Case Finding Through Multiple Screening

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DURING the past few years, there has been a widespread interest in multiple screening—an approach to case finding characterized by the application, to apparently well populations, of a combination of screening tests for various diseases or conditions. Within a period of 4 years, multiple screening has been given extensive trial, has demonstrated its ability to find cases of disease, and has been hailed by some as an important new tool in public health work.

It is the purpose of the present paper to discuss the methods and results of some of the more extensive multiple screening projects, to consider certain principles and problems of this approach, and to stress some of their implications for the planning of screening projects.

The brief but active history of multiple screening includes at least nine major projects, ranging from pilot studies that have tested a few thousand screenees to local or Statewide operations that have screened tens, or even hundreds, of thousands of persons. Screening has been incorporated in such research studies as those planned by the Chronic Disease Research Institute in Buffalo, N. Y., and by the Commission on Chronic Illness in Baltimore, Md., and in Hunterdon County, N. J. The procedure was established on a continuing basis in Alabama and Georgia, and has been operated as an annual project in Alexandria, Va., for the past 3 years. In addition, at least 30 other projects throughout the country have come to the attention of the Public Health Service.

Screening, using a combination of tests—although not always called "multiple screening"—has for some time been conducted by industries and labor unions. Some of this work—for instance, that done by the International Ladies Garment Workers Union—antedates the multiple screening projects operated by health departments.

To a limited extent, multiple screening has also been introduced into hospitals. At St. Michael's Hospital in Newark, N. J., several screening tests have been given to both inpatients and outpatients, with a significant return in newly discovered cases of previously unsuspected disease. Results of a cooperative project are now being analyzed, in which the District of Columbia's General Hospital and the Public Health Service screened outpatients to study case-finding possibilities. Some proponents of the multiple-screening approach recommend that all hospitals use screening as a general preventive medicine service, giving routinely such tests as height and weight, blood pressure, urinalysis, blood counts, hemoglobin, serologic test for syphilis, chest X-ray, and electrocardiogram.

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Results to Date

In the trial projects discussed above, multiple screening has shown definite promise as a way of discovering previously unrecognized disease. Nine of the major projects together have screened more than a million persons and have identified approximately 50,000 cases of disease and/or abnormalities. In all proba-

bility, this number represents a considerable understatement of the true case finding accomplished, since complete reporting of diagnostic followup is lacking. Furthermore, some of the projects mentioned have included only 2 or 3 tests, rather than the usual battery of 10 to 12.

The project carried out through the Permanente Foundation, which screened about 4,000 longshoremen in the San Francisco Bay area, and which secured rather complete followup reports on the persons screened, discovered new cases of disease in 19 percent of the men screened. The Indianapolis, Ind., pilot study discovered new cases of disease in 10 percent of persons screened. This project, which screened an almost entirely Negro population group, applied most of the same tests that were used in the Permanente project but obtained no followup reports on abnormal weight, vision, or hearing. In Richmond, Va., 9 tests were offered to the general population and followup reports were obtained on a large number of screenees. An analysis of the total persons screened showed that about 5 percent of this total were found to have previously unknown disease.

Thus, in screening projects testing various segments of the population, 5 percent or more of those screened have been found to have significant disease that was previously unknown.

The combinations of tests used by nine major multiple screening surveys and research projects are outlined in table 1. The most commonly used tests in these projects have been chest X-ray, serologic tests for syphilis, and blood sugar determinations.

Details of the major multiple screening projects are shown in table 2, which gives a brief statement of the methods used, standards applied and results obtained. It is evident, even on casual inspection of this table, that there has been great variety on each of these points. As pointed out earlier, there was also variation in the population groups screened. Such considerations make it clear that the figures shown here should not be compared without attention to all circumstances.

Many of the available reports lack complete followup information covering the verification of screening results and the number of new cases actually discovered. Those projects using a long array of tests include those with the most complete followup studies.

It seems appropriate to consider here certain of the fundamental concepts involved in screening. Misconceptions as to basic points may lead to misapplication of methods and standards, and ultimately to the impression that the technique is without merit.

Table 1. Summary of tests used by 9 major multiple screening projects

Type of test	Project									
	Alabama	Alexandria	Atlanta	Boston	Georgia Counties	Harnett County, N. C.	Indianapolis	Permanente	Richmond	Total
Cardiovascular history				(1)			X			1
Blood pressure		X		X			X	X	X	5
Electrocardiogram		X		X				X	X	4
Auscultation of heart							X			1
Chest X-ray	X	X	X	X	X	X	X	X	X	9
Serologic test for syphilis	X	X	X	X	X		X	X	X	8
Hemoglobin		X	X	X			X	X	X	6
Blood sugar	X	X	X	X	X	X	X	X		8
Urine sugar		X		X			X	X	X	5
Urine albumin		X		X			X	X		4
Height, weight, and build		X	X	X			X	X	X	6
Hearing		X		X			X	X		4
Vision		X		X			X	X	X	5
Intraocular tension									X	1
Self-screening history				X				X		2
Total	3	11	5	12	3	2	12	12	9	69

[1] Not included separately in screening line but covered by self-screening history.

Table 2. Summary of tests and standards used on various multiple screening projects, with available results of screening and of cases discovered on basis of diagnostic followup reports

Test, project, description, and standard for abnormality [1]	Number of persons screened	Percent abnormal on screening	Reports received		Estimated cases found [2]	
			Total cases	New cases	Total	New
CARDIOVASCULAR HISTORY:						
Boston—See Self-screening history						
Indianapolis—Questions by physician on chest pain, dyspnea, orthopnea, rheumatic fever, and/or history of high blood pressure or heart disease	5,706	30.8	(5)	(5)	(5)	(5)
Permanente—See Self-screening history.						
BLOOD PRESSURE (STANDARD METHOD):						
Alexandria, Va. (*150/100*)	6,151	11.0				
Boston (*Master et al.*) [3]	4,536	14.3	176 high 4 low			
Indianapolis (*150/90*)	5,711	25.7	(5)	(5)	(5)	(5)
Permanente (*170/95*)	3,989	21.0	369	207	[4] 369	[4] 207
Richmond (*150/100*)	37,442	14.6	1,306	162	2,584	321
ELECTROCARDIOGRAM:						
Alexandria, Va.—3 standard limb leads	6,027	7.0				
Boston—Lead I	5,057	(5)				
Permanente—3 standard limb leads and VI, V3, and V5	3,984	16.7	301	182	301	182
Richmond—12 standard leads	3,179	14.0	99	27	205	56
X-RAY, HEART—70 MM.:						
Alabama	168,290	.8	1,105			
Alexandria, Va	7,209	.4				
Atlanta	213,488	1.1				
Boston	4,536	(5)	(5)	(5)		
Georgia Counties	213,542		1,964			
Harnett County, N. C. (No data on method)	6,875					
Indianapolis	5,701	11.8	(5)	(5)		
Permanente	3,990	(5)	(5)	(5)	(5)	(5)
Richmond	37,548	5.7	433	55	1,010	129
COMBINED CARDIOVASCULAR TESTS:						
Boston—ECG and X-ray	4,536	4.4	41			
Indianapolis—History, blood pressure, auscultation, X-ray	5,711	31.6	336	93	646	177
Permanente—Blood pressure, ECG, and X-ray	3,990		571	339	571	339
X-RAY, TUBERCULOSIS—70 MM.:						
Alabama	109,967	.5	198			
Alexandria, Va	7,209	2.0				
Atlanta	213,488	1.9	287	234		
Boston	4,536	.07	1			
Georgia Counties	213,542	1.3	182			
Harnett County, N. C. (No data on method)	6,875	3.0				
Indianapolis	5,701	1.7	22	17	22	17
Permanente	3,990	4.2	[6] 74	[6] 33	[6] 74	[6] 33
Richmond	37,554	6.0	[7] 289	[7] 72	[7] 770	[7] 191
X-RAY, MISCELLANEOUS CHEST PATHOLOGY—70 MM.:						
Alexandria, Va	7,209	.1				
Atlanta	213,488	.3				
Boston	4,536		17			
Georgia Counties	213,542		1,626			
Indianapolis	5,701	2.7	[8] 36	[8] 8	[8] 40	[8] 10
SEROLOGIC TEST FOR SYPHILIS:						
Alabama—Kahn	221,312		4,747		4,747	
Alexandria, Va.—VDRL	2,504	1.5				
Atlanta—VDRL	228,024	9.8	11,671	2,245	11,671	2,245
Boston—Hinton	4,536	.2	5			
Georgia Counties—VDRL	244,493	9.9	12,520	6,965	12,520	6,965
Indianapolis—Mazzini	5,684	12.5	541	118	541	118
Permanente—VDRL or Mazzini	3,974	10.4	159	23	159	23
Richmond—Kahn	36,981	.6	168	50	169	51

See footnotes at end of table.

Table 2. Summary of tests and standards used on various multiple screening projects, with available results of screening and of cases discovered on basis of diagnostic followup reports—Continued

Test, project, description, and standard for abnormality[1]	Number of persons screened	Percent abnormal on screening	Reports received		Estimated cases found[2]	
			Total cases	New cases	Total	New
HEMOGLOBIN:						
Alexandria, Va.—Cyanmethemoglobin (*12 gm.*)	2,613	8.7				
Atlanta—Copper sulfate (*males 11 gm., females 10 gm.*)	180,128	5.4				
Boston—Photoelectrometer (*males 12.3 gm., females 10.3 gm.*)	4,536	4.4	70			
Georgia Counties—Copper sulfate	225,281	7.0				
Indianapolis—Sheard & Sanford, with photoelectrometer (*males 12.5 gm., females 11 gm.*)	5,694	16.2	115	50	220	96
Permanente—Copper sulfate (*males 12.3 gm.*)	3,986	.1	1	1	1	1
Richmond—Dare hemoglobinometer (*12 gm.*)	37,603	13.2	1,034	527	2,111	1,078
BLOOD SUGAR:						
Alabama—Modified picric acid (*150 mg. % retest 180 mg. %, venous*)	477,846	6.4	2,032		4,380	
Alexandria, Va., 1950—Modified picric acid (*150 mg. %, venous*)	2,618	5.7				
Alexandria, Va., 1951—Wilkerson-Heftmann (*130 mg. %, venous*)	3,489	3.2				
Atlanta—Anthrone (*130 mg. %, later 170, venous*)	211,639	3.3				
Boston—Wilkerson-Heftmann (*130 mg. %, venous*)	4,532	3.7	40			
Georgia Counties—Anthrone (*170 mg. % under 2 hrs. postprandial, 130 mg. % over 2 hrs. venous*)	266,432	3.2				
Harnett County, N. C.—Wilkerson-Heftmann (*130 mg. % fasting, 180 postprandial, capillary*)	6,197	2.1	74	48		
Indianapolis—Wilkerson-Heftmann (*130 mg. %, venous*)	5,695	2.2	48	22	48	22
Permanente—Wilkerson-Heftmann (*180 mg. %, 1 hr. after 50 gm. sucrose, venous*)	3,966	3.9	55	33	55	33
URINE SUGAR:						
Alexandria, Va.—Benedict (*1+ or more*)	7,136	3.3				
Boston—Clinitest (*trace or more*)	4,536	3.4	6			
Indianapolis—Clinitest (*trace or more*)	5,704	2.0	53	24	53	24
Permanente—Benedict (*2+ or more*)	3,987	5.0	53	28	53	28
Richmond—Clinitest (*trace or more*)	34,124	1.5	145	51	274	97
URINE ALBUMIN:						
Alexandria, Va.—Acetic acid (*1+ or more*)	7,159	1.1				
Boston—Sulfosalicylic acid (*no data*)	4,536		11			
Indianapolis—Heller ring test (*positive or trace*)	5,701	2.2	33	10	33	10
Permanente—Sulfosalicylic acid (*1+ or more*)	3,988	2.3	35	16	35	16
HEIGHT, WEIGHT, BUILD:						
Alexandria, Va. 1950, 1952—Ideal weight tables[9] (*10% variation*)	3,915	29.4+ 26.2−				
Alexandria, Va. 1951—Ideal weight tables[9] (*20% variation*)	3,511	15.8+ 8.6−				
Atlanta—Standard weight tables[9] (*25% variation*)	213,488					
Boston—No data (*20% variation*)	4,536	27.4+ .2−	347+ 0−			
Indianapolis—Ideal weight tables[9]; later Pryor measurements[10] (*22.5% variation*)	5,710	13.9+ 4.7−	(17)	(17)		
Permanente—Ideal weight tables[9] (*−25% and +40% from ave. for med. build*)	3,992	9.0+ .03−	241	74	241	74
Richmond—Measured and recorded (*no standard established*)	(11)	(11)				
INTRAOCULAR TENSION:						
Philadelphia[14]—Schiøtz tonometer (*25 mm. or over*)	9,535	10.2	[15] 217	[15] 217	217	217
Richmond—Schiøtz tonometer (*25 mm. or over*)	6,020	23.8	65	33	130	65

See footnotes at end of table.

Table 2. Summary of tests and standards used on various multiple screening projects, with available results of screening and of cases discovered on basis of diagnostic followup reports—Continued

Test, project, description, and standard for abnormality[1]	Number of persons screened	Percent abnormal on screening	Reports received		Estimated cases found[2]	
			Total cases	New cases	Total	New
HEARING—PURE-TONE AUDIOMETER:						
Alexandria, Va., 1950, 1951 (*30 db loss at 4,000 cycles; 20 db at 1,000, 2,000, 6,000 cycles*)	6, 140	22. 8				
Alexandria, Va., 1952 (*20 db loss at 1,000, 2,000, 4,000, 6,000 cycles*)	1, 267	30. 0				
Boston (*30 db loss in either ear at 500, 1,000, or 2,000 cycles*)	4, 536	8. 2	27			
Indianapolis (*30 db loss at 2 frequencies in 1 ear or 1 frequency in each ear: 500, 1,000, 2,000, 4,000, 8,000 cycles*)	5, 650	19. 8	(17)	(17)		
Permanente (*combinations of 20–60 db loss*)	3, 992	12. 6	243	92	243	92
VISION:						
Alexandria, Va.—Sight Screener[12] (*20/40 either or both eyes*)	7, 338	26. 0				
Boston—Ortho-Rater[13] (*Less than 20/40, near or far, either or both eyes*)	4, 536	8. 9	65			
Indianapolis—Sight Screener (*2 tests 20/40, or 1 test 20/50 either eye or both, near or distant vision*)	5, 697	44. 5	(17)	(17)		
Permanente—Jaeger chart (*Distant, 20/40; near, J–4 line either eye*)	3, 972	23. 8	395	205	395	205
Richmond—Sight Screener (*20/50 in either or both eyes*)	7, 384	5. 5				
SELF-SCREENING HISTORY:						
Boston—222 questions similar to Cornell Medical Index	4, 536		[16] 474			
Permanente—Modified Cornell Medical Index	3, 994	(11)				

[1] Italicized text in stub indicates standard for abnormality.
[2] Estimated on basis of percent positive among diagnostic reports returned by physicians.
[3] See J. A. M. A. 143: 1464–1470 (1950).
[4] Where diagnostic reports were obtained for practically all persons referred, so that reported results represent total case finding, the figures for diagnoses returned are repeated in the columns for "estimated cases found."
[5] See "Combined cardiovascular tests."
[6] Includes all chest X-ray results. The 33 new cases include 6 of "active or possibly active" tuberculosis.
[7] Includes both active and inactive cases.
[8] Diagnoses include inactive tuberculosis.
[9] Tables of height and weight distributed by life insurance companies derive from the medico-actuarial mortality investigation of 1912. The tables of "standard weights" are based on averages of life insurance policyholders included in that study. The tables of "ideal weights" are based on the same study but show age and weight giving the lowest mortality expectation.
[10] Uses lateral thoracic diameter and bi-iliac diameter to determine body build. Method and tables of standards in: Width-Weight Tables, 2d rev. ed., by Helen B. Pryor, Stanford University Press, Stanford University, Calif.
[11] Not referred for this test.
[12] American Optical Company.
[13] Bausch & Lomb.
[14] Not a multiple screening project.
[15] Previously known cases were not screened.
[16] Number of conditions.
[17] No followup.
NOTE: Where no figures are given, no data were available.

Screening vs. Diagnosis

The role of screening as a brief health examination in contrast to a complete checkup has been mentioned often in the literature, but the point is worth further emphasis. The antecedents of the screening approach are to be found in many forms of examination—complete and incomplete, thorough and cursory—done for purposes of employment, life insurance, selection for military service, and school health. The deliberate combination of several rapid, simple tests for such specific purposes as case finding and health education is, however, characteristic of the present concept of multiple screening.

In the nature of the two processes and in the concepts involved, fundamental differences exist between screening and diagnosis. Screening attempts only to select high-prevalence groups through the application of standardized tests to numbers of people, with full realization that there will be "errors" in the form of false positives and false negatives. Diagnosis, on the other hand, establishes or rules out disease through a synthesis of the most complete and accurate information available about a particular individual. While each of these processes is appropriate in its place, they cannot be used interchangeably.

Important differences in details of application and interpretation naturally follow because of these fundamental differences. Screen tests are applied at random to the apparently well, whereas need for the diagnostic process is indicated in the presence of symptoms or suspicion of disease. Screening is impersonal in nature, and the result of each test is measured separately by a definite standard determined in advance and generally adhered to despite the results of other tests. Even where some subjective element enters (as in examining X-ray films for evidence of pathology) the interpreter of the test results tries not to deviate from a fairly definite set of criteria. In making a diagnosis, on the other hand, the results of tests are considered in relation to other factors, and individual judgment is an important aspect of the process. If these distinctions are not kept clearly in mind in carrying out screening, confusion results.

Deficiency and Degenerative Diseases

The fact that multiple screening is used to uncover deficiency and degenerative diseases as well as diseases caused by infectious agents poses another problem which at present does not lend itself to any perfect solution. For infectious diseases we have criteria by which screening can be judged, namely, whether the infectious agent is, or is not, present, either demonstrably or in its known biological manifestations. With deficiency or degenerative diseases, however, within the limits of our present knowledge, we are dealing with variations in physiological states that may occur normally in anyone. In this kind of situation, there is no single "correct" standard or screening level, since we are measuring values along biological gradients, with a considerable range of normality.

Along such a scale the most accurate screen test does not usually point to definite disease as contrasted to definite absence of disease. Instead, we find a gradual transition up or down a scale from relative normality to relative abnormality. We cannot expect to determine either statistically or medically an exact point where the line between normal and abnormal is to be drawn. The problem is not one of the accuracy of tests alone. The screen test measures a particular physiological state at a given point in time, but diagnostic study is necessary to relate the finding in question to other pertinent factors in order to determine whether significant disease is actually present. That is why—be the screen test ever so accurate in measuring a condition—there is a substantial percentage of suspects whose ultimate diagnosis is negative.

As the screening level is moved further and further away from the average, smaller numbers of suspects are found, but the rate of diagnostic confirmation becomes greater. Two examples that follow illustrate concretely the manner in which this occurs. The examples are taken from results of screening 857 hospital outpatients for hypertension by blood pressure determinations, and 551 such patients for diabetes by means of the Somogyi-Nelson blood sugar test at various intervals after eating (including overnight fasting). All members of both groups received diagnostic study without regard to the screening findings.

The results found in blood pressure screening are illustrated in table 3. Here it is seen that about 70 percent of the screenees had test readings below 150 mm. systolic. Above 150 the percentages of screenees found at successively higher levels decrease rapidly until only 0.6 of 1 percent had readings of 250 and above. Referring to the third column of the table, we find that at this extremely high level 100 percent of the suspects were diagnosed as hypertensive. Reading up the column, we find successively smaller percentages of established diagnoses. With a screening level of 230 mm., 100 percent of the suspects would have been confirmed as

Table 3. Percentage distribution of blood pressure readings on screening, and corresponding percentages of persons diagnosed as hypertensive [1]

Systolic blood pressure reading (mm.)	Percent of persons with indicated reading at screening	Percent in each group diagnosed as hypertensive
70–89	0. 3	0
90–109	14. 2	0
110–129	33. 6	3
130–149	21. 6	26
150–169	14. 8	52
170–189	7. 5	78
190–209	4. 4	89
210–229	2. 0	94
230–249	1. 0	100
250–269	. 6	100
Total	100. 0	

[1] Data from a cooperative screening project at the District of Columbia General Hospital, Washington, D. C., results of which have not yet been published.

Table 4. Percentage distribution of blood sugar values on screening, and corresponding percentages of persons diagnosed as diabetic [1]

Venous blood sugar value (mg. per 100 cc.)	Percent of persons with indicated value at screening	Percent in each group diagnosed as diabetic
30–49	0. 4	0
50–69	12. 5	0
70–89	51. 5	. 4
90–109	22. 5	7
110–129	4. 7	11
130–149	2. 5	29
150–169	1. 8	60
170–199	1. 1	67
200–299	1. 5	100
300–399	1. 1	100
400–499	. 4	100
Total	100. 0	

[1] Data from a cooperative screening project at the District of Columbia General Hospital, Washington, D. C., results of which have not yet been published.

positive, but a great many cases would have been missed. Conversely, if the screening level is lowered in an attempt to pick up additional cases, smaller and smaller percentages of confirmations will be obtained, and the cost of finding these cases will involve the referral and examination of many persons representing false positive tests.

A second example, using blood sugar values, is shown in table 4, where a striking parallel to table 3 is seen. Again we find decreasing percentages of suspects if successively higher values are considered as screening levels. Accompanying these decreasing percentages, the proportions of confirmations of diabetes increase from 0 for persons screened at less than 70 mg., up to 100 percent at 200 mg. per 100 cc. and over. The same reciprocal relationship is evident here as was pointed out in the preceding example. Lowering the screening level makes it necessary to process larger and larger groups of suspects with a decreasing rate of confirmation.

"False-Positive" Results

In populations where the prevalence of a disease is low, furthermore, significant percentages of false positives must be expected in screening, even where measurements along a range of values, or gradient, may not be involved. Suppose, for example, that screening is being done for a disease actually present in only about 2 percent of the screenees. In such a situation, let us assume a typical population of 1,000 persons, among whom 20 have the disease in question. Let us also assume a screening test which, applied to this group, will screen out 19 of the 20 diseased persons and only 19 others. Nineteen of these positives will then be verified by diagnosis and the other 19 will be diagnosed negative. Thus, 19 out of 38 screen positives are false, giving a "false-positive" rate of 50 percent. It would be a mistake, however, to condemn the screen test itself for this rate. Actually, a false-positive rate calculated in this manner is misleading, unless allowance is made for the fact that the rate depends on the prevalence of disease in the population screened. Nineteen of the twenty persons with the disease were properly classified by the test, and, therefore, sensitivity in this example is 19/20 or 95 percent. The specificity is 961/980, or 98 percent, since 961 of the 980 persons without the disease were correctly classified. Thus the screen test must be acknowledged to be highly efficient.

Planning the Project

The problems illustrated here lie at the root of much confusion regarding tests and standards, and have even cast doubt upon the feasibility of the screening approach in general. However, the same situation is faced in screen-

ing by any method that yields a wide range of values or deals with conditions of relatively low prevalence. It is more realistic and more productive—and in accord with medical traditions—to seek practical solutions to such problems, rather than to surrender for lack of perfect solutions.

Practical solutions must be sought in terms of the work involved in retesting and referral, the diagnostic workload that results from screening and retesting at any given level, and the resources required to meet the resulting diagnostic and care problems, as well as the costs incurred at each stage. The psychological effects upon the screenee cannot be overlooked. Particular care must be taken not to give him a false sense of confidence in the results of the screening test: He should be aware from the beginning that the screening is not a substitute for a complete health examination and that he is being tested for only certain specific conditions. Each local situation must be studied in the light of the possible effects of false positives and false negatives upon medical practice and on public reaction.

The local physicians and heads of clinics or hospitals, who will be expected to diagnose and treat the various conditions, should be included in the planning so that standards for screening, procedures and facilities for referral, diagnosis, treatment, rehabilitation, and education will be coordinated and have meaning for all concerned.

This cooperative planning should also deal with the problem of the person without frank disease who may have an abnormal condition in an early or incipient stage. Although frequently mentioned in the literature, such cases have not always been dealt with adequately in connection with screening programs. Decisions as to how this problem is to be handled have important implications for early case finding, for management of screenees and patients, and for the health education to be accomplished throughout the entire project. As indicated above, we can no longer think only in terms of the presence or absence of disease when dealing with deficiency and degenerative diseases. Many of the persons falling between the definitely normal and the definitely abnormal will not be regarded by their physicians as needing medical supervision in the usual sense. The physician may, however, want to follow them because of the possibility of subsequent development of frank disease.

The objectives of a screening project should not only be discussed thoroughly and agreed upon definitely by those concerned, but should be expressed clearly in writing to avoid the possibility of later misunderstandings. Two major objectives—direct service to the public, and research—may be involved. If they are combined, each of these objectives will exert a limiting influence upon the other. Definite decisions as to the relative emphasis to be given to direct service and to research should be made in advance.

The kind of thorough planning indicated here for multiple screening and its ramifications will, of course, be familiar to those with experience in the public health field, since counterparts of the problems involved are found in the development of any public health program.

Evaluation of Multiple Screening

Although much progress has been made, multiple screening is still in an evolutionary stage. Screening and followup programs for syphilis and tuberculosis have been highly developed, but this is not true of screening for other diseases or for groups of diseases. Much remains to be learned through evaluation of multiple screening, in terms of accomplishments and costs of procedures to be followed at various stages from the original screening through the entire followup.

In the final analysis, of course, screening can be evaluated only by its results, such as reduced morbidity, disability, or mortality. Its ultimate value in the local community will be achieved as it becomes an integral part of a well-rounded chronic disease program, but on a limited scale multiple screening can serve to stimulate and guide the evolution of such a program.

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A complete bibliography on multiple screening may be obtained upon request to the Publications Section, Division of Chronic Disease and Tuberculosis, Public Health Service, Washington 25, D. C.