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AUTOMATED MULTIPHASIC HEALTH TESTING  
AND THE  
REGIONAL MEDICAL PROGRAMS

A Report of a Subcommittee  
of the

NATIONAL ADVISORY COUNCIL ON REGIONAL MEDICAL PROGRAMS

May 11, 1971

Rockville, Maryland  
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To: THE NATIONAL ADVISORY COUNCIL ON  
REGIONAL MEDICAL PROGRAMS

In November, 1970, Council requested a subcommittee examination of automated multiphasic health testing as a regional medical program activity.

The subcommittee that received this assignment is submitting its report and recommendations.

The projects that regional medical programs have funded have not operated long enough to accumulate experience that can be evaluated fairly. Summaries of their direct cost funding and their statements of purpose and benefit are included in the report.

Most of the RMP funded projects emphasize early detection of disease and preventive medicine as a principal reason for their existence. Health education and conservation of physician time are also stressed as purposes of these projects.

With these arguments in mind, the subcommittee conducted a conference on multiphasic health testing in Bloomfield Hills, Michigan on April 29-30. At the conference the subcommittee heard expert presentations on the states of the arts of: diagnostic testing; secondary prevention of chronic disease; utilization of technicians and automation in testing program; and practical experience with the acquisition and application of personal health data in a variety of episodic and preventive care programs.

The subcommittee has concluded that regional medical programs should withhold funding from any new multiphasic health testing projects, including those that have been approved, but were not funded by the end of 1970. The subcommittee is convinced that intensive efforts should be made to gather and evaluate the experience that will be gained in the projects already funded. The subcommittee also believes that modelling the natural histories of chronic diseases through systems analysis techniques should be explored. Such explorations might identify diseases for which preventive care of predictable value can be designed and identify the gaps in our knowledge of others.

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## AUTOMATED MULTIPHASIC HEALTH TESTING

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### REGIONAL MEDICAL PROGRAMS

Multiphasic health testing, as examined by the subcommittee, is the application to a defined population of a uniform battery of tests capable of detecting disease or high risk of disease in persons in whom these conditions have not been recognized. Some multiphasic health testing systems employ several batteries of tests and measurements, each of which is applied uniformly to a segment of the test population that is distinguished by specified demographic, medical history, or other characteristics. Multiphasic health testing may or may not employ automated or computer-assisted means of acquiring medical histories, obtaining measurements and storing and retrieving information.

#### Automated Multiphasic Health Testing

Among purists in the field, the term "automated" is reserved for those systems in which automation is most extensive. In these systems not only many individual operations, but the flow of examinees through the testing establishment and much of the interpretation of the data obtained are computer-controlled. The costs of equipping and installing such a system can be amortized within a reasonable length of time only by a high volume of service or a high fee for service. In general the extent to which a health testing system is automated is determined by the volume of service it is designed to perform.

#### Services Provided by Multiphasic Health Testing

Multiphasic health testing systems acquire data about examinees which are similar in range of application to those acquired by a physician administering a health check-up with the aid of laboratory services. The multiphasic testing systems employ non-physician technicians to acquire and process the data for physicians. This relieves physicians of routine data collection and of the more mechanistic interpretations. Hopefully, this reduces the time the physician spends with each patient, and enables him to provide his higher levels of professional service to more patients.

Patients also save time in the testing process by comparison with the time required for an individualized physician directed check-up. One trip through the multiphasic testing process may replace separate visits to the physician's office, a clinical laboratory and an x-ray department.

Both physicians and patients have recognized those benefits accruing from the consistent structuring of the multiphasic testing and reporting. Automated systems are credited with additional benefits in improved reliability. It is claimed that automated test performance, data recording and reporting are less error prone than similar operations controlled by humans.

The uniformity of terminology and format of a multiphasic system's reports offer another time saving advantage. Any physician familiar with the system can utilize any of its reports, whether he is at the initial point of referral or comes into the case later.

#### In-System Economic Considerations

Multiphasic health testing systems may be classified as either integrated, or free-standing. For purposes of this report, integrated systems are those that serve fixed groups of physicians and their patients. The physicians may be in solo practice associated with a specified hospital or hospitals or clinic on a conventional fee for service basis, or they may be members of one or more groups providing health and medical care under a prepayment plan. Integrated testing systems are owned, under exclusive contract to, or otherwise controlled by the medical care groups they serve.

Free-standing testing systems accept examinees on self-referral, physician referral or under contractual arrangements with labor, employer, or other organizations. Their services are rendered caveat emptor, and the physicians or patients they serve can exercise only indirect controls on their operations through economic action.

All multiphasic systems inevitably face economic problems. In addition integrated and free-standing systems each have special economic problems.

#### The Volume-Capacity Equation

A crucially important determinant of the survival of a multiphasic testing system is the unit cost of its service. In each testing system's environment, there is a maximum cost which cannot be exceeded for long, and there is a minimum cost below which the service cannot be provided. The limits of this range will be more sharply marked for free-standing than for integrated systems, but both must accommodate to very real limits. The relationship between the volume of service performed and the intended design capacity plays an important role in determining the unit cost of the service. The cost of maintaining the system in readiness

tends to be close to the cost of operating at full capacity. When the volume of service falls significantly below capacity, the cost of each unit of service tends to mount above that contemplated in the design. When demand for services exceeds the capacity of the system, excessive requests must be denied or back logged, or extraordinary operations must be undertaken. A decline in volume may be more readily tolerated in an integrated system, where health care demand and efficiencies generated by the testing may justify some subsidy of its operations. Demand in excess of capacity may be attractive to the free-standing testing system which may even gain prestige by developing a waiting list. In the interest of production, neither type of testing system can long tolerate a wide disparity between design capacity and actual volume of service.

#### Patient Satisfaction

Another economic constraint is imposed on the unit costs of both types of systems by the need to satisfy the examinees. In any multiphasic testing system it is necessary to process a large number of patients whose tests will yield negative or normal reports. If the testing program is beneficial to the individual, the examinee should continue to utilize it periodically, because his condition may be expected eventually to change.

Continued participation of the "normal" examinee is important to the health of the system also, to maintain its volume of service at or near design capacity.

The examinee's interest in periodic testing is directly dependent upon his perception of the benefits of the exercise in comparison with his outlay of time and money. Thus, a health testing system that is dependent upon periodic examination of the same population is constrained to control its changes and to utilize the opportunities provided by the system for health education of the examinee.

#### Health Care Demand in the Integrated Testing System

One of the purposes of multiphasic testing in the integrated system is generation of increased demand for the diagnosis and treatment of pre-symptomatic, early, or previously unrecognized chronic disease. Early treatment of such disease is alleged to improve the chance of restoring health and to reduce the lifetime health care needs of the patient, if not by curing his condition at least by reducing his needs for more costly forms of care.

To realize the benefits visualized by this hypothesis, the patient must actively seek and persist in the indicated treatment or management of his disease. Equally important to successful realization of the hypothesis is the capacity of the system to provide the indicated treatment and long term management.

The benefits of trading participation in low cost ambulatory care for future high cost late-stage care accrue to patients who persist in, and receive effective early stage care. To achieve this benefit for its patients therefore, the integrated care system must respond to the early treatment needs it discloses with services that are effective both in control of disease and in retention of the patient's cooperation.

In the early years when screening is applied to a closed population, the ambulatory care workload may increase rapidly, while the saving in more costly forms of care is not realized. In a closed population limited capacity system, the revelation of additional patient needs tends to frustrate their fulfillment, because it overloads treatment resources. The medical care services are pressed to expand and increase in cost, while cost control pressures tend to reduce the long term gains for patients who stay in the system, to reduce patient satisfaction, and stimulate patient defection.

In this kind of situation the system is pressed economically toward:

(a) abandonment or rigid control of its response to the preventive care indications of its multiphasic screenings, and (b) toward dilution of the ill and high risk components of its patient population by acquiring new low-risk persons or by reducing its accessibility to high risk persons.

The integrated multiphasic testing service that provides pre-admission or routine work-up services for the staff of a hospital or clinic is less affected by these economic pressures. Its services generally are performed as adjuncts to care of acute disease and the attending physicians are not barred from active participation in the promotion and implementation of preventive care programs.

The free standing health testing system may be almost entirely free of these pressures. Both types of testing systems can prosper at relatively constant levels of operation as long as their services fulfill their limited promises.

#### Intrinsic Values of Multiphasic Health Testing

All of the foregoing economic and functional views of multiphasic health testing have been stated without reference to the intrinsic health care values of testing.

In the long run the individual examinee or patient pays the dollar costs of the testing by drawing either in one way or another on his personal resources, or by drawing on protection offered to him by government. The patient also invests time and emotion in the testing. The patient may receive three kinds of return on his investments.

#### Returns in Emotional Reassurance

The processes of obtaining professional health care are costly in money, time and emotion.- Any increase in any of these types of expenditures will be resisted unless it is associated with perception of offsetting reductions in the others.

To most patients, multiphasic health testing initially offers appreciable emotional reassurance. Its promise of early detection and preventive care seems both effective and up to date. It's lists of facts about the patient assure him that his physicians will not overlook and he himself will not forget to mention important features of his health status. The pitch of the whole activity encourages a hopeful attitude toward his health.

For all patients and particularly for those inclined to pre-occupation with health, (the worried well) these potential returns are fragile. They are subject to abrupt reversal by insensitive behavior of medical care personnel and by errors or breakdowns in the testing, reporting, and medical care responses of the system.

#### Returns in Process Efficiency

Almost all multiphasic health testing systems, whether designed primarily to facilitate preventive care to control disease, or to assist in work-ups of acute illness are wholly or partially additions to the patient's health care costs. To be justified, these new expenditures should yield new benefits.

If multiphasic testing of patients with acute complaints reduces hospitalization costs, or time spent in visits to laboratories, or shortens the diagnostic process in almost any way, the economic return on the investment can be made obvious by a few words from the attending physician.

Multiphasic testing for preventive care and disease control is less obviously profitable. The ultimate economic return, if any accrues, is so long in coming that the patient is constrained to rely upon his convictions to justify his expenditures.



In the detached view, the possibility of long term gain is very fragile because it depends upon adequate performance of multiple, small, complexly related acts over a long period of time.

Proof of ultimate gain in life cost for medical services through preventive care is also apt to be elusive for most chronic diseases. Partly because the prevention or containment processes applicable to much of chronic disease are so lengthy and subject to so many kinds of lapses and ruptures, evidence that reductions in their lifetime costs in time or money are actually feasible will be difficult to develop. It follows that evaluation of AMHT as a factor in preventive medicine is a long and complex task.

#### Returns in Health Improvement

Actual gains in longevity or even in health status resulting from multiphasic health testing are very difficult to measure for any chronic diseases.

Much of this difficulty is rooted in lack of controls and in the lack of knowledge of the natural histories of the diseases themselves. For some diseases we do not know how many or which of the cases detected or forecast would not progress to impair, function, or threaten life, even if left undisturbed. For others it is as yet impossible to predict the effectiveness of available control measures. For others the risks associated with available treatment have not been fully evaluated.

Similarly, many of the parameters utilized in multiphasic health testing are not completely understood. This increases the difficulty of measuring effectiveness of disease control, because it casts doubt upon the validity of the initial detection.

Clearly an investment in multiphasic health testing as a predictable way to obtain long-term health status maintenance or improvement remains highly speculative.

#### Current Status of Multiphasic Health Testing in Regional Medical Programs

Ten Regional Medical Programs have invested in twelve projects that feature multiphasic health testing that is automated to some degree. The regions represent the east and west coasts, and southeastern, midwestern and mountain states. The populations to be served represent inner city ghetto residents, rural disadvantaged groups, employee groups and cross-sections of hospital admissions.

One of the projects is primarily developmental in nature. Among the others, the immediate objectives most frequently mentioned (See Tables 2 and 3) are education of the examinees and of physicians and the axiomatic preventive services of screening and casefinding. The broader purposes cited include demonstration of the AMHT clinical approach, introduction to medical care of inadequately served groups and modelling of improved dollar, manpower and medical efficiency for the health service system. We have little information on plans for continuation of these projects after their grant periods. (Table 4)

Some of the projects sponsor single examining establishments. Some have or plan to open several. One is concentrating on mobile service in a medically disadvantaged area and one concentrates on disadvantaged school children. Each project has some degree of automation, and each has its own plan of tests and measurements. Apparently none of these projects plan automation as extensive as that developed by Kaiser Permanents, the leader in this field. At this time we have little experience by which to evaluate these projects. Six of the twelve projects received their initial awards in 1970, two in 1969, two in 1968 and the developmental project began in 1967. It has taken these screening projects from nine months to two years after their initial awards to attain operational status resembling that visualized in their initial plans. In the more complex systems, de-bugging of the mechanism, building up the volume of business, and activating follow-up of examinees take more time.

Most of the projects have declared the intent to study themselves. Patient and physician acceptance of the system, follow-up of examinees with abnormal tests, system efficiency and cost-benefit comparisons are included in the plans, as are the significance of the tests and various epidemiological topics.

Unfortunately, the studies planned to date will be of an internal nature. The sponsors do not appear to have the base-line data and control capabilities that would enable them to compare their AMHT systems with alternative systems for achieving the desired purposes. Even under the best of circumstances, it will be difficult to get highly reliable system comparisons within the relatively brief span of a three to five year RMP grant. Current study plans of the project do not include evaluation of their effects on regionalization of health care services.

The cumulative total of RMP investment through 1970 (See Table I) for the direct costs of these projects was about \$5,920,000. The average direct cost award for a project year has been about \$269,000. These sums, with their attendant overhead costs, make up a significant share of the total amounts of risk money available to all regional medical programs, or to any one regional medical program. The 1970 total for direct costs of \$2,884,500 alone is 6.7% of the \$43,246,000 amount awarded for project grants in that year.

For this reason as well as because of the lack of consensus on so many of the AMHT hypotheses, the questions before the council remain insistent.

Is it a concern of the RMP system to make the definitive evaluations of the AMHT hypotheses?

Can the Regional Medical Programs (or any other single sub-system of the medical economy) complete these evaluations in time and with sufficient authority to steer the nation's (or a region's) application of the valid hypotheses?

Will the hypotheses be tested in the open market, regardless of regional medical program intervention?

To this sub-committee it is clear that automated multiphasic health testing is a mode of obtaining patient health data that is being tested in many of the applications for which such data are required. Disregarding the many lively questions that present themselves about the validity of the tests employed and of the purposes to which the data are applied, automated multiphasic health testing can be an efficient method of acquiring and processing the data.

Three conditions must exist in any situation in which these systems are to become efficient. First, there must be a sufficient volume of testing to keep the cost of operating the system commensurate with the efficiencies achieved.

Second, the automated multiphasic testing system must be linked with equally efficient systems for feeding examinees into the testing process and following through on its data output, to accomplish the purposes for which the data are acquired. The testing system is not an end in itself, unless its sole objective is acquisition of epidemiologic information, which is a question of questionable relevance to the RMP mission.

Thirdly, automated health testing as such is a method that should be chosen only when the choice is supported by thorough cost-benefit comparisons with alternative methods of data acquisition and processing. Because of the large investment involved an automated testing system in an economically marginal situation can become a monster, whose needs can distort the health care system it is intended to serve.

The sub-committee has not found evidence that AMHT itself has directly improved regional deployment or utilization of health service resources. Some of the purposes served by AMHT methods may have such effects but AMHT in itself can only contribute efficiencies or inefficiencies to the performance of the tasks assigned to it.

The sub-committee believes that regional medical programs should concentrate on improving deployment and utilization of practice-ready health care systems of predictable effects. So many of the hypotheses on which AMHT rests are unproven that it cannot be credited with predictability as positive influence in health care.

The sub-committee also finds that the uncertainties surrounding preventive health care are not likely to be resolvable within the life span of a regional medical program project.

#### Recommendations of the Subcommittee

The subcommittee proposes that the Council issue the following recommendation:

"At this time eleven regional medical programs have funded projects that feature automated multiphasic health testing. The purposes of these projects present a fair representation of the purposes for which patient health status data are acquired.

"Automated health testing is very costly. The influence of the projects in which it appears on regional deployment and utilization of health care services is highly unpredictable. For these reasons Council recommends that no new projects featuring automated health testing be funded.

"The Council further recommends that the Director, RMPS, and the appropriate regional medical programs, coordinating with the National Center for Health Services Research and Development, Community Health Services, the National Center for Health Statistics, the National Institute of General Medical Sciences and other interested agencies, institute consultation and investigation to:

1. Provide market and financial analyses and advice to avoid loss in post-grant operations of projects currently funded by regional medical programs.
2. Build into RMP and other projects base line data, defined goals and measures of progress for cohorts of persons whose initial multiphasic tests were positive, negative and refused, among such populations as urban and rural poor, employee groups, hospital and clinic patients, to help resolve debate about the affects of multiphasic testing on quality of and access to health care services and the regional deployment and utilization of health care resources; and
3. Utilize systems analysis and all available epidemiologic information to stimulate <sup>development of</sup> natural histories of diseases and identify those for which secondary prevention might be feasible and acceptable in cost."

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Relationship of 1 test against another -  
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AUTOMATED MULTIPHASIC TESTING IN REGIONAL MEDICAL PROGRAMS

TABLE 1. DIRECT COST FUNDING, FISCAL YEARS 1967-70

No.	Region Name	Project No.	Direct cost commitments (Thousands of dollars)				Total	Project Years
			1967	1968	1969	1970		
9	Missouri	4R	421.5	274.3	317.5	121.0	1134.3	4
25	Rochester, N.Y.	7		202.2	265.5	259.9	727.6	3
18	Tenn. Mid-South	28		245.5	798.8*	604.5	1648.8	3
24	Florida	1			202.5	179.2	381.7	2
43	Indiana	2			225.0	225.0	450.0	2
44	Maryland	2			83.0	76.8	159.8	2
49	Ohio Valley	7				200.0	200.0	1
19	California	38				91.0	91.0	1
19	California	46				187.6	187.6	1
15	Intermountain	26				358.3	358.3	1
51	Memphis	18				312.6	312.6	1
51	Memphis	17				269.5	269.5	1
	TOTAL		421.5	722.0	1892.3	2884.5	5920.3	
	Project years		1	3	6	12		22
	Average funding, project year		421.5	240.7	315.4	240.7		269.1

\*Includes \$192,000 for renovation of space.

AUTOMATED MULTIPHASIC TESTING IN REGIONAL MEDICAL PROGRAMS

TABLE 2. PURPOSES OF FUNDED PROJECTS

<u>No.</u>	<u>Region Name</u>	<u>Project No.</u>	<u>First Year</u>	<u>Stated Purposes</u>	<u>Primary Character</u>
9	Missouri	4R	1967	Establish centers to determine diagnostic laboratory tests useful for screening populations.	Developmental
25	Rochester, N.Y.	7	1968	Detection of early disease in selected population, evaluation of data collecting systems.	Demonstration
18	Tennessee - Mid South	28	1968	Health evaluation studies on a defined population group, preventive care, case-finding, bringing disadvantaged group into health care system.	Demonstration
24	Florida	1	1969	Education (unspecified) preventive care, pre-admission evaluation, case-finding, research.	Demonstration
43	Indiana	2	1969	Casefinding, educational (patients) preventive care, research.	Demonstration
44	Maryland	2	1969	Development and evaluation of screening children of low-income families, primarily for cardiovascular and pulmonary disease.	Developmental
49	Ohio Valley	7	1970	Automated multiphasic screening demonstration; physician education, case-finding, pre-admission evaluation.	Demonstration
19	California	38	1970	Screening urban poor population using an OEO ambulatory care units.	Demonstration
19	California	46	1970	Preventive care, bringing urban poor and migrants into health care system, case finding, patient education.	Demonstration
15	Intermountain	26	1970	Preventive care, casefinding, education (patient) minor research.	Demonstration
51	Memphis	18	1970	Improving health service for residents of a northeastern Miss. area.	Demonstration
51	Memphis	17	1970	Preventive care, patient education, research, improve manpower utilization.	Demonstration

AUTOMATED MULTIPHASIC HEALTH TESTING IN REGIONAL MEDICAL PROGRAMS

TABLE 3. BENEFITS TO REGIONAL MEDICAL PROGRAMS

<u>No.</u>	<u>Region Name</u>	<u>Project No.</u>	<u>Benefits cited by applicants</u>	<u>Noted by others</u>
9	Missouri	4R	AMHT systems design.	
25	Rochester, N.Y.	7	Prestige of innovating a service. Links community and providers in demonstration.	
18	Tenn. Mid-South	28	Early detection of target diseases. Project's visibility in community helps RMP.	Brings disadvantaged into the health system.
24	Florida	1	Education, service, coordination, research	Cooperation among institutions
43	Indiana	2	Helps round out medical care in community service, education, research.	
44	Maryland	2	Service to disadvantaged school children Model child screening system.	
49	Ohio Valley	7	Demonstrate MHT, educated physicians in comprehensive, preventive care and health manpower utilization.	
19	California	38	Not yet operational, regional strategy not cited.	Could bring disadvantaged population into better care.
19	California	46	Early detection of target diseases Service to disadvantaged Brings disadvantaged into care system.	Brings disadvantaged population into better care.
15	Intermountain	26	<ol style="list-style-type: none"> <li>1. Reduce disability and hospitalization.</li> <li>2. Reduce overall costs of medical care.</li> <li>3. Apply modern techniques to medical records.</li> <li>4. Employ and train para-medical personnel.</li> <li>5. To provide comprehensive care by integrating with health center.</li> </ol>	Improves clinic service to low income area.



BENEFITS TO REGIONAL MEDICAL PROGRAMS

<u>No.</u>	<u>Region Name</u>	<u>Project No.</u>	<u>Benefits cited by applicants</u>	<u>Noted by others</u>
51	Memphis	18	A community generated solution to area needs.	
51	Memphis	17	Model preventive care clinic system.	

AUTOMATED MULTIPHASIC HEALTH TESTING IN REGIONAL MEDICAL PROGRAMS

TABLE 4. PLANS FOR POST-GRANT SUPPORT OF DIRECT EXPENSE

No.	Region Name	Project No	RMP Support Plan		Equipment	Cost, grant plans		Revenue Pts. needed
			Operating expense			Operating expense		
9	Missouri	4R	100% RMP - Now combined with other dev. projects					
25	Rochester, N. Y.	7	100% RMP-3 years		\$6100 Clinical	Hope for 3rd party approval, industry contracts.		Flexible
18	Tenn. Mid-South	28	100% RMP - 4 years		\$2225,000 lab. & clin. 15,000 p.a. computer	80% revenue 20% grants		\$15,000
24	Florida	1	100% RMP, 2 years, 50% 3rd		\$140,000 clinical	40% patient revenues 60% VA and research		6,200
43	Indiana	2	100% RMP, 3 years		\$333,800 lab & Clin.	No plans given		
44	Maryland	2	Related to school health programs			No plans given		Flexible
49	Ohio Valley	7	RMP and Hospitals			100% hospital revenue		Flexible
19	California	38	Not operational		Will contract for Lab.	Plans not yet started		
19	California	46	100% RMP, 3 years		\$968 laboratory	\$12,000 p.a. from county No other shown.		
15	Intermountain	26	100% RMP, 1st year, declining for 5 years		\$140,000 computer 52,500 clinical	\$525,000 revenue p.a. after 5 years		20,000
51	Memphis	18						
51	Memphis	17	Operating since 1956,		share assumed by RMP not clear			Flexible 4/23/71