queries to which he responds by typing in code letters on a keyboard similar to that of a typewriter. Information previously fed into the computer may be retrieved by the same terminals. When the report is finished, it will be stored in the computer, will become part of the patient's record and will be transmitted to the ward or, eventually, to other hospitals or the office of a physician. If the radiologist seeks diagnostic aid, a number of questions will be displayed to which he answers according to his own findings. When he has answered all the questions, the computer calculates and displays the possible diagnoses.

At the moment, RADIATE is operational in the Department of Radiology of the University of Missouri Medical Center. The system is based on the investigations of Doctor Templeton and co-workers.[1-3] Numerous programming problems had to be solved.[4-6] Extensive studies were done to determine standard terminology for the type of radiological examination, the anatomic sites to be described and the radiological diagnosis. This standardized terminology is stored on magnetic disks. Each term can be retrieved by radiologists using RADIATE by specifying the first four letters of any word in the pertaining description. When several applicable descriptions are stored, all are displayed and the radiologist may choose the most accurate term. This may enhance the accuracy of the report. Furthermore, the user may be guided through the different anatomic sites pertaining to a certain type of examination. This is intended to be a teaching feature for residents.

Fig. 1 shows the initial display by which RADIATE introduces itself to the radiologist. Fig. 2 gives an example of the display of diagnostic terms retrieved by the keyword "ULCE." Modifiers to the description (such as acute, healing, left, right, etc.) may be added. Fig. 3 gives an example of a report generated in the described fashion. Each time the radiologist specifies a diagnosis, he has to assign a probability estimate of accuracy (confidence level 1-9). Free text comments may be added and precoded standard reports may be generated by specifying a code number.

* Doctor Reichertz is Association Professor of Radiology Science and Director of Radiology Computer Research at the University of Missouri School of Medicine.

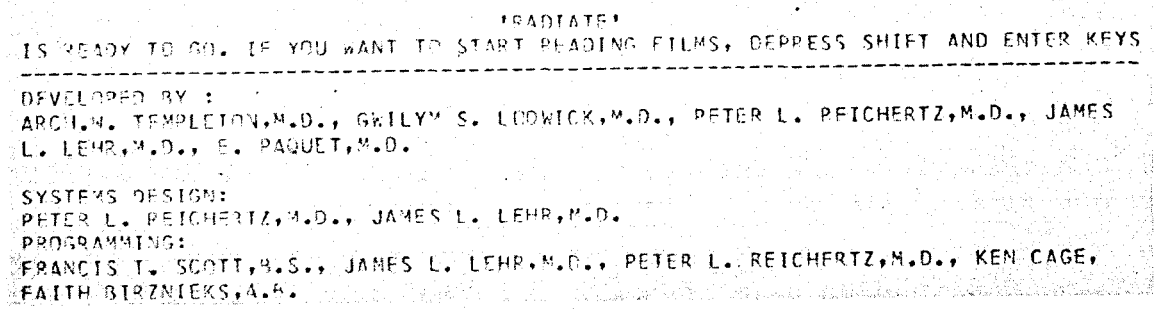


Fig. 1 Introductory display of "RADIATE." It instructs the radiologist how to proceed in order to have access to the system.

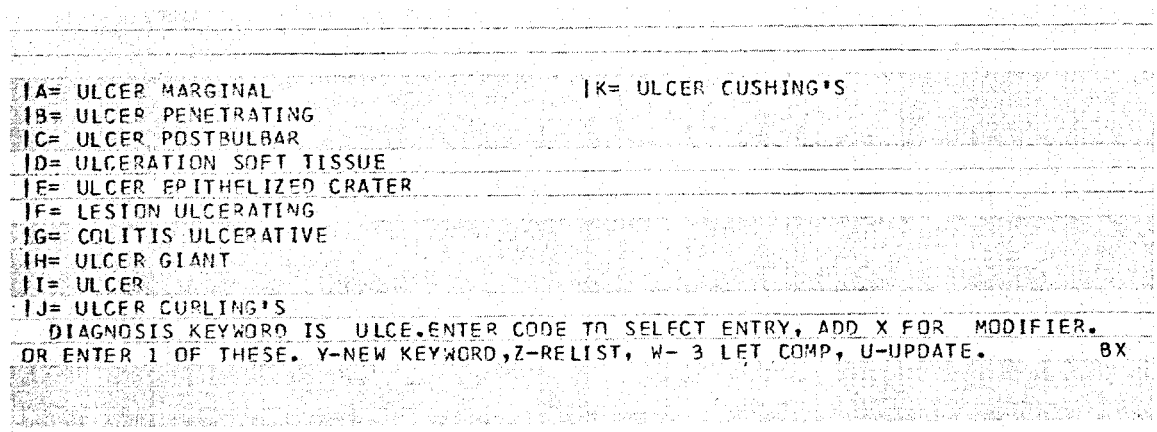


Fig. 2 Display of the diagnostic terms that are retrieved from the information stored on magnetic storage devices by the keyword "ULCE." In this case, the physician has chosen the term "Penetrating Ulcer" and has specified that he wants to add modifiers (such as acute, chronic, etc.) to the description.

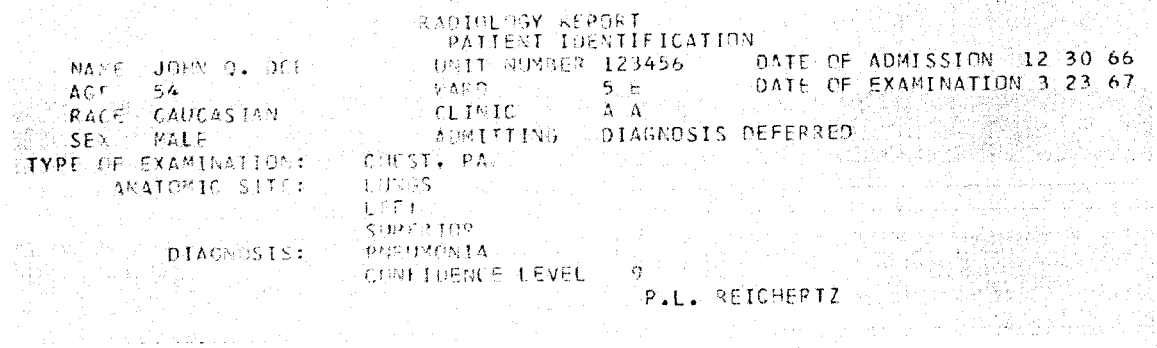
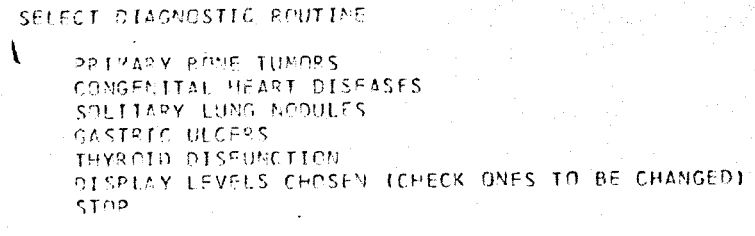


Fig. 3 Report generated by "RADIATE."

Fig. 4 Display of the currently implemented diagnostic routines. Whenever a number of questions has been answered, the most probable diagnoses will be displayed. The specified symptoms may be redisplayed (option: display level chosen) and symptom descriptions may be changed in order to come to a better diagnosis.



At the present time, computer-aided diagnosis is available for primary bone tumors, congenital heart diseases, solitary lung nodules, gastric ulcers (differentiation between malignant and benign ulcers) and thyroid disfunction. Fig. 4 shows the display from which the physician may make this choice. The diagnostic programs are based upon the investigations of Doctor Lodwick and co-workers.[7-11]

At the present time, the system is ready for application in several hospitals connected by a computer network. Ultimately, private physicians might participate. RADIATE's use will result in the acceleration of report transmission, the improvement of diagnostic accuracy and the central storage of findings.

The work in "Ultrasound and Thermography" is being carried out by Dr. P. Wollschlaeger. Ultrasound techniques to improve the detection of intracranial masses and cerebral displacement are being explored, as well as methods to evaluate cerebral perfusion. Ultrasound methods are being tested in order to provide means for the detection of vascular lesions by measuring frequency alterations due to the Doppler effect. Plans are to develop techniques to detect and visualize areas of vascular malfunctions, especially in the cerebral systems, by means of thermography. This method is based on the measurement of emission of infrared (heat) waves. The emission spectrum is influenced by vascular lesions and underlying tumors. Early tests have yielded satifactory results, but engineering changes of existing equipment have to be made in order to provide more effective means for mass screening. This is being done in cooperation with the Bioengineering Project of the Missouri Regional Medical Program.

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A special progress report on Federal Health Programs published by the National Health Education Committee includes the following items:

—The death rate in the U. S. is now as low as it has ever been in history. It is 3% lower than it was in 1963.
—Cancer, the "number two killer of Americans," claimed 300,000 lives in this country last year. *But* one cancer patient in three is now being saved, against one in four just a few years ago.
—Our infant death rate has declined 13% since 1963 to a record low of 22 deaths per 1000 live births in 1967.
—There's been a 19% decline in rheumatic fever and chronic rheumatic heart disease deaths since 1963; a 22% decline in the same period for hypertensive heart disease fatalities; a 21.6% decline in chronic and unspecified nephritis and other renal sclerosis deaths; and a 5% decrease in mortality from vascular lesions affecting the central nervous system (strokes).

In explaining various federal programs that are helping to bring about these striking improvements, the Report discusses the Regional Medical Programs and, among them, singles out "the Missouri Region (which) is pioneering new services to enable doctors and patients anywhere in the area to use computer-assisted X-ray diagnosis and other advanced techniques." The Coronary Care Unit as a concept for local and community hospitals is also credited for helping bring about these reductions.

JOHN C. LYSEN, Ph.D.* *and* ALLEN PURDY, M.S., *Columbia*
Project Director and Deputy Project Director, MRMP

Bioengineering in MRMP

The team of bioengineers of MRMP assist the Program by testing, measuring and developing devices and equipment that will aid the physician in diagnoses and treatment of patients. The authors report that the results of their efforts include the development of a diagnostic chair, a cerebrospinal fluid pressure monitor and a therapeutic current generator for the rapid healing of decubitus ulcers.

BIOENGINEERING IN MRMP is perhaps a misnomer. A more appropriate name in this case might be medical engineering. If this calls to mind a man in white coat with a stethoscope hanging out of one pocket and a slide rule sticking out of the other and surrounded by numerous wires, tubes, pumps, transistors and IBM cards, then the image is correct.

The human body, as viewed through the bioengineer's eyes, is the most exquisite machine of all. Where else can one find every known principle of engineering (and unknown, too) in one bundle, topped by a computer unrivaled by artificial means?

The relationship of bioengineering to MRMP springs from the object of MRMP, i.e., to deliver the best possible medical care to as many people as possible. To this end, we seek to assist and extend the hands, eyes, ears and, presumptuously, the wisdom of the physician.

In real terms, this takes several forms:

A. *Sensing and quantitation* of physiological information with the use of all available engineering sophistication needed for that task. This means searching for or originating designs and the actual construction of prototypes to that end.

B. *Signal Conversion.* Sensing (or transducing) of information usually results in electrical analog signals. These signals must be converted to meaningful numbers or language for the physician. This takes the form of analog to digital conversion, digital computing and a read out system. Bioengineering shares this function with the engineering computer team.

C. *Advisory Service.* The physician and medical researcher are often faced with the problem of matching different brands of equipment or the selection of equipment to work in a given environment. To assist with this problem, we have amassed an extensive file of the latest commercial equipment available. Further, we are able to recommend modifications for a successful installation. Bioengineering also maintains contact with the Midwest Research Institute for the retrieval of medical research information.

One of the major efforts of the bioengineering group is directed toward multiphasic screening The diagnostic chair is an outgrowth of these efforts. The diagnostic chair records spirometry, pulse wave velocity, automated blood pressure, heart sounds (including vibrations) and automated EKG. A working model of the chair has been built and is capable of transducing pulse waves, heart acoustics and three lead electrocardiograms. In addition, the commercial apparatus used in conjunction with the chair will allow the taking of spirograms and automatic blood pressure. At the present time, this information can be gathered in less than three minutes. We currently are involved in computer analysis of this information as well as improvement of the apparatus. In addition to assisting in the evaluation of the above data, computer analysis will calculate cardiac output (90% correlation with the Fick Method).

To help achieve the MRMP goals, a number of other projects have evolved from without and within our group. A cross-section showing the widely variable character of these bioengineering projects is as follows:

—A cerebrospinal fluid pressure monitor. This unit gives a continual readout of CSF pressure.

—A therapeutic current generator for the rapid healing of decubitus ulcers.

—Application of ultrasound to organ location and possible atherosclerosis diagnosis.

—A simple rapid method of damping cardiac catheters for maximum frequency response

(Continued on page 745)

* Doctor Lysen is Director of the Engineering Experiment Station at the University of Missouri.

DONALD A. B. LINDBERG, M.D. *and*
P. RUDOLPH AMLINGER, M.D., *Columbia**
Project Director and
Deputy Project Director, MRMP

Automated Analysis of the Electrocardiogram

Focusing on a technique of computer processing of electrocardiograms developed by the U. S. Public Health Service, the authors are seeking to develop a working system in Missouri using telephone lines to link outlying areas with a central computer at the University Medical Center for rapid and accurate reading and interpreting of EKGs. They discuss their efforts in detail and report that the system is now in daily operation in the offices of six collaborating physicians or groups of physicians.

IT IS OUR INTENT to start with a system for computer processing of electrocardiograms which was designed and produced by Cesar Caceres, M.D. and his colleagues at the Instrumentation Field Station of the Heart Disease Control Program of the United States Public Health Service. We wish to make this system available, so far as we are able, to a large group of physicians in a number of communities within and, also, eventually outside the Missouri Region *to assist* them in interpreting their patients' electrocardiograms. Selection of the Caceres system for implementation as a Missouri Regional Medical Program project followed a very careful study and evaluation of all alternative systems.

We wish to provide for collaborating physicians in medical settings outside of Columbia the appropriate "data acquisition carts" and related equipment so that they can make recordings of their patients in the usual fashion, produce a traditional paper tracing for their inspection and, also, transmit a magnetically-recorded version of the same examination via telephone lines to Columbia for parallel computer interpretation.

Existing "dial up" telephone lines are being used, along with a Wide Area Telephone Service (WATS) billing arrangement. No special private or leased lines will be employed unless it can be shown that the telephone connections truly limit the operation of the system.

We will be selecting additional collaborators (through an appropriate advisory committee) primarily with the objective in mind of testing our system in a large number of different medical settings. Only the collaborating physicians in those communities can tell the profession about the true contribution to care or to saving of physician time contributed by operation of the system.

Our ultimate objective, should all preliminary testing phases end satisfactorily, is to provide 24-hour-a-day computer service via telephone with reasonably short "turn around time." Within the present project, cardiographic signals will be recorded on high quality tape in Columbia and batch processed by the computer. The results will be returned to a teletype printer in the collaborating physician's office as soon as possible. An important issue for us to resolve in this setting is one familiar both to physicians and computer men, namely, how to balance the economic advantages of batch processing against the convenience of immediate processing.

An objective for future study is to determine the medical worth of simple automation of the interpretation of the electrocardiographic signal as opposed to all of the other benefits ordinarily derived from consultation with a cardiologist.

SYSTEMS DESIGN

Fig. 1 presents the arrangement of necessary equipment. Fig. 2 reproduces an actual interpretation as it was received in the collaborator's private office. Fig. 3 presents a portion of the criteria by which the computer program judges the electrocardiogram.

* Doctor Lindberg is Associate Professor of Pathology and Director of the Medical Computer Center and Doctor Amlinger is Associate Director of Physiological Monitoring of the Medical Computer Center at the University of Missouri School of Medicine. This investigation is supported by USPHS grant 3-503-RM-0009.

STATUS OF THE INVESTIGATION

Data acquisition carts and telephone data sets have been installed in the offices of six collaborating physicians or groups of physicians. They include Cecil Auner, M.D., Springfield; C. L. Clark, M.D., Trenton; Wallace D. English, M.D., Cardwell; P. Hill, M.D., Kansas City; Jack M. Mart, M.D., Columbia; and B. M. Stuart, M.D., Boonville.

The system is in daily operation, except for the expected delays associated with malfunctioning new equipment. Breakdowns of the data acquisition carts in the doctors' offices have been relatively more common than we originally expected. The computer operates from 8 AM to midnight on Monday through Friday and from 8 AM to 5 PM on Saturday. During those hours, we are able to assure collaborators of immediate (10-20 minutes) processing of any examination they classify as a medical emergency. The remainder are getting out on a "same day" basis.

Our present collaborators are testing the system in the following different medical settings: a University medical center; the heart station of a community hospital with cardiologists; a community hospital without cardiologists; a city hospital emergency room; the office of a private physician in solo general practice in a small com-

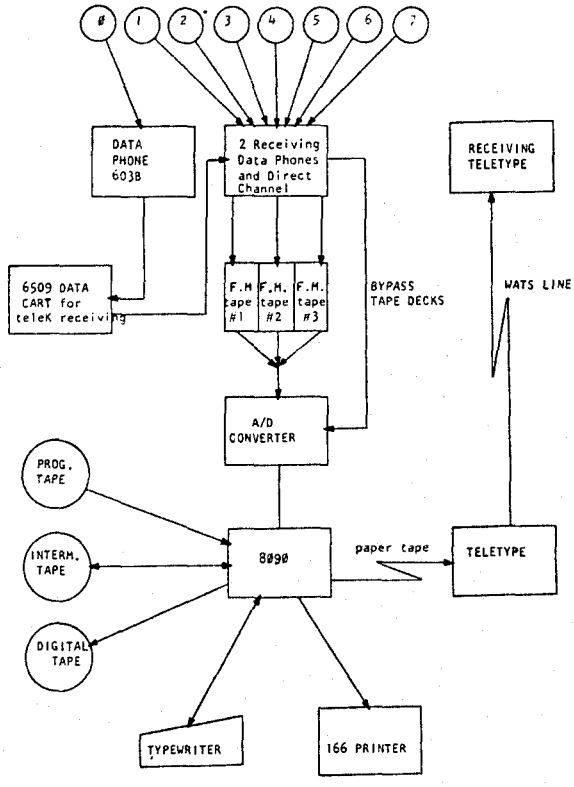
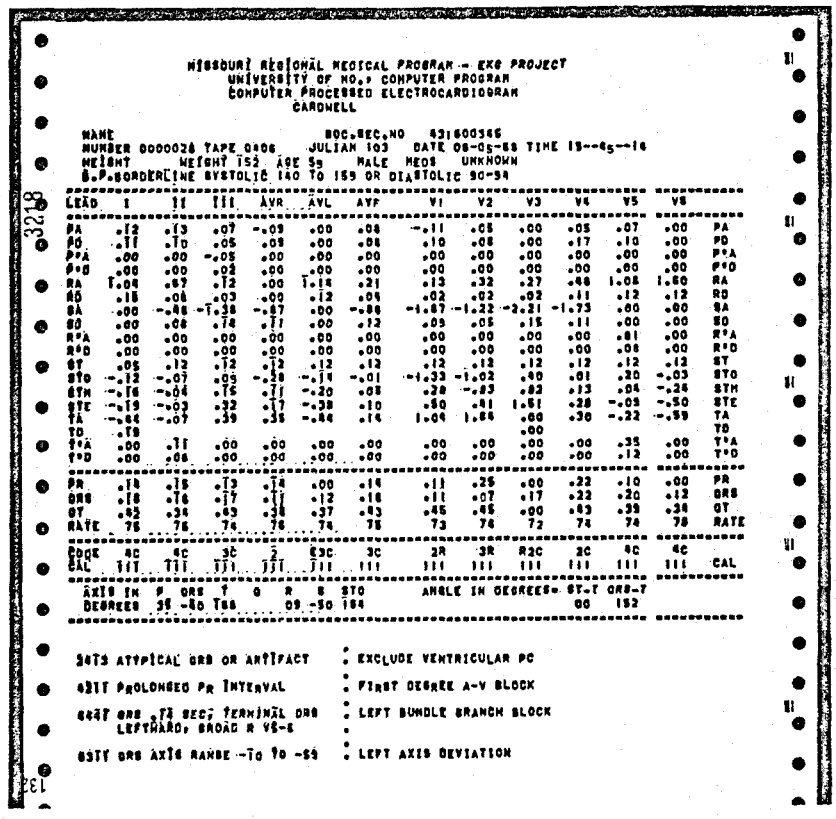


Fig. 1 MRMP automated EKG project system's blockdiagram.



MISSOURI REGIONAL MEDICAL PROGRAM - EKG PROJECT
UNIVERSITY OF MO.,* COMPUTER PROGRAM
COMPUTER PROCESSED ELECTROCARDIOGRAM
CARDWELL

NAME BOC.SEC.NO 431600346
NUMBER 0000028 TAPE 0006 JULIAN 103 DATE 08-05-68 TIME 19--45--14
HEIGHT WEIGHT 152 AGE 58 MALE MEDS UNKNOWN
B.P.BORDERLINE SYSTOLIC 140 TO 159 OR DIASTOLIC 90-94

LEAD	I	II	III	AVR	AVL	AVF	V1	V2	V3	V4	V5	V6	
PA	.12	.13	.07	-.09	.00	.08	-.11	.05	.00	.05	.07	.00	PA
PD	.11	.10	.05	.08	.00	.08	.10	.08	.00	.17	.10	.00	PD
P*A	.00	.00	-.05	.00	.00	.00	.00	.00	.00	.00	.00	.00	P*A
P*D	.00	.00	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	P*D
RA	1.04	.87	.12	.00	1.15	.21	.13	.32	.27	.48	1.08	1.60	RA
RD	.15	.08	.03	.00	.12	.04	.02	.02	.02	.11	.12	.12	RD
SA	.00	-.48	-1.38	-.87	.00	-.88	-1.87	-1.22	-2.21	-1.73	.00	.00	SA
SD	.00	.08	.74	.77	.00	.12	.05	.05	.15	.11	.00	.00	SD
R*A	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	R*A
R*D	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.08	.00	R*D
ST	.05	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	ST
STO	-.12	-.07	.05	-.28	-.14	-.01	-1.33	-1.02	.40	.01	.20	-.03	STO
STM	-.16	-.04	.16	.11	-.20	.08	.28	-.83	.82	.13	.04	-.28	STM
STE	-.19	-.03	.32	.17	-.38	.10	.60	.41	1.61	.28	-.09	-.50	STE
TA	-.44	-.07	.39	.35	-.44	.14	1.04	1.84	.60	.30	-.22	-.59	TA
TD	.19								.00				TD
T*A	.00	.11	.00	.00	.00	.00	.00	.00	.00	.00	.35	.00	T*A
T*D	.00	.06	.00	.00	.00	.00	.00	.00	.00	.00	.12	.00	T*D
PR	.14	.15	.13	.14	.00	.14	.11	.25	.00	.22	.10	.00	PR
QRS	.18	.16	.17	.11	.12	.16	.11	.07	.17	.22	.20	.12	QRS
QT	.42	.34	.43	.38	.37	.43	.45	.45	.00	.43	.39	.34	QT
RATE	76	76	74	76	74	75	73	74	72	74	74	78	RATE
CODE	4C	4C	3C	3	83C	3C	2R	3R	R2C	2C	4C	4C	
CAL	111	111	111	111	111	111	111	111	111	111	111	111	CAL

AXIS IN P QRS T Q R S STO ANGLE IN DEGREES- ST-T QRS-T
DEGREES 36 -86 166 09 -30 164 66 152

3&T3 ATYPICAL QRS OR ARTIFACT : EXCLUDE VENTRICULAR PC
4&1T PROLONGED PR INTERVAL : FIRST DEGREE A-V BLOCK
6&4T QRS .12 SEC; TERMINAL QRS LEFTWARD, BROAD R V5-6 : LEFT BUNDLE BRANCH BLOCK
8&1T QRS AXIS RANGE -76 TO -89 : LEFT AXIS DEVIATION

Fig. 2 Teletyped measurements' matrix and diagnostic statement received in doctor's office.

MYOCARDIAL INFARCTS

Diagnostic Statement	*Criteria*
Poor R progression V leads. Consider old infarct or fibrosis	R ⩽ 0.15 MV both V2 and V3, or either V4 or V5
Atypical Q V2 or V3. Consider old infarct or fibrosis	Q ⩾ 0.07 MV in V2 or V3
Small R2 Leads V2-V5. Possible old infarct—anterior or fibrosis	R ⩽ 0.10 MV in 2 leads V2-V5
Absent R2 leads V2-5. Consistent with old infarct—anterior	R Absent 2 leads V2-5
Small or absent R and negative T 2 leads V2-5. Consistent with age undetermined infarct—anterior	Either of preceding 2 R criteria and T or T′ ⩾ −0.10 MV in 2 leads V2-5
Small or absent R and elevated ST 2 leads V2-5. Consistent with acute infarct—anterior	R Wave criteria as above and STO ⩾ 0.15 MV in 3 leads VI-5
	QRS peak to peak must be ⩾ 0.20 MV
Questionable @ 2 leads I, AVL, V5-6. Possible old infarct—anteriolateral	1) Q at least 0.04S C and ¼ R amplitude 2) Another Q at least 0.03 (OR) ¼ R amplitude 3) QRS peak to peak at least 0.20 MV 2 leads 1, AVL, V5-6

NOTE: ⩽ means equal to or less than; ⩾ means equal to or greater than.

Fig. 3 Examples from the computer program developed by the Medical Systems Development Laboratory of USPHS: Version of Jan. 31, 1968.

munity; and a medical group in a medium-size town. Daily operation has revealed several classes of problems which were largely unexpected by us. Solutions, so far, have been satisfactory. Additional data carts have been ordered and additional medical settings are being examined.

Brief experience with the system so far confirms Caceres' previous claims.[1] Specifically, the system is 100% correct when it classifies a tracing as "normal." It is incorrect less than 15% of the time in its abnormal interpretation. Many (about 5%) of these instances constitute minor and/or insignificant deviations from the interpretation of reference cardiologists.

The simple provision of an electrocardiogram interpretation has so far seemed worthwhile.

In addition, we are creating prerecorded audio messages related directly to the computer interpretations for a "dial up" telephone medical lecture system.[2] We believe this system will partially relieve the absence from the computer/EKG system of true cardiologic consultation. Collaborators in the preparation of the audio lectures include Drs. Allen Bures, Cesar Caceres and Frank Brand.

Comparison With Other Systems

Fig. 4 presents a comparison of salient features of some of the major computer/EKG systems. We have made arrangements for parallel interpretation of selected tracings with other computer systems throughout the next two years in order to be able to recommend the very best system for this region.

Future Plans

We would hope to serve a maximum number of communities. To do this, it may be necessary to reprogram the existing system in order to use more efficient, more modern computers.[3] Alternatively, collaborators may be able to work with us and Doctor Caceres to improve and render the existing system more efficient. Caceres is personally investigating the possibility of production by private industry of small, special purpose computers to be dedicated only to interpretation of the electrocardiogram. If these prove to be sufficiently inexpensive, we may be able to test them in selected communities which would then be totally independent of the Columbia computer center.

Amlinger and Carlson[4] are testing a preprocessing circuit which may be able to reliably classify a tracing as "normal" or "abnormal" without use of an expensive general purpose computer. This would radically reduce the cost of processing and increase the number of communities we could serve.

Engineering collaborators in the Missouri Regional Medical Program are exploring the problem of mass screening data acquisition devices. Cox at Washington University, working independently, has been investigating the use of a special computer for on-line processing of various physiological signals, including the electrocaridogram. This work has focused on the problem of the intensive care facility.

All present systems fail to provide for a large data file to store concisely the results of previous electrocardiographic signals and interpretations. We plan during future years to be able to con-

	PHS-Caceres	Mayo Clinic/IBM*	Mt. Sinai Hospital	Queens Univ.
Does MD get 12 lead tracing	Yes	Yes	Yes	Yes
Computer interpretation based upon 12-lead scalar system	Yes	No	Yes	Yes
Computer based on 3-lead vector system	No	Yes	No	Planned
Computers utilized	CDC 8090, or CDC 160A	IBM 1800	(IBM 1401) IBM 360/40	PDP-8 and IBM 360/50
Published medical evaluation	See note 1	See note 2	See note 3	Not yet completed
Data Carts	CIC (Computer Instruments Corporation)	Marquette Electronics	IBM Experimental Data Console	CIC
Telephone connections	Hartford Hosp: Private leased line Missouri: ordinary "dial up"	Private leased line	In-house connections	Undetermined

* Dr. Robert A. Stratbucker of the University of Nebraska also is utilizing the Mayo/IBM System.
Note 1. Computers, Electrocardiography and Public Health, A report of Recent Studies From the Instrumentation Field Station, Heart Disease Control Program, Div. of Chronic Diseases, U. S. Public Health Service, Dept. of Health, Education and Welfare, Washington, D. C.
Note. 2. Smith, R. E. and Hyde, C. M.: A Computer System for Electrocardiographic Analysis, Third Annual Rocky Mountain Bio-Engineering Symposium, Univ. of Colorado, Boulder, Colorado, May 2-3, 1966.
Note 3. Pordy, M. D. *et al:* Computer Aanalysis of the Electrocardiogram. Journal of the Mount Sinai Hospital, Vol. XXIV, No. 1, January, 1967.

Fig. 4 Features of selected systems for interpretation of electrocardiograms by computer.

tribute this feature and, also (with collaborators), to encode the requisite rules for comparing within the computer new and old tracings from the same patient.

All of these efforts have been based upon "the expert cardiologist" as the reference against which any new system is measured. In the meantime, other groups of mathematicians and biostatisticians are looking toward new techniques with which a computer system could extract from the electrocardiogram information which the human viewer cannot see by present methods of inspection. This is an exciting time. The next five years will see major changes and improvements in electrocardiography.

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Bioengineering (Cont'd)

and minimum artefact.

—A rapid portable system of obtaining six EKG leads simultaneously.

As might be expected, serendipity is bound to occur. In the case of bioengineering, we have stumbled onto an electrostatic wave surrounding the human body with up to five times the voltage of an EKG signal. It pulses at the heart rate with its own peculiar wave form. We don't know the origin or method of modulation of the wave, but only that it is there. One suggested use of the phenomenon is monitoring without attachment of gadgetry to patient.

We are prepared to dream and to imagine, but we are prepared through basic knowledge in medicine and engineering to convert dreams and imagination into useful hardware and systems of an advanced nature to provide more accurate, reliable, durable, economical and simple-to-use equipment for patient care.

GLENN O. TURNER, M.D., *Springfield**
Project Director, MSMP

The Community Approach to Reduction of Cardiovascular Deaths

A preliminary summarization of the unit recommendation of the Project Staff of the MRMP Comprehensive Cardiovascular Care Unit in Springfield as expressed by Doctor Turner in collaboration with Dr. Cecil R. Auner, Associate Director and Dr. John J. McKinsey, Advisory Committee Chairman. The author details the need for and the development of a community-supported Comprehensive Cardiovascular Care Unit with specific reference to his experience in Springfield, where such a unit is well underway under the aegis of MRMP.

WOULD YOU BELIEVE that there is within our grasp a medical advance, the most important in a decade, that could save as many lives per year as were lost each year of World Wars I and II? Corday[1] draws this comparison, even if only half of the 100,000 potential reported by Wakerlin[2] is actually achieved. The means to this end is the application of the Coronary Care Unit Concept in all our hospitals.

Fox[3] reported that 350,000 of the nearly 600,000 who die annually in this country from heart attacks arrive at the hospital alive (250,000 die without benefit of hospitalization). The Coronary Care Unit can reduce the inhospital death rate from approximately 30% to about 20%, resulting in the saving of roughly one third of the 350,000 who are still alive upon arrival. Using these figures, Corday's estimate of a possible 50,000 lives saved per year is, indeed, modest.

Fox reports that, as of June, 1967, only 300 of the nation's 7,000 hospitals had coronary care units in operation. Even doubling or tripling this number of units during the past year would have left more than 6,000 hospitals without such modernized service. Extending this improved care into these remaining hospitals presents the greatest challenge the American health team has yet faced.

Preservation of future earnings of this one third of heart attack admissions who were saved justifies a major community expenditure in improving coronary care. Add to this the potential lifesaving from bringing about, by earlier recognition of and attention to warning signs, hospital admission of some of the 250,000 who now die each year at home or at work, and one is even more impressed. Heart damage and deaths in those admitted also can be reduced by earlier entry of all coronary patients. Additionally, applying intensive treatment methods to other high risk cardiovascular patients will swell the total of lives saved. Ultimately, actual prevention of heart disease through attention to "Risk Factors" is now foreseeable.

The Project Staff of the Ozarks Regional Comprehensive Cardiovascular Care Unit in Springfield is undertaking these objectives on a regional basis under a grant from Missouri Regional Medical Program. Incomplete, capsulized results of the first year of this study are as follows:

1. *Promptness of recognition and hospital admission* of heart attack suspects is the prime consideration. In the Ozarks an initial effort to teach the people the early warning signs by the Greene County Division of the Missouri Heart Association by mass media communications led to a proposal for a pilot public information program under Missouri Regional Medical Program. Such a program also should stimulate physicians to respond more promptly and more definitively to early heart attack manifestations. Pain in the substernal region, back, jaws, arms or combinations of these areas and otherwise unexplained dyspnea or sweating frequently can be interpreted accurately enough by telephone to justify immediate admission as a heart attack suspect and, often, to permit by-passing outpatient facilities. Systems of more rapid ambulance transport of patients with emergency care capability en route should be developed.

2. *Bed needs for the establishment* of a cardiovascular care unit can be determined most simply by a patient count and classification of the entire hospital population. This can be done

* Doctor Turner is in the private practice of medicine.

by one physician in less than a day and can be repeated on other days by other physicians for confirmation. The Springfield group feels that all high risk cardiovascular patients should be tallied for probable inclusion in a specially staffed and equipped cardiovascular division. These include proved or suspected acute myocardial ischemia and infarction, congestive failure, arrhythmias, pulmonary embolism, thrombophlebitis, hypertension, cardiacs with other medical and possibly surgical problems and, perhaps, acute strokes. Pulmonary insufficiency also deserves similar care. Not only can this grouping reduce the number of emergencies that arise, but resuscitation efforts also can be enhanced by doing away with the "galloping exercise that ends in failure." In February, 1965, the initial such count in St. John's Hospital showed 75 of the total 450 patients to be in such a high risk cardiovascular category. This one count alone led to the restriction of an entire 40 bed hall, by rigid admitting policy, to these patients. Validity of the count was immediately shown by the inadequacy of this number of beds in meeting the needs as reflected by requests of staff physicians for admission of their patients to this newly-created division. This count (Fig. 1) can be carried out in any hospital with the anticipation that roughly 10% to 25% could be classified as benefitting from grouped, specialized care.

3. *A progressive care system with three zones,* acute, intermediate and convalescent should be provided in one common area. The acute zone should include intensive and "observation" beds. The ratio of beds needed in these areas can be determined from the patient tally. Underestimation of needs as utilization increases was one of the most common deficiencies noted elsewhere by Springfield teams.

4. *A cardiovascular hall or division,* including an intensive unit, can be established in almost any hospital to accommodate these patients, once bed requirements are ascertained. Existing construction usually can be used. One device for provision of intensive care is to knock out portions of walls between rooms and to install a door and large windows extending down to or below bed level to give easy access and full visibility.

5. *Subdivision of the intensive care unit* into "quiet" and "noisy" areas will permit reception

CARDIOVASCULAR DISEASE CENSUS, ST. JOHN'S HOSPITAL, BY DIVISION

FEBRUARY 5, 1965

		4N	INT	5W	4W	3W	2W	GW	4E	3E	2E	PIUS	TOTAL
1.	Acute Myocardial Infarction and/or ischemia	6	1	2	1		3	4		1	2	1	21
2.	Chronic Coronary Disease	3						1				2	6
3.	Congestive Failure	2		1	1		1	1		3	1	1	11
4.	Stroke	3		3				1	1				8
5.	Seizures, miscellaneous			1	2				1				4
6.	Chronic Cor Pulmonale	1			1			1					3
7.	Pulmonary Embolism												
	a) Complicating leg fracture				3								
	b) Complicating abdominal surgery	1											
	c) Complicating Phlebitis, without surgery									2			
	Total Pulmonary Emboli												6
8.	Arrhythmias, acute				1						1		2
9.	Arrhythmias, chronic				1								1
10.	Hypertension				1								1
11.	Congenital Heart Disease								1				1
12.	Acute Rheumatic Fever								3				3
13.	Pericarditis	1											1
14.	Bleeding Esophageal Varices	1											1
15.	Ruptured CNS Aneurism		1										1
16.	Chronic Coronary Disease, in for Surgery			1				1			1	2	5
	Total	18	2	8	11	0	4	9	6	6	5	6	75

Fig. 1 Patient Survey. This rough tabulation of high risk cardiovascular patients in St. John's Hospital on Feb. 5, 1965, led to establishment of pilot 40-bed comprehensive cardiovascular care unit.

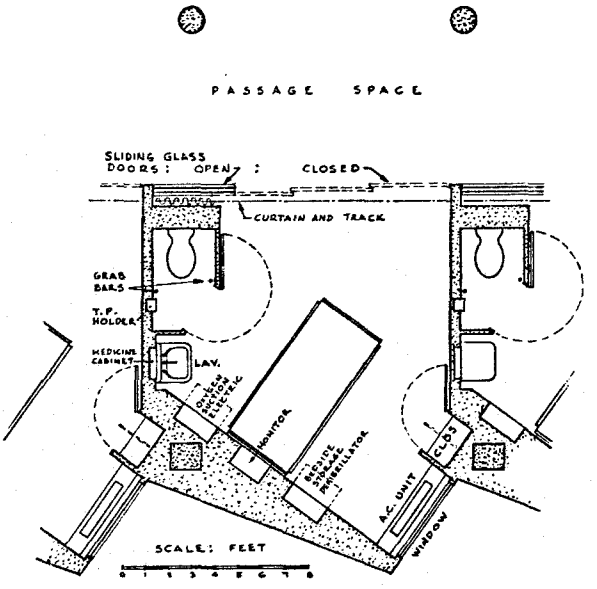

Fig. 2 Model Room Floor Plan. Floor plan of "saw-tooth" design of one of 14 rooms in round unit for observation of less complicated acute patients (six-bed intensive unit is separate).

of patients of varied requirements. This arrangement also lends itself to a combination with general medical-surgical I.C.U. Staffing problems will be less with this comprehensive grouping than with permitting these zones to be scattered throughout the hospital. Nurse instruction is simplified and there is better back-up for any overloaded component. Patients can be shifted within the division with ease as they improve or worsen.

In new construction, one can incorporate into the "observation" or uncomplicated acute care area the following desirable features (Figs. 2 and 3):

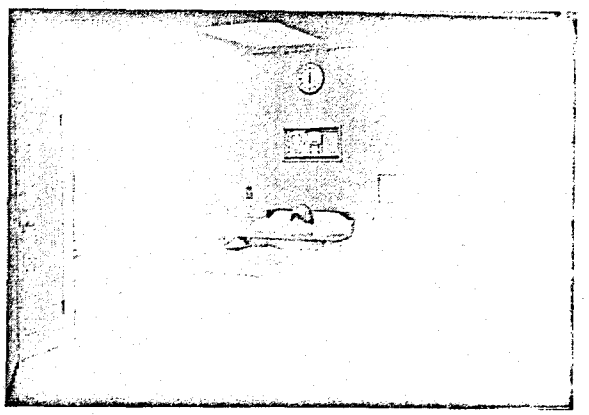

Fig. 3 Model Room. Photo of room represented by floor plan sketch in Fig. 2. Over-the-bed auto-headlight-type, recessed reading light and oxygen-and-suction outlets have not been installed.

a. Direct visual surveillance, in addition to electronic.
b. Recessing of gruesome monitors and other gear.
c. Outside windows with low sills.
d. Bathrooms, which do away with that monstrosity, the commode. A couple of steps into the bathroom is surely less stressful than the commode or bedpan.
e. Carpeting and acoustical ceilings for noise control.
f. Power drape operation—cost is about $70 per room.
g. An abundance of electrical outlets, including at least one 220 volt line.

6. *Bedside defibrillator provision for each patient is ideal.* Saving the life or brain function of just one wage earner by this means of cutting off that precious fraction of a minute would pay for numerous defibrillators.

7. *The following ancillary services* ideally should be in or near the cardiovascular division:

a. Department of electrocardiography, bearing in mind possible later application of central recording and of computerization.
b. Inhalation therapy department.
c. Cardiopulmonary laboratory, including blood gas analysis, where feasible.
d. Procedure room for cardioversion and pacemaker placement.
e. Exercise tolerance evaluation.

8. *Radiographic service should be intensified.* The Springfield group agrees with Meltzer[4] that congestive failure, the second most death-dealing complication of acute myocardial infarction, can be treated more effectively if recognized earlier through frequent chest x-raying. Furthermore, even low output portable equipment can be successfully used by well-trained technicians to obtain six foot sitting PA films for determination of heart size and pulmonary vascularity (Fig. 4). Radiologists are urged to routinely record heart size on films and reports in cardiac roentgenography. A difference of one cm. or less may be significant on serial study. Also, there should be a greater index of suspicion in looking for early increases in vascularity.

9. *Telephone EKG transmission,* preferably utilizing bedside magnetic tape recording which permits sending a number of tracings with one phone call, will give same-day reporting and will eliminate one of the most serious deficiencies in hospitals without an electrocardiographer.

10. *Radio telemetry will expand EKG surveil-*

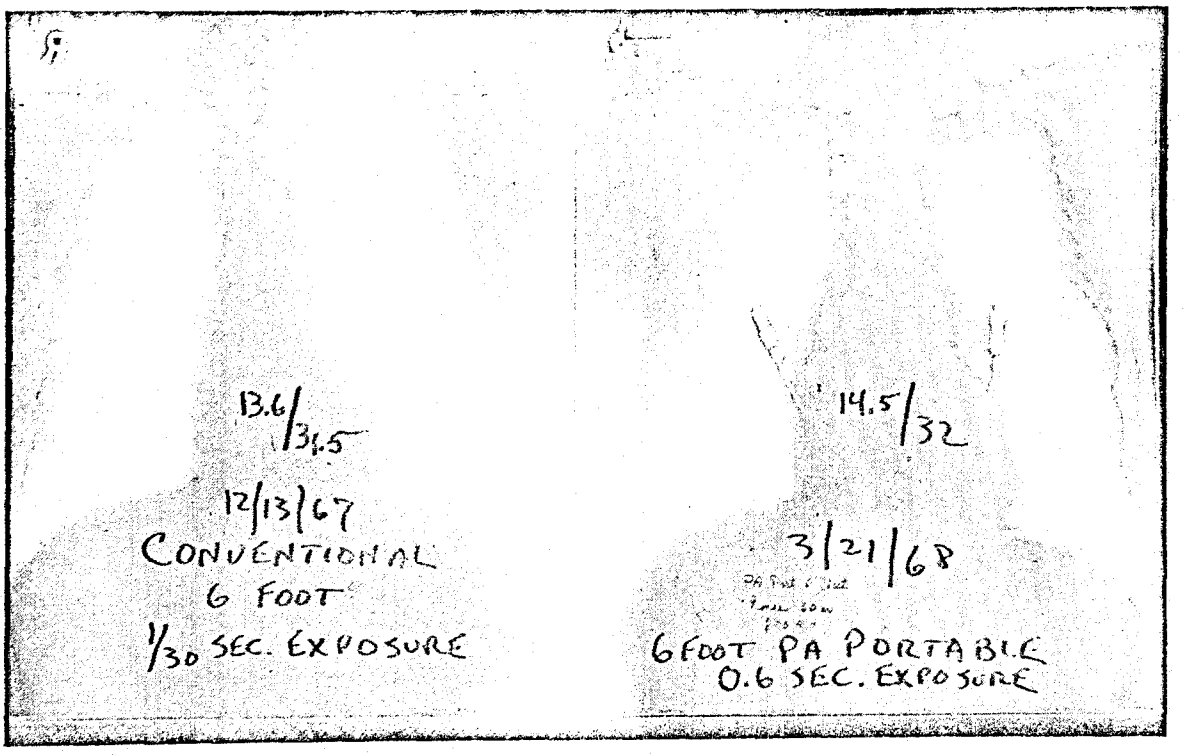

Fig. 4 X-Ray Photo. Comparison of conventional versus ICU portable techniques to show significant alteration in heart size and pulmonary vascularity (latter is more obvious on original films). Monitor needle electrodes are in place.

lance into intermediate and convalescent zones. Length of stay in the acute care zone can be diminished, perhaps, by this means.

11. *Financing of instrumentation* and possibly meeting other costs should be actively sought through civic groups, particularly hospital ladies' auxiliaries. This can reduce daily rates by several dollars.

12. *Nursing staff, relatives' lounges* and teaching and conference rooms should be better planned.

13. *LPN and nurse aide utilization* can be very effective in cardiovascular care units, including reading monitor scopes. In addition to holding costs down, they permit expansion of services into the areas of RN shortage.

14. *Defibrillation by nurses* is mandatory for maximum service to the patient. Not providing this capability may soon be legally indefensible.

Specialized cardiovascular training for nurses must be expanded. Under Missouri Regional Medical Program and other interested groups and agencies, an early objective should be the provision of training facilities to enable each hospital in the Missouri Region to have one or more such specially trained nurses. These nurses, under continued guidance of nursing instructors and with time for travel to community hospitals, can organize local teaching programs. Instituting this system of consultation in Missouri is the ambition of the Springfield group. These nurses are the key to the entire program and must be given special recognition and encouragement. Physicians will find that they can learn a great deal in the specifics of cardiovascular unit operation from them and also will be stimulated in their own study.

15. *Physician education* will accelerate as the potential and mechanics of the entire program are made more clear. Workshops and conferences designed for the community hospital, ideally cosponsored by Regional Medical Programs and the Heart Association, will best accomplish this goal. The Springfield MRMP Project Staff and the Missouri Heart Association are now planning such a workshop for October, 1968 to be offered statewide.

16. *Hospital administrator and governing board participation* in unit development is an obvious necessity. The latter serves as representation of the taxpayer and of the purchaser and consumer of health services.

17. *Alliance with health agencies,* both gov-

(Continued on page 753)

HENRY M. HARDWICKE, M.D., *Columbia**
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The Smithville Project

An Evaluation

The SMITHVILLE PROJECT of the Missouri Regional Medical Program attempts to measure the assumption that if comprehensive care were made available to the people of a given medical service area, the people of this area would (a) profit from the extended medical knowledge available to them, (b) demonstrate acceptance of comprehensive medical care which would be meaningful in their lives, (c) exhibit less ambivalence in cooperating with the physicians' directives, (d) develop an innate motivation toward increasing their own productivity and lowering their own morbidity and, in addition, that (e) the comprehensive care, having been made available to a medical service area, will inculcate within the consumers of this care the type of discipline which makes the care most effective.

The Smithville Project also set out to measure the degree to which physicians in practice within the given medical service area would avail themselves of the totality of comprehensive care. It also attempted to measure the extent to which physicians, given an appropriate time for learning and for familiarization with comprehensive care, would accept it as a way of medical practice.

The purpose of the Smithville Project was, therefore, to determine and to focus upon those inadequacies of current practice of which the physicians were aware. Once these inadequacies had been determined, the purpose was to supply the equipment and the necessary backup personnel so that inadequacies would no longer exist. The aim of the Smithville Project was, consequently, to shorten in one dimension, namely, time, the progress which physicians in the area were currently making toward providing their patients with a total kind of care to which they were receptive.

It is important to point out that the Smithville Project did not set out to provide comprehensive care to a community. It did not set out to direct the doctors in the manner in which they were to provide medical care to their patients, nor did it set out primarily to lower morbidity or mortality or absenteeism within the medical service area chosen.

The Smithville Project *did* set out to prove what we believe to be a valid assumption—if physicians were given the equipment and the backup personnel which, for financial reasons, they currently did not have available but which they felt were needed, these same physicians would proceed to give the very best quality medical care that they were capable of giving in the most comprehensive manner that their patients would accept.

SELECTION OF THE MEDICAL SERVICE AREA

Smithville appeared to be ideally structured for conducting research of this type. The Smithville Hospital, an economically self-sufficient unit serving approximately 75,000 people and staffed with some 38 doctors, was currently providing the best medical care that equipment, training and time permitted.

Smithville, as a medical service area, also was unique in that Dr. Arch E. Spelman had founded the hospital, had developed a clinic adjacent to it and had acted as Medical Director of the Hospital and the Clinic without being so named. His personality was dynamic, his knowledge of medicine tremendous, his interest in people unending. For many years prior to the initiation of the Smithville Project, Doctor Spelman had been interested in studying the complexities of a patient's illness. He was acutely aware of the role that environment, economics and emotional stability played in the well-being of his patients. He also was aware of and had studied rather intensely the effects that sudden illness had upon the stability of an entire family. He, in short, had developed the habit of practicing medicine in depth. His work and his records will prove of

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great value when the final story of the Smithville Project is written.

Smithville is a "ruralpolitan" area. The medical service area contains both well-established agrarian families whose roots are deep in the soil and whose mores and traditions are strong and a large number of suburbanites who had moved into the Smithville medical service area from Kansas City where they still maintain employment. This area, therefore, offered an interesting cross-section of the American scene. The interplay of social forces are inevitable under these circumstances.

This evaluation of progress made during the first year at the MRMP project in Smithville includes a review of the basis for selecting this medical service area, the initiation of the project and the implementation of the program. The author emphasizes that the MRMP is not attempting to change the practice of medicine in Smithville. The goal is to establish a model which, having been developed by the physicans practicing in that community, may be utilized with effectiveness in other interested areas.

INITIATION OF THE PROJECT

The scope and intent of the Smithville Project were presented to the Board of Directors of the Smithville Community Hospital at their regular monthly meeting in February, 1967. After a perceptive discussion of the proposed project by the Board, it voted unanimously to submit the Project to the staff for its approval. The Board further voted that if the staff approved the Project, the Board would endorse and support the Project.

Two meetings were arranged with the active staff. The first took place within the first week of March, 1967. The meeting, interestingly, was held at a hotel in Kansas City, the place of the meeting being established by the active staff.

At the first meeting with the staff, the Project was presented for their comments and consideration. This meeting was devoted, for the most part, to a discussion by the staff of their deep feelings concerning federal funds being brought into the practice of medicine. It could well have been classified as a psychotherapeutic group meeting. It was our feeling that a great deal was achieved since the foundations for an honest exchange of views were well laid. It was evident, however, at the end of the meeting that a second meeting to discuss the Project itself would be in order.

A second meeting was held with the active members of the staff in the latter part of March. With some expressed reservations, the staff at this time agreed to participate to the extent that they felt their patients would benefit from the Project. Their reservations all related to the fact that they anticipated that once they had succumbed and become part of the Project, representatives of the federal government would then move in and begin to dictate in what fashion they should practice medicine. They were assured that this would never happen. They also were reminded at this second meeting that the Project was self-limited; that at the end of two and half years all financial support for personnel or additional equipment would be withdrawn; and that equipment purchased for the Smithville Hospital, which had been used sufficiently to justify its continued existence, would be left there. At the end of the second meeting, the staff voted to recommend to the Board that it accept the Smithville Project.

IMPLEMENTATION OF THE PROGRAM

Implementation of the Smithville Project has been extremely difficult. Personnel had to be found in all areas that were lacking within the Smithville medical community. Research-oriented individuals were needed to implement the repeated necessary surveys of the community. These surveys were designed to continually test, on a random sampling basis, the people's attitudes about medicine, their willingness to utilize the medical resources of their community, their mores or traditions that might interfere with their appropriate utilization of medical science. As time went on, surveys would remeasure these same things so that changes for the better or for the worse might be recorded.

Personnel had to be found who would offer expert services in the fields of physical therapy, medical social work, home care nursing, rehabilitation nursing and intensive coronary care nursing. From a purely professional level, resources which were not then present in Smithville had to be recruited in the fields of psychiatry, internal medicine and physical medicine.

It also was necessary to set up administrative devices which made it possible to cost-count the operation of the extended care facility which was to be developed within the existing hospital, of any home care program which was to be started, and of all other programs to be initiated for the physicians in their use of the extended care program.

Slowly, but steadily, administrative mechanisms were developed and personnel were recruited in the several areas. It was impossible to recruit trained intensive coronary care nurses, so it was necessary to recruit nurses who would be willing to leave for training at recognized training centers. Professional personnel are difficult to recruit at best. When they are recruited under special conditions and at salaries usually lower than those paid by hospitals less than 15 miles away, recruiting becomes extremely difficult.

It was possible by June 1 to maintain in the hospital 15 beds which were devoted to extended care. It was possible to recruit and train a rehabilitation head nurse who was responsible for the training of aides and other nurses on her ward. It also was possible to recruit a physical therapist who was registered and had had experience in professional physical therapy. After great difficulty, the services of two well qualified internists and two physiatrists were made available to the group at Smithville.

Things were moving ahead in accordance with schedule.

Suddenly, on Oct. 7, 1967, Dr. Arch Spelman, the prime mover of the program, the prime supporter of comprehensive care in the Smithville area and the founder, builder and developer of the program, died of a coronary. An immediate hiatus of no small magnitude ensued. The staff was disoriented and without leadership; the administrator found himself somewhat inadequate to the many tasks that fell upon him. The members of the University of Missouri Medical Center faculty, who were assigned to Smithville to assist, felt it incumbent upon them to remain aloof from the organizational problems that existed. Any direct participation by members of the team from the University of Missouri probably would have delayed the final resolution of these problems and might well have placed a bias upon the whole study which could not have been tolerated. There actually ensued a period of approximately four to five months in which no real concentrated work was done on the program by the members of the active staff of the Hospital. All the related work was done indirectly by representatives from the Missouri Regional Medical Program. Their task was to maintain as much cohesion and progress as possible under the circumstances.

This was an unexpected complication which, in the long run, probably will move the entire project to quicker consummation than otherwise could have been achieved.

The staff has learned to relate to each other since the death of Dr. Spelman six months ago. Interestingly, the quality of care has not deteriorated, the patient load in the hospital has not decreased and the attention which physicians pay to their patients and their dedication to their patients' welfare has not been altered.

A new staff organization has begun to emerge, the strong have begun to take leadership, the pieces of the puzzle have begun to fall into place and the Smithville Project has begun to move ahead. A new administrator is being actively sought by the Board of Directors. Cost accounting systems which are meaningful are being inaugurated. The management of the Hospital is beginning to assume more definite shape and pattern.

A new extended care pavilion containing 50 beds and a large rehabilitation and occupational therapy area is under construction. Plans already are on the drafting board for a 250-bed acute hospital which will serve as an addition to the present hospital. The nursing home, which was partly finished when the Project began, will now be finished; funds have been raised for its completion. Plans have been altered so that the home will be more usable than its original design would have permitted. It now appears that the Smithville hospital will begin to assume its proper responsibility for the personnel provided by the Regional Medical Program. Six months later than anticipated, the pattern is reassumed and the program continues.

There has been a growing acceptance by local physicians of the role that intensive coronary care facilities and rehabilitation and extended care can play in the lives of their patients. An increasing number of physicians are not only admitting patients to both services, but are supervising their medical care after they are admitted. Consultation is requested only when the physicians feel they honestly need it and not as a matter of routine. The home care program is growing quite rapidly and very satisfactorily. There is evidence now that each of these programs will be self-supporting in the near future. It is probably true that the one aspect of the program that offers the greatest difficulty from a financial point of view is the intensive coronary care unit. It is the most expensive to operate, the one least frequently covered by third party carriers, and the one which those who do not have insurance are least able to afford.

It would appear that the research unit has done its work quite well. An original survey representative of the entire 75,000 people in the medical service area has been completed. The

second survey is now underway to measure, if possible, any change in attitude on the part of the recipients of medical care in the area during the past year. Physicians on the staff are now planning actively to become part of a lay educational program and to conduct lay educational meetings.

PARTICIPATION OF HEALTH AGENCIES

Concentrated efforts have been made to utilize the public health department and voluntary health agencies located within the medical service area. Efforts to inform these groups will be continued as opportunity permits.

EVALUATION

It is hoped that by the end of 1968 it will be possible to institute a retrospective study of those patients who have come under the influence of the extended comprehensive program offered through the Missouri Regional Medical Program conducted by the physicians in practice, and to compare this progress with patients who have not come under the same influences. By the end of 1968, there should be a sufficient number of people in both categories to make such a study meaningful.

Within the next six months, it is hoped that the home care program will prove self-sufficient both economically and from the service point of view. It also is hoped that the intensive coronary care unit will prove to be self-supporting during this same period of time. The balance of the programs appear to be moving in this direction quite rapidly.

SUMMARY

In spite of unexpected difficulties, unexpected sorrows and the expected antipathy and distrust of the practicing physicians toward any program connected to possible federal control, the Smithville Program has moved along in satisfactory fashion. A great deal of work has gone into the Program, both by people interested locally and by those representing the Missouri Regional Medical Program. This work seems to be well justified at this time. We are hopeful that the outcome will be especially rewarding to the recipients of medical care in the Smithville area.

Community Approach (Cont'd)

ernmental and volunteer, provides broadly based support and vast resources of skill and experience. There should be better utilization of USPHS systems development. Partnership with the Heart Association is a key factor.

18. *Local medical society approval* can provide cooperation of all physicians in the community extending beyond any one hospital staff.

19. *News media involvement,* through sharing of plans and objectives from the outset, will probably assure unprecedented public interest and support, as exemplified in Springfield.

20. *Limitations of units* will vary with the hospitals and must be stressed. If full professional and hardware capability is not at hand, prompt referral or consultation when needed is obligatory. This particularly applies to pacing catheter placement, to management of serious arrhythmias, unresponsive congestive failure and intractable pain and to uncertainty of diagnosis.

SUMMARY

The Missouri Regional Medical Program has provided in the Ozarks the best mechanism yet available to meet the greatest health challenge ever faced here by creating a forum for assembling a vast array of people and resources to bring about a reduction in cardiovascular death and disability.

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Communication Research

By "pre-testing" the impact of health pamphlets, posters, brochures, films and radio-TV spots being developed, the Communication Research Unit of MRMP is able to improve their effectiveness before general distribution to the public. Doctor Stephenson shows how "pre-testing" and "facilitators" applied to medical publications on preventive health measures result in "changing behavior directly" and facilitating desired action and response.

THE COMMUNICATION RESEARCH UNIT (CRU) has as its objective the development of communication which serves not merely to inform, but to bring about immediate change. Its concepts are communication-facilitation, communication-action and the like; its affinities are with advertising and public relations programming rather than with education and information dissemination.

First, CRU has devised methods for "copy-testing" news releases, pamphlets, radio and television spots, posters, documentary films and movies and any or all of the materials produced for public consumption. It is important to be able to do this because few, if any, of these materials are "pre-tested" today. Costly films are produced and pamphlets published without prior copy-testing to find out how far people identify with them. The result is that many are doing more harm than good. One pamphlet on cancer, for example, is calculated to alarm women and not at all to assuage their anxieties about cancer.

Copy-testing shows that women react highly negatively to this kind of leaflet, in spite of the happy-looking graphics. It is not merely that they dislike having their attention drawn to the grave consequences of leukemia. What disturbs the women is the triteness of the treatment—the scrappy bit of paper for so grave a matter is totally out of place. As one woman said, "It's like printing the Bible in a comic book." Serious topics, somehow, have an intrinsic "demand" character of their own, and this throw-away bit of paper in no way satisfies it. Many examples of this kind could be given in which good intentions, fine photography and expensive films make serious communication mistakes which could have been obviated by prior copy-testing.

Second, CRU adds to pre-tested materials certain "facilitators" which aim at changing behavior not by "persuasion," "education" or "injunction" (Stop Smoking!), but in some sense directly.

The best analogy here is "programmed learning" by which materials can be learned very effectively when each step in the learning is "rewarded." Children will learn very effectively and happily if they are paid to do it. Poor women will readily look at a television program on birth control if paid to do so. Mass advertising for consumer goods wouldn't be successful without the facilitation of supermarkets where housewives who are shopping can see again the items they saw on television and, thus, be reminded to act. Each of us, upon hearing some news about which we feel strongly, may intend to write to the editor or to one's congressman, but how often do we do so? CRU sets out to facilitate action. Given pre-tested materials, how does one cause people to act?

An example of CRU at work in this matter is seen in connection with the Smithville Project of MRMP. Can women be persuaded to examine themselves regularly for early signs of breast cancer?

CRU studies show that women are worried about cancer. As one physician has said, "There are two major diseases today, cancer and worry about cancer." How, then, assuage the anxiety and, at the same time, get women to examine themselves? First, cancer experts devised the self-examination procedures. Next, CRU undertook some outstanding photography to illustrate the self-examination by using a beautiful model with restrained, dignified poses (Fig. 1). An expensive-looking pamphlet was then written and designed by a creative advertising expert whose work had won many awards for excellence nationally and at the 12th Festival International

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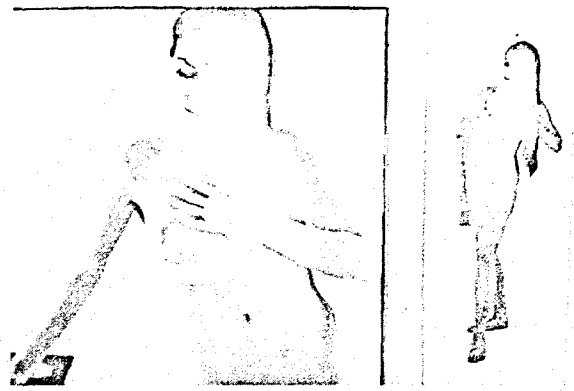

Fig. 1 This model was used for the many photographs required for the pamphlet. Note the restrained, quiet dignity.

du Film Publicitaire in Cannes (1965). All of this material is copy-tested. Men like looking at it as much as their wives. Finally, comes the facilitator. The responsibility for putting the pamphlet into the hands of women in Smithville rests, of course, with their physicians. Once it is in the homes, however, will the women undertake the monthly examination following menstruation as advised in the pamphlet? How can this be facilitated? CRU hit upon the idea of asking the women to hang the pamphlet in the bathroom, just as cookbooks are kept in kitchens. So, this medical booklet has to find a place in a bathroom. People read there. The booklet is expensive-looking and worth keeping; it is provided with a silk loop so that it can be hung from a hook. A newspaper campaign is used to impress upon women the idea of keeping the booklet (and other MRMP "do it yourself" booklets) hanging near a seat in the bathroom. Such is a facilitator.

It is scarcely necessary to add that husbands act as facilitators, too, in the above case. Put a copy of *Playboy* in a man's hands and his interest in breasts is obvious. The pamphlet on "How to Make a Self-Examination" interests men as well as women, and husbands influence their wives in the matter of regular self-examination. The beauty, the elegance of the production is anxiety-reducing—a matter CRU puts to test.

Consider cigarette smoking. Everybody knows that lung cancer and cigarette smoking are linked. Smokers, however, meet the situation with reactive indifference. How, then, can we change their behavior?

Current advertising campaigns by the American Cancer Society stress the risks run by smokers and call on smokers to stop smoking. CRU offers no such categorical injunction. Following basic principles, CRU doesn't seek to persuade, enjoin or inform anyone (although these benefits may occur incidentally). Instead, the object is to change behavior directly.

Again, resort has been made to a pamphlet written from the standpoint of a "do-it-yourself" kit. It doesn't tell anyone to stop smoking. It merely says that if you want to quit smoking, there is a scientific way to do it by "switching" the smoking habit for another habit. The method is based upon a modern learning theory (reinforcement of a low probability habit by a high probability habit). If you want to switch "chewing gum" for "smoking," the trick is to reinforce the one at the expense of the other. Thus, the reader finds that the next time he wants to smoke, he "chews gum" for five minutes and then has a smoke. The latter begins to reinforce the former. Soon he finds himself enjoying the gum, and forgetting the smoking. It sounds like expecting a snake to eat itself tail-end inwards, but it works. Again, the pamphlet on "How to Cope With Cigarette Smoking" (Fig. 2), is expertly produced. It tells no one not to smoke. CRU tests how far behavior is changed this way. The attitudes, no doubt, change *pari passu*.

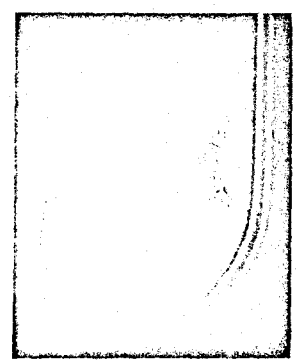

Fig. 2 This poster, through graphics alone, alerts high school students to the dangers of smoking. The above-mentioned folder explains how they may then handle their smoking problem. They will find copies in the school library.

It should be clear, then, that CRU is directed to changing behavior by communication, and not simply to communicating information to people. Where information is involved, it is incidental to the main purpose. In particular, it is nowhere assumed that "educating" or informing people leads *ipso facto* to desired actions, nor is it anywhere assumed that messages themselves may be "persuasive" and that they induce behavior on that account. Instead, action requires action. This is the basis of CRU's work.

Is it not interesting that where matters of opinion arise, CRU may have a place? This follows from the body of theory at issue.[1-3] When one thinks of theory in the communication fields,

one thinks of it in relation to information science (such as enters into library science, cybernetics and computerized networks generally) and to mass communication, interpersonal communication and organizational networks and so on. There can be little doubt, however, that what is common to these areas, upon which so much effort is being expended in the applied sciences today, is *information theory* in the Shannon and Weaver sense.[4] The concern is with signal transmission expressed as entropy, redundancy, networks, noise, coupling, channel capacity and the like. From this standpoint a regional medical program is a network involving the lay public, hospitals, general practitioners and MRMP research and development projects. One would study, from this standpoint, which parts of the network have the greatest information input, output and couplings. One might inquire about channel capacities. If information is fed to the public at increasing rates and volume, is there a maximum capacity for its absorption? What of the couplings between lay public and practitioners, public and MRMP and practitioners and MRMP? Who channels what information in these couplings? What is the fidelity of the messages they receive? What distortions occur? Who passes on what to whom? How repetitious (redundant) do messages have to be in order to communicate? Is terse and simple writing the best for information flow? These and similar questions illustrate very well to what information theory leads. The questions, no doubt, are all important ones requiring answers by scientific means. The concern, however, is with information and the afore-mentioned flow, couplings, networks, redundancy, entropy, channels and the like. All enter, no doubt, into mass, interpersonal and organizational communication, but none leads to action as such. Indeed, there is an assumption in information theory that motivation is either nonexistent or of maximum and constant impact upon the systems under consideration. CRU can accept no such assumption. On the contrary, it sets out to study these motivations in the form of operant behavior, first as attitudes (whether before or after events) and, then, as changed behavior. This in no way denies importance to information theory. We use it in CRU whenever necessary to get at facts.

At first, perhaps, it is a little difficult to grasp what operant communication (which is CRU's principle concern) really is. However, examples can help. Consider, for example, how CRU might enter into multiphasic testing. Where does opinion enter here? No doubt, there may be differences of opinion among biomedical researchers about this or that in the multiphasic test battery. Ordinarily, this would not become a problem for CRU unless these scientific differences took on considerable, almost ideological proportions. Or if automated multiphasic testing can drastically reduce costs for tests in general hospitals, there might be differences of opinion regarding the desirability of instituting these reductions, at least until hospitals have found a way to recoup themselves for loss of income that this more efficient testing would occasion. Again, it is unlikely that CRU would find much of a problem here that wouldn't be solved more easily in other ways. What of the public's body of opinion about such testing, such as attends the Kaiser Foundation Health Plan in California, compared with the wider medical profession's standpoint? It is here that CRU can find its problems.

One could illustrate the matter for every project of every regional medical program. Enough has been said, it is hoped, to introduce the purpose of CRU. Nothing has been said about the technical resources it has at its command, such as in depth-type interviewing, Q-sorting, "copy-testing" pamphlets, television spots, posters and in programmed factor analysis and the like. Its staff are journalists with behavioral-science (as well as information theory) perspectives and includes Communications Director, William Stephenson, Ph.D.; Associate Director, Normand DuBeau; Associate, Donald J. Brenner, Ph.D.; Technical Consultant, Terrill Rees, Jr.; Administrative Assistant, Elvera Scroggs; and Research Assistants, Cathryn Buesseler, Richard Carlson, Thomas Drese, Robert Dunham, William Ingenthron, Leah Krawetz and Arlene Stewart.

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Manual of Medical and Paramedical Services in Missouri

A description of *The Manual of Medical and Paramedical Services in Missouri* which consists of two volumes and was developed by MRMP in response to the demand for a statewide directory of various health facilities and personnel in Missouri. The first volume offers a county-by-county breakdown of all health facilities and services. The second is a supplementary report on all aspects of employment and training of health manpower in Missouri. The author discusses distribution of the books and invites interested persons to send for copies.

FOR A NUMBER OF YEARS in Missouri, a demand for a statewide directory or manual of the various health facilities and personnel has been expressed at meetings and conferences of physicians, nurses, hospitals, nursing home staffs and public health, welfare and voluntary health organization personnel. The Health and Welfare Council of Greater St. Louis and the Regional Health and Welfare Council of Kansas City have published directories for their areas. Also, numerous voluntary health associations have published special booklets and brochures on the specific diseases in which they are interested.

At the inception of planning for the Missouri Regional Medical Program, the Missouri Health Council, a federation of some 35 statewide and regional health organizations, presented a project to collect and arrange information concerning the entire state and to make this information available through publication. The project was approved by the National Advisory Council for MRMP and the Missouri Health Council assumed responsibility for its implementation.

As the project progressed, it appeared that two publications would be more useful. As a result, one was developed on facilities and services and the other on the health manpower situation in Missouri.

THE MANUAL

This publication is a book consisting of more than 400 pages with particular emphasis on the health facilities and services available in every county in Missouri. They include hospitals, nursing homes, medical laboratories, clinics, treatment centers, pharmacies, public health services, permanent local offices of voluntary health associations and societies, field representatives of various health organizations and local clubs or groups that furnish some type of medical or paramedical service.

The official health agencies of the Division of Health, Division of Welfare, Division of Mental Diseases, Vocational Rehabilitation of the Department of Education and the State Crippled Children's Service are described in regard to functions, district or area territories, hospitals, treatment centers, clinics and other health services. The principal professional health organizations are listed with location, permanent branch offices, officers, membership and other pertinent information. The voluntary health organizations are included with location of principal and branch offices, field representatives, executive directors and the services offered.

HEALTH MANPOWER IN MISSOURI

The supplementary report on health manpower in Missouri is a much smaller publication of approximately 60 pages. Current employment or practice of the various principal health professions, current needs in the various disciplines, the number of specialists in medicine, dentistry and nursing, salary ranges and schools for education and training are presented on a statewide basis and, also, for each county in the state. The counties are represented in a series of charts that are self-explanatory. Each discipline is described and schools are listed with location, admission requirements, length of study, costs and degrees given. Twenty-two health disciplines are represented in the book.

The Health Manpower in Missouri Report is

* Mr. Starr is Secretary of the Missouri Health Council.

especially adapted for use by the disciplines in recruiting young persons for health careers.

DISTRIBUTION

The circulation of the two books will reach personnel of the Division of Health, Division of Welfare and Division of Mental Diseases. The voluntary health organizations plan distribution to their county and area districts. The Missouri State Medical Association and the Missouri Association of Osteopathic Physicians and Surgeons plan to distribute copies to all of their county and district societies and organizations. The Missouri Dental Association is placing copies in each of its area districts. Many hospitals and nursing homes have requested copies also.

Any person who is interested in the information contained in the books may secure copies from the Missouri Regional Medical Program, Lewis Hall, Columbia, Mo. 65201

National Manpower Conference To Be Held in Columbia

One of the most urgent problems facing the nation's health care systems is the critical and ever-growing need for health manpower—the right numbers and kinds of people in the right places. About 2.8 million people were employed in health occupations in 1966; estimates are that another million will be needed by 1975. In order to help meet this serious challenge, the Missouri Regional Medical Program and the University of Missouri Medical Center has announced that a national conference will be held on Sept. 25, 1968 at the Medical Center Auditorium to discuss "Manpower: Does Health Get Its Share?"

The one-day conference will include presentations by Dr. Vernon E. Wilson, Vice-President of the University of Missouri for Academic Affairs; Dr. Leonard Fenninger, Director of the Bureau of Health Manpower, NIH, Bethesda, Md.; Dr. William L. Kissick, Executive Director of the National Advisory Commission on Health Facilities, Washington, D. C.; Dr. James P. Dixon, President of Antioch College, Ohio; and other prominent figures from across the nation who are deeply involved in health care planning.

The conference will be unique in considering manpower needs, supply and recruitment for the health and competing professions, such as law, engineering, finance, industry, etc.

Key officials from Regional Medical Programs from all over the U. S. are being invited to attend and participate in the conference and panel discussion which will follow, as well as representatives of medical schools, educational institutions, hospitals, health professional organizations, voluntary health agencies, official health agencies and consumer groups.

Health manpower needs are a national challenge, and a nationwide sharing of ideas is needed to find solutions.