

# Multiple Screening Pilot Study

—*Report of the Indianapolis, Indiana, Project*—

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A PILOT STUDY of the multiple screening case-finding technique was conducted in Indianapolis, Ind., from January 1950 through August 1952, to determine the kind and amount of disease discoverable by this method and, at the same time, to examine the feasibility of using the technique in a permanent health center setting. The study was carried out through the joint efforts of the city health department, the Indiana Department of Health, the Public Health Service, and Flanner House, a community center in Indianapolis designed primarily to serve the Negro population of the city.

## Study Population and Procedures

The screening project was located in the Herman G. Morgan Health Center, a modern, well-equipped facility which serves as a city health department clinic and center for the dissemination

of health information. Although the center is available to anyone in the city, the majority of the persons who come there for service live nearby.

Screenees were drawn from census tracts in Indianapolis that account for all but 2 percent of the city's Negro population. Area of residence (census tract) was entered on the screenee's record for only 1 year of the project, June 1, 1951, through May 31, 1952. During this time, 1,344 Negroes were screened, which was 2.1 percent of the Negro population of Indianapolis in 1950. In the 2 census tracts immediately surrounding the health center, 2.4 percent of the Negro population was screened; in the areas relatively near the center 2.5 percent was screened, and in the outlying areas 1.5 percent was screened. For the duration of the project, it is estimated that approximately 8 percent of the Negroes in Indianapolis received the tests.

Although no general public announcement of the project was made, considerable door-to-door visiting was done. Most screenees, however, were recruited by talks to various community groups. About 82 percent of the screenees came in through such efforts; the remainder were persons who needed health certificates in order to work.

During the project, 5,711 persons were screened. The age, race, and sex of the screened population are given in table 1.

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All persons screened were tested for the conditions and by the tests listed in table 2. Table 3 shows the results of screening and retesting, together with the number of persons referred for further diagnostic work. Of the 5,711 persons screened, 3,102 were referred for 6,474 conditions, and 2,420 persons were referred for 2,743 conditions other than weight, vision, or hearing. The latter figures represent 1.13 conditions per person referred.

**Table 1. Composition of population screened: race, sex, and age**

Age (years)	Negro			All races		
	Male	Female	Total	Male	Female	Total
16-34 <sup>1</sup> ...	611	1, 613	2, 224	676	1, 738	2, 414
35-54.....	563	1, 458	2, 021	656	1, 646	2, 302
55-74.....	318	502	820	348	579	927
75-88.....	31	25	56	35	31	66
Unknown..	0	0	0	2	0	2
Total...	1, 523	3, 598	5, 121	1, 717	3, 994	5, 711

<sup>1</sup> Persons under 16 years of age were not screened.

When only tests for weight or vision were positive, the screenee was usually advised by letter to seek medical advice or care, although some overweight screenees were referred to the health center nutritionist for advice. If other tests were positive, screenees were requested to return for retesting usually 8 days after the initial tests. When both the original test and the retest were positive, the screenee was advised to see his personal physician or to visit a public clinic for diagnosis and, if necessary, medical care.

### Followup Methods

When referral was made, a complete transcript of both screening and retesting results was forwarded either to the physician or to the appropriate public clinic. A report card was sent with each transcript, with the request that it be returned with a record of diagnosis and disposition of the case. The city health department checked all referrals for tuberculosis and syphilis, and records of final diagnosis of these two diseases were therefore available. For the

noncommunicable diseases, however, results of diagnosis had to be obtained from the physicians to whom screenees were referred. Since the returns were not adequate for a valid evaluation of the results of referral, it was necessary to develop a method of followup which would attain this objective and which might be generally applicable elsewhere.

Concentrated followup of referrals by personal visit was therefore directed to the 3 public clinics and the 7 private physicians having the largest volume of referrals and to all persons in whom diabetes or kidney disease was suspected, regardless of where the diagnostic procedures were carried out. This task was handled by a worker familiar with the screening project and with an understanding of the information necessary for meaningful analysis. The method yielded 100-percent reporting on a group of 1,365 persons referred for diagnostic procedures.

There was a possibility that selection of physicians on the basis of volume of referrals might introduce a bias into the data so that the followup group would not be a representative sample of the screenees as a whole. It was possible to make a test for this type of bias, however, since the volume of cases also varied among the 17 physicians selected. Reports from the 7 physicians with the most referrals were compared with one another and with reports from the other 10 physicians as to important aspects of diagnosis and disposition. Tested on this basis, the reports were found to be quite homogeneous. Comparison of age distributions was also made between persons in the followup group and other screenees. Again, no significant difference was found. Thus, within the limitations of the data available for statistical testing, no bias was discovered which would make the followup sample unsuitable for use as a basis for estimates.

In the sample followup group of 1,365 persons, 19.4 percent failed to go to a physician or clinic; 2.4 percent reported to physicians but no definitive diagnosis was made; and diagnostic reports were received for 78.2 percent of persons referred. One or more conditions were confirmed for 70 percent of the group, and 21 percent, or 283 persons, had previously unknown diseases diagnosed.

**Table 2. Screening and retesting procedures**

Screening procedure	Technique	Criterion for positivity	Retesting
Height-weight-body build measurement.	First method: Height and weight with shoes on but without outer clothing.	10 percent below or 30 percent above normal range of life insurance company table of ideal weights for small, medium, and large frame (as judged), for age 25 years and over.	Not routinely done.
	Pryor method <sup>1</sup> (adopted later): Lateral thoracic diameter and bi-iliac diameter used to determine body build.	Weight expressed as percentage of Pryor standard; limits of normal, 77.5 percent and 121.5 percent.	Not routinely done.
Chest X-ray-----	70-mm. film-----	Judgment of radiologist, reading for tuberculosis, heart disease, and other chest pathology.	14" x 17" film (not routine for cardiac abnormality alone).
Cardiovascular tests done by a physician:			
History-----	Questions covering chest discomfort, dyspnea, orthopnea, or rheumatic fever and/or history of heart disease or hypertension.	(Screenees not referred on basis of positive history alone.)	Not routinely done.
Blood pressure-----	Sitting position, standard mercury manometer.	Over 150 mm. systolic and/or 90 diastolic.	Same method and standard.
Auscultation-----	Brief check for evidence of possible heart disease.	Judgment of examining physician.	Not routinely done.
Hearing test-----	Each ear tested with pure-tone audiometer at 500, 1,000, 2,000, 4,000, and 8,000 cycles.	30 decibels; 1 failure in each ear or 2 failures in 1 ear.	Complete audiogram; average threshold above 30 decibels in either ear considered abnormal.
Urine specimen obtained for:			
Urine albumin test---	Heller ring test-----	Trace or more-----	Same method and standard.
Urine sugar test-----	Clinitest-----	Trace or more-----	Same method and standard.
Blood specimen taken by venipuncture for:			
Blood sugar-----	Wilkerson-Heftmann tablet method, done manually.	Initially 180 mg. percent; later lowered to 130 mg. percent; no account taken of food eaten.	Same method at 180-mg. level, 1 hour after ingestion of 50 gm. glucose.
Serologic test for syphilis.	Mazzini qualitative-----	Doubtful or positive-----	Same method, done by city laboratory, quantitated if positive.
Hemoglobin-----	Sheard and Sanford photoelectrometer.	Under 11.0 gm. per 100 cc. for women; under 12.5 gm. for men.	Same method and standard.
Visual acuity test-----	Sight screener (American Optical Co.), 6 acuity test.	2 tests 20/40 or poorer or 1 test 20/50 or poorer.	Same method and standard.

<sup>1</sup> Pryor, Helen B: Width-weight tables. Ed. 2. Revised. Stanford University, Calif., Stanford University Press, 1940.

**Table 3. Results of screening and retesting, and number of persons referred for further diagnostic work**

Test or condition	Screening test			Retesting			Persons referred	
	Number persons screened	Number (positive)	Percent (positive)	Number persons retested	Number (positive)	Percent (positive)	Number	Percent of total screened
All.....	<sup>1</sup> 5, 711	4, 283	75. 0	3, 007	2, 639	87. 8	3, 102	54. 3
Cardiovascular.....	5, 711	1, 802	31. 6	1, 395	1, 106	79. 3	1, 094	19. 2
Blood pressure.....	5, 711	1, 465	25. 7	1, 375	1, 024	74. 5		
History.....	5, 706	1, 756	30. 8	3	3			
Auscultation.....	5, 709	286	5. 0	26	17	65. 4		
X-ray.....	5, 701	675	11. 8	28	28	100. 0		
Diabetes.....	5, 708	147	2. 6	131	98	74. 8	117	2. 0
Blood sugar.....	5, 695	127	2. 2	114	87	76. 3		
Urine sugar.....	5, 704	113	2. 0	101	87	86. 1		
X-ray (tuberculosis).....	5, 701	98	1. 7	74	64	86. 5	90	1. 6
Miscellaneous chest pathology.....	5, 701	153	2. 7	72	40	55. 6	87	1. 5
Hemoglobin.....	5, 694	923	16. 2	492	381	77. 4	538	9. 4
Mazzini.....	5, 684	709	12. 5	682	547	80. 2	702	12. 4
Urine albumin.....	5, 701	125	2. 2	101	57	56. 4	81	1. 4
Overweight <sup>2</sup> .....	4, 108	656	16. 0	5	4		655	15. 9
Underweight <sup>2</sup> .....	4, 108	245	6. 0	2	1		244	5. 9
Overweight <sup>3</sup> .....	1, 602	137	8. 6	1	1		137	8. 6
Underweight <sup>3</sup> .....	1, 602	22	1. 4	0	0		22	1. 4
Vision.....	5, 697	2, 534	44. 5	1, 737	1, 373	79. 0	2, 173	38. 1
Hearing.....	5, 650	1, 120	19. 8	1, 059	437	41. 3	500	8. 8
Other <sup>4</sup> .....	5, 711	47	. 8	2	2		34	. 6

<sup>1</sup> Includes only the original screening for those persons screened more than once. <sup>2</sup> Based on life insurance tables. <sup>3</sup> Based on Pryor measurements. <sup>4</sup> Miscellaneous conditions observed by the physician in charge.

**Results**

The results of the project in terms of confirmation of screening results and of previously unknown cases discovered are presented in table 4. Shown are the number of persons referred for each condition and the number of cases, both new and old, diagnosed as a result of the screening of 5,711 persons. The numbers of

cases of cardiovascular disease, anemia, and "other diseases" are estimated on the basis of the sample findings.

Table 4 also shows that 1,612 positive diagnoses, including 474 newly discovered conditions, resulted from the screening and referral process, a ratio of 8.3 newly discovered conditions for every 100 persons screened. The per-

**Table 4. Senees referred, positive diagnoses, and new cases, according to disease for which referred**

Disease for which referred	Number persons screened	Persons referred for diagnosis		Positive diagnoses		Previously unknown cases	
		Number	Percent	Number	Percent	Number	Percent
Anemia.....	5, 694	<sup>1</sup> 538	9. 4	<sup>1</sup> 220	3. 9	<sup>1</sup> 96	1. 7
Cardiovascular disease.....	5, 711	1, 094	19. 2	<sup>1</sup> 646	11. 3	<sup>1</sup> 177	3. 1
Diabetes.....	5, 708	117	2. 0	66	1. 2	25	. 4
Kidney disease.....	5, 701	81	1. 4	33	. 6	10	. 2
Syphilis.....	5, 684	702	12. 4	541	9. 5	118	2. 1
Tuberculosis.....	5, 701	90	1. 6	58	1. 0	23	. 4
Active.....				22	. 4	17	. 3
Other diseases.....	5, 711	121	2. 1	<sup>1</sup> 48	. 8	<sup>1</sup> 25	. 4
Total.....	5, 711	2, 743		1, 612		474	

<sup>1</sup> Estimated on basis of followup sample.

**Table 5. Cases of cardiovascular disease diagnosed in the special followup group of 336 persons**

Diagnosis	Number of cases	Newly discovered cases	
		Number	Percent
Total.....	378	107	28.3
All heart disease.....	167	38	22.8
Hypertensive heart disease.....	77	17	22.1
Arteriosclerotic heart disease.....	37	12	32.4
Syphilitic heart disease.....	8	0	-----
Rheumatic heart disease.....	9	1	-----
Other heart disease.....	36	8	22.2
All vascular disease.....	211	69	32.7
Hypertension <sup>1</sup> .....	175	56	32.0
Arteriosclerosis.....	34	13	38.2
Other vascular disease.....	2	0	-----

<sup>1</sup> All diagnoses of hypertension, with or without mention of heart disease, but exclusive of hypertensive heart disease.

centage of screenees referred for diagnosis ranges from 1.4 for kidney disease to 19 for cardiovascular disease. The percentage with confirmed diagnoses ranges from 0.4 for active tuberculosis to 11.3 for cardiovascular disease. The percentage with new cases ranges from 0.2 for kidney disease to 3.1 for cardiovascular disease.

Because of the importance of cardiovascular disease, the principal types diagnosed and the number and percentage of previously unknown cases in the special followup group are shown in table 5. Cases of hypertension numbered 175; of hypertensive heart disease, 77. Twenty-eight percent of all cardiovascular disease diag-

noses were previously unknown. Nearly a third of the cases of hypertension and of arteriosclerotic heart disease were new cases.

### Summary

1. A multiple screening project was conducted from January 1950 through August 1952 in Indianapolis, Ind., through the cooperative efforts of the city health department, the State health department, the Public Health Service, and Flanner House. The project was designed to determine the kind and amount of disease discoverable by the multiple screening case-finding technique and the feasibility of using such a technique in a permanent health center setting.

2. During the project 5,711 persons were screened; 3,102 persons were referred for a total of 5,611 conditions.

3. Concentrated followup of referrals was undertaken by visits to 17 physicians and 3 public clinics in order to secure 100-percent reporting on a definite segment of referrals. The followup worker also visited physicians and clinics to whom diabetes and kidney disease suspects were referred in order to secure 100-percent reporting on these conditions. The city health department checked all referrals for tuberculosis and syphilis. No followup was undertaken on referrals for weight, vision, or hearing.

4. A significant number of new cases were discovered; the number amounting to 8.3 cases per 100 persons screened. The diseases discovered included such serious conditions as cardiovascular disease, active tuberculosis, diabetes, syphilis, and kidney disease.

