Evaluation During the Development of a Public Health Program in Chronic Disease

The Albany Cardiovascular Health Center

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Evaluation is presented here more as a scientifically critical point of view—which must be built into each program during its development—rather than as a special procedure to be performed periodically. As many of our current programs have not been so constructed, their successful evaluation demands rigid attention to the validity and reliability of the measures upon which conclusions about them are to be based.

Effective evaluation in public health requires the same planned research approach which should characterize the performance of any project aimed at increasing the systematized body of knowledge. When one considers, then, the evaluation of a long-term research project in program development like the Albany Cardiovascular Health Center, it becomes evident that such an evaluation depends upon how well the project has been planned and executed with this exact purpose in mind.

The Cardiovascular Health Center (CVHC) was established in 1953 as a program for the periodic examination of the cardiovascular status of 2,000 male Civil Service employees, ages 40–54, in the Capital District area of New York State.[1] It was devised with these major objectives:

1. To detect and follow coronary heart disease and hypertension, determining the incidence, prevalence, and progress of these diseases among the participant group.
2. To determine the accuracy and efficiency of the various technics for the detection of these heart diseases during their preclinical or earliest clinical stage.
3. To develop and evaluate methods of applying these detection tests to large groups in the population.
4. To develop and maintain a research team which will be encouraged to perform satellite studies around the core examination program. These studies in turn should constitute significant additions to basic knowledge about heart disease.
5. To offer an excellent periodic cardiovascular diagnostic service to 2,000 "susceptible" males, sending all pertinent data to each participant's family physician.
6. To stimulate and develop the interest of all public health workers in New York State in heart disease problems and programs.

Hence, the CVHC program is a long-term research approach to a complex public health problem. While planning and consolidating the basic structure in some detail, the exact procedures employed have been allowed to remain fluid, to keep them "timely," under the guidance of suitable medical scientists. In terms of program planning, this means simply that the CVHC has certain long-range objectives which give it a consistent purpose and direction, and numerous short-term objectives, which

are created and tested. The successful ones serve as the premises upon which new short-term objectives are based; the unsuccessful are discarded. Evaluation under such a plan is built in as a continuous process. Success in meeting the distant objectives can only be obtained now in terms of such yardsticks as are available and shows only that we appear to be on course.

In this project the validation of the yardsticks themselves forms the short-term objective. It is with these yardsticks that we hope to build toward our distant goals, in a step-by-step fashion. It is in terms of these, and only in such terms, that a true evaluation of the long-range goal becomes possible. In short, it is unlikely that one could perform a successful evaluation of any existing program for the "control" of adult heart disease using the yardsticks and disease classifications that are now available. Certainly such an evaluation, if performed, would lack the scientific precision required for both widespread understanding of the results and their extension toward the next step in practical heart disease control.

The discussion presented here relates to several of the long-range and short-term objectives. Most of the data are based upon the first examinations of the 1,494 participants already studied at the CVHC. Only illustrative examples will be presented. A complete description of the program and some of the early findings are available,[1-3] and additional reports will follow.

Evaluation in Terms of Long-Range Objectives

The stated purposes of the project include measures of the prevalence and incidence of various conditions among middle-aged male state employees. This requires a relatively low refusal rate among the potentially eligible participant group, particularly among the younger individuals whom we hope to follow for many years. The over-all refusal rate was found to be 10.9 per cent, with the 40–44 age group refusals at 9.7 per cent. Refusals at ages 45–49 were 11.0 per cent, and in the group 50–54 they were 14.2 per cent. The next step, an attempt to assess the extent of heart disease among refusals, is now being developed. Even if this cannot be clearly established, we may follow our 90 per cent sample, fairly certain that no crucial bias will result in our studies with coronary heart disease, which is responsible for one-third of all male deaths in New York State.

What can we say about the prevalence of the various heart diseases in our group? Table 1 indicates this prevalence under two categories, that reported by the patient himself and substantiated at the center, and that which was diagnosed at the center but not reported by the patient. This latter group has not yet been divided into those who do not report heart disease on interview because they do not know their condition, from those who know but do not confide in the examiner. In presenting these data we must emphasize that the diagnostic categories are based upon currently detectable signs and symptoms. These are almost certainly not the best possible yardsticks for this purpose, although they are the best that medical science now has available. Newer diagnostic procedures and criteria as

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Table 1—Possible Newly Diagnosed Cases of Certain Diseases * Cardiovascular Health Center—April 1, 1954

	Diagnosed at Center		Previously Known		Newly Diagnosed	
	Number	Rate per 1,000	Number	Rate per 1,000	Number	Rate per 1,000
Tuberculosis	48	34	26	19	22	16
Bronchial asthma	11	8	5	4	6	4
Diabetes	15	11	12	9	3	2
Chronic arthritis	22	16	18	13	4	3
Coronary heart disease	42	30	30	21	12	9
Hypertensive heart disease	42	30	0	0	42	30
Hypertension	184	132	62	44	122	88

* For ages 40–54, 1,394 persons

well as repeated observations may effect major changes in these rates.

Toward the objective of developing research teams and encouraging satellite projects, it can be reported that six members of the staff of the New York State Department of Health and three of the Albany Medical College are actively engaged in such studies. A highly skilled protein chemist has been employed by the Health Department and is exploring the lipoprotein problem with the latest technics and laboratory equipment. It is, of course, too early to give an appraisal of the scientific merit of these satellite research projects, and one can note only their promising beginning.

A marked stimulation of interest in heart disease among the public health physicians in New York State has been a direct result of the CVHC. Inservice training sessions on heart disease have been held for 30 key members of the department, and more are planned. The CVHC program contributed to the development of a new Bureau of Chronic Disease and Geriatrics in the department, and to the selection of heart disease control as one of its high priorities for the coming two years. Gradually there is developing a feeling among the staff of understanding and interest in the current public health aspects of heart disease. This is the kind of interest and understanding through which the department has been able to contribute to the art and science of public health in so many other fields. It is for these and similar reasons of a general nature that the New York State Department of Health feels it is on the right path toward the successful attainment of the long-range objectives of the CVHC.

Evaluation in Terms of Short-Term Objectives

The program in yardstick evaluation can be described as an assessment of the confidence that can be placed in certain standards, diagnostic categories and other classifications which are used or proposed in public health. Yardsticks are required for the evaluation of general program performance, and of what use is a final evaluation if the standards employed are unreliable, invalid, or unnecessary? Even if one limits the term "evaluation" to an appraisal of final program results, the first step in this process must always be an appraisal of the yardstick used.

Physicians frequently place great reliance on the medical history of their

Table 2—Signs and Symptoms in Various Diagnostic Groups Cardiovascular Health Center—April 1, 1954

Total Number in Group	Coronary H. D. 47 *		Hyper. H. D. 49 *		Hypertension 147		Hemorrhoids 192		All Others 1,064	
Sign or Symptom	Number Positive	Per cent	Number Positive	Per cent	Number Positive	Per cent	Number Positive	Per cent	Number Positive	Per cent
Pain, heaviness or discomfort in chest	37	79	16	33	47	32	51	27	357	34
Aching or tenderness around heart	26	55	11	22	32	22	38	20	213	20
Unusually fatigued during day	20	43	9	18	28	19	43	22	222	21
Feel choked or smothered	12	26	6	12	16	11	16	8	110	10
Short wind	12	26	7	14	24	16	26	14	163	15
Feel heart beating	27	57	26	53	73	50	86	45	536	50
Heart races	16	34	20	41	50	54	62	32	391	37
Ankles swell	4	9	3	6	17	12	18	9	62	6

* There are five individuals included in both groups

patient in arriving at a diagnosis. The history is usually listed among the important steps toward a diagnosis of coronary and other heart diseases. Table 2 shows the proportion of certain symptoms in various diagnostic groups among the CVHC participants. "Pain, heaviness or discomfort in the chest" is the symptom which leads all others in its relative frequency among cases of coronary heart disease compared with the other diagnostic groups. In addition, the next four symptoms on the list are also associated significantly with coronary heart disease, while the final three occur equally among all the groups. Patients with hemorrhoids were selected as a control group with a noncardiac disease which is also detectable by the CVHC program, to see how these symptoms, referable to the cardiovascular status, were associated with a completely different kind of clinical "condition."

Before deciding to rely for screening purposes upon the five symptoms which appear most frequently among cases of coronary heart disease, there are several more questions to be answered. One of these relates to the reliability of the symptoms, i.e., would each competent physician elicit the same symptoms from the same patient? One obviously cannot subject the same patient to a succession of different physicians and hope to obtain independent histories. However, Cochrane, et al.,[4] assumed that when patients are assigned randomly among a group of physicians, the symptoms elicited by these physicians should also be randomly distributed. Table 3 indicates that this is not true for each symptom found among the participants in this study. There is poor reliability with the first two symptoms, but the physicians seem to be about equal in eliciting the next three. Among the last three symptoms which were not more frequent among cases of coronary heart disease, the last, ankle edema, was elicited uniformly by the examiners, whereas the other two were not.

The table is also useful in pointing out those physicians who differ markedly from their colleagues in taking histories. With respect to "pain, heaviness or discomfort in chest," physicians A and G are responsible for the bulk of the variance. Similarly, with the symptom, "feel heart beating," physician A

Table 3—Signs and Symptoms in Persons Seen by Different Physicians Cardiovascular Health Center—April 1, 1954

Sign or Symptom	Per cent Positive for Symptom Among Persons Seen by Each Physician										
		Physician									
	Total	A	B	C	D	E	F	G	H	Others	Probability
Number examined by each	1,494	74	202	204	233	217	231	97	142	94	
Per cent examined by each	100.0	5.0	13.5	13.7	15.6	14.5	15.4	6.5	9.5	6.3	
Pain, heaviness or discomfort in chest	34.5	16.2	38.1	30.9	30.5	32.3	37.2	54.6	35.9	34.0	0.001
Aching or tenderness around heart	21.8	17.6	28.7	21.1	13.7	17.1	23.8	32.0	22.5	25.5	0.01–0.001
Unusually fatigued during day	21.6	21.6	27.2	18.1	17.6	19.4	23.4	22.7	27.5	17.0	0.10–0.20
Feel choked or smothered	11.0	4.1	13.4	9.3	10.3	8.8	13.9	12.4	12.7	10.6	0.30–0.50
Short wind	15.7	17.6	18.3	16.7	11.6	14.3	16.0	20.6	16.9	12.8	0.30–0.50
Feel heart beating	50.7	24.3	54.0	57.4	50.2	52.1	51.1	49.5	53.5	44.7	0.001
Heart races	36.9	25.7	35.1	37.7	36.1	38.2	37.7	49.5	39.4	27.7	0.02–0.05
Ankles swell	7.2	4.1	7.4	4.4	8.2	7.3	7.8	8.2	6.3	10.6	0.70–0.80

seems responsible for the total significant variance. This does not prove a given physician right or wrong, but it does indicate that the examiners must reappraise their criteria for symptomatology and attempt to standardize their methods of eliciting the information. If this cannot be done, then symptoms and the diagnoses based upon them may be of limited value in the evaluation of community cardiac needs or programs.

An important part of every patient's history is that portion devoted to a review of the family history. The CVHC data indicate that the patient with coronary heart disease has a past history of heart disease 49 per cent of the time in the father and 34 per cent in the mother. This compares with a paternal history of heart disease in 23–29 per cent and a similar maternal history in 18–26 per cent of those with hypertension, rheumatic fever, hemorrhoids, or hypertensive heart disease. Since so many of the cases of coronary heart disease among the participant group had been diagnosed before the CVHC examination, many of them may have been more aware of a positive family history for heart disease because of repeated discussions with a family physician. However, even though the numbers are small, it is of interest that of the 12 cases of coronary heart disease presumably detected at the center, 6 (50 per cent) had a positive family history among their fathers, and 5 (42 per cent) among their mothers. Additional evidence will be obtained as repeat examinations reveal still more new cases of coronary heart disease. The next step will be for us to gain more information about the parents and attempt to trace the actual death certificates of those who died in New York State.

Another measure of cardiac disease used frequently today is heart size—commonly left ventricular hypertrophy and dilatation. Rutstein, et al.,[5] have reported on the screening value of chest x-rays for heart disease, and Gubner and Ungerleider [6] have emphasized the value of the electrocardiogram as a sign of cardiac enlargement. In addition, clinicians, since the days when chests were first percussed, have determined heart size by physical examination. Table 4 shows the cardiac enlargement on 1,453 of the participants by both electrocardiogram and x-ray. One may say that

Table 4—Cardiac Enlargement on Electrocardiogram and on X-ray Cardiovascular Health Center—April 1, 1954

			X-ray			
	Total		Enlarged		Not Enlarged	
Electrocardiogram	Number	Per cent	Number	Per cent	Number	Per cent
Total	1,453	100.0	51	3.5	1,402	96.5
Enlarged	93	100.0	12	12.9	81	87.1
Not enlarged	1,360	100.0	39	2.9	1,321	97.1

the electrocardiogram finds relatively more large hearts among those who have cardiac enlargements on x-ray, and vice versa, but the electrical and photographic technics by no means screen out the same patients. We may conclude tentatively that the human interpretations of electrocardiograms and the x-ray films show either different stages or different kinds of cardiac hypertrophy. Future follow-up studies should help to explain this more fully.

When cardiac enlargements as detected by the x-ray and physical examination are compared in Table 5, the poor validity of the physical examination must be admitted. We can think of no other reasonable explanation for the difference between these two technics. These data cast considerable doubt upon the value of a routine physical examination for the detection of cardiac enlargement.

Before leaving the question of measuring heart size by the electrocardiogram, one might ask about the reliability of this technic for the detection of cardiac enlargement. Studies on the reliability of x-ray films for tuberculosis detection have pointed out the significant differences between the readings made by individual competent radiologists.[7] It seems reasonable to suspect that differences in the interpretation of electrocardiograms by individual cardiologists may occur. To determine this, four cardiologists working independently read the 12-lead tracings on 163 participants. These sample records were selected by a statistician in consultation with a fifth cardiologist, and included the tracings suggestive of left ventricular hypertrophy, as well as a number of presumed negative tracings from matched controls. Table 6 tells its own story and suggests that much more

Table 5—Cardiac Enlargement on X-ray and on Physical Examination Cardiovascular Health Center—April 1, 1954

			Physical Examination *			
	Total		Enlarged		Not Enlarged	
X-ray	Number	Per cent	Number	Per cent	Number	Per cent
Total	1,453	100.0	179	12.3	1,274	87.7
Enlarged	51	100.0	15	29.4	36	70.6
Not enlarged	1,402	100.0	164	11.7	1,238	88.3

* Heart was enlarged if the left border of dullness in the fourth, fifth, or sixth interspace exceeds the mid-clavicular line

Table 6—Left Ventricular Enlargement as Read From EKG's Taken at Rest Cardiovascular Health Center—April 1, 1954

	Total	Heart Enlarged on X-ray	
		Number	Per cent
Total number of EKG's read	163	14	8.6
No enlargement	75	1	1.4
Enlargement present	88	13	14.8
All four agree	23	7	30.4
Three agree	18	3	16.8
Two agree	20	0	0.0
One person	27	3	11.1

experience and study are required before this yardstick can be accepted as a reliable technic for heart size detection. It is this type of study which the CVHC hopes to carry on through a program of repeated examination of its participant group.

Among the individuals examined at the CVHC, 44 were diagnosed as definite cases of coronary heart disease. Table 7 demonstrates that three groups of roughly one-third each were discovered by history alone, by history plus electrocardiogram, and by electrocardiogram alone. This again emphasizes the importance of standardizing the history. Of the group diagnosed by electrocardiographic findings alone, one-third, or about 9 per cent of the entire series of cases, were discovered because of the exercise test: the double Master's test or 10 minutes walking on the treadmill at three miles per hour on a 5 per cent grade. The exercise test was also required to obtain a positive electrocardiogram in three of the persons who also had a positive history for coronary heart disease. Hence, we may conclude that the postexercise electrocardiogram has a definite role in the detection of coronary heart disease, since it was the only positive electrocardiogram obtained in 16 per cent or seven out of the 44 cases of this disease diagnosed.

Table 7—Electrocardiogram and Basis for Diagnosis Among those Diagnosed as Coronary Heart Disease Cardiovascular Health Center—April 1, 1954

Basis for Diagnosis	Total		Resting EKG Pos. for Cor. Dis.	Electrocardiogram			
				Resting EKG Normal			
					No Exercise Test	After Exercise Test	
	Number	Per cent		Total		EKG neg.	EKG pos.
Total	44 *	100.0	22	22	6	9	7
History alone	15	34.1	0	15	6	9	0
EKG and history	17	38.6	14	3	0	0	3
EKG alone	12	27.3	8	4	0	0	4

* Excludes three cases of questionable angina diagnosed on the history alone

When one considers the detection of coronary heart disease from the standpoint of the electrocardiogram, the exercise was crucial in nearly one-quarter or seven of the 29 electrocardiograms which indicated the presence of this condition.

Another side to this story will come from the analysis of data on those persons with positive exercise electrocardiograms who are not considered as clinical cases of coronary heart disease by the cardiologists because the exercise test was not deemed sufficient evidence for a diagnosis. These "false positives" are being studied to see whether they have a decidedly higher risk of developing coronary disease during future years.

The examinations of the participants also furnish data on the association of age, obesity, and blood pressure. Table 8 indicates that over the age range studied the obese, those whose weight is more than 20 per cent over the Metropolitan Life Insurance Company standards for height-weight, comprise about 20 per cent of persons whose blood pressures are above 160 systolic and 100 diastolic. As age increases, the proportion of those with the higher blood pressures increases in both the obese and the nonobese groups. In each age group, however, the proportion of those with "high" blood pressure among the obese is about twice that in the nonobese group. This suggests that the obese participants in our series have about twice the risk of having a blood pressure over 160 systolic and 100 diastolic, compared to their nonobese colleagues in the same five-year age group. Still unanswered for the present are the crucial questions of whether reduction of weight among our obese participants will result in less hypertension now and less hypertensive heart disease in the future.

Although these obese males may be a good group in which to detect elevated blood pressure, the prevalence of coronary heart disease does not differ from that of the males in our series who are not obese. The frequency of obesity (20.0 per cent) among cases of coronary heart disease was found to be similar to the obesity prevalence rate of 20.7 per cent among those who had no heart disease. On the other hand, 37.4 per cent of those whose blood pressure was over 160/100 were obese. Satellite projects are being planned to discover whether there are certain dietary differences between coronary cases and others, but such studies present exceedingly complex methodological problems.

Table 8—Blood Pressure by Age and Extent of Obesity Cardiovascular Health Center—April 1, 1954

Age	Total		Per cent Obese in Normals *	Per cent with Diastolic Blood Pressure 100 and over		Per cent with Systolic Blood Pressure 160 and over	
	Obese	Nonobese		Obese †	Nonobese	Obese	Nonobese
Total	334	1,144	20.0	25.4	13.3	18.9	10.9
Under 40	6	24	20.0	0	8.3	0	8.3
40–44	112	395	21.0	20.5	9.4	10.7	6.6
45–49	111	387	20.0	24.3	13.2	19.8	9.8
50–54	91	286	21.0	34.1	18.5	27.5	16.4
55 and over	14	52	20.0	28.6	17.3	28.6	23.1

* Persons without coronary heart disease, hypertension, or hypertensive heart disease
† 20 per cent or more overweight according to MLI standards

Table 9—Blood Pressure by Median Mid-costo-iliac Skinfold Reading Cardiovascular Health Center—April 1, 1954

Median Mid-costo-iliac Skinfold Reading	Total	Systolic Blood Pressure 160 and over		Diastolic Blood Pressure 100 and over	
		Number	Per cent	Number	Per cent
Total	426	55	12.9	70	16.4
Less than 5.0	10	1	10.0	0	0.0
5.0– 9.9	68	4	5.9	6	8.8
10.0–14.9	113	10	8.8	12	10.6
15.0–19.9	100	13	13.0	13	13.0
20.0–24.9	72	9	12.5	15	20.8
25.0–29.9	39	6	15.4	12	30.8
30.0 and over	24	12	50.0	12	50.0

Besides the usual height-weight standards of obesity, the skinfold thickness has been proposed as a yardstick. Preliminary statistical studies at the CVHC, still unreported, indicated that the mid-costo-iliac fold appeared to be more reliable than several others when measurement is repeated, while giving the greatest difference in measurements made between individuals. Table 9 presents the blood pressure data for 426 consecutive participants tested by skinfolds along with the remainder of the CVHC examination. Although the numbers are small, there appears to be an association between thickness of the mid-costo-iliac skinfold and blood pressure over 160 systolic and 100 diastolic.

Table 10 presents some additional data comparing the height-weight and skinfold technics of screening for elevated blood pressures when a skinfold thickness of 22.5 mm and over is used as a standard. This technic screens 22 per cent of a sample group of 424 consecutive participants as obese. This is numerically similar to the 24 per cent of the same group of 424 who are more than 20 per cent overweight by height-weight standards. The group of 22 per cent detected as obese by the skinfold test contains 32.6 per cent with a diastolic blood pressure over 100 mm, and those obese by the height-weight standards contained a similar number of hypertensives (29.7 per cent). In the group who are obese by both the height-weight and skinfold tests, the prevalence of hypertension is 37.5 per cent. Among those who are not obese by either test,

Table 10—Diastolic Blood Pressure and Obesity by Skinfold Measurement and by Height and Weight Standard Cardiovascular Health Center—April 1, 1954

Standard for Obesity	Total Number	Diastolic Blood Pressure 100 or over	
		Number	Per cent
Skinfold measurement	95	31	32.6
Height-Weight standard	101	30	29.7
Both *	56	21	37.5
Neither	284	30	10.8

* Also included under each technic separately

only 10.8 per cent are found to be hypertensive. The prevalence of hypertension among those obese by both tests is thus three and one-half times as great as it is among those who are negative on both tests. Hence, by using the two tests together we have raised the degree of association of hypertension with obesity, by developing a new compound standard for obesity. Here, also, much more work must be performed in an attempt to refine these tests and determine their reliability.

Discussion

Public health is now at that stage in transition where the emphasis is shifting from the communicable diseases toward those serious problems posed by the chronic degenerative illnesses. Evaluation must play a constant role in the step-by-step development of these new programs as well as in the over-all measurement of the success of some of our more traditional efforts. Although evaluation can be defined, molded into definite conceptual systems and discussed, it is after all primarily a critical point of view. It becomes a question of proving to scientific colleagues how we know our efforts have been successful, what assumptions were required in order to establish this proof, and what degree of confidence we demand for these assumptions. Perhaps if these points of view had been built directly into more of our traditional programs, we would not now be called upon to prove to the sceptics, including in this group a large number of our own colleagues, that so many of these activities are essential or even useful to the conquest of disease. This failure must not be repeated as we progress against heart disease, cancer, diabetes, and obesity. The intermediate steps offer innumerable challenges to all interested in their exploration. The summation of successful evaluations of each short-term project affords a considerable portion of the answer to the question of the performance of these public health programs of the future. For those programs now operating, which were not constructed with these principles in mind, great care must be given to an appraisal of the yardsticks in common use. One such study has questioned the value of the current vital statistics system as a yardstick for the measurement of public health needs and accomplishments in chronic disease.[8]

The Commission on Chronic Illness has listed the criteria for the evaluation of screening tests and mass screening programs,[9] as (a) the reliability of the test, (b) the validity of the test, including an analysis of true positives, true negatives, false positives and false negatives, (c) yield of a screening program, (d) cost, and (e) acceptance. Except for the item of cost, the present report deals with some illustrative exercises in evaluation which fit in with each of these categories.

The Albany Cardiovascular Health Center program has been planned with a large measure of humility in view of the complexity of adult heart disease and the deficiencies in the available scientific diagnostic technics. We believe that its development and operation is an example of how official public health agencies can lead in the exploration of new important but mysterious fields employing these special abilities which are part of the art and technic of public health. The data presented here are illustrative of a few of the systematic steps which must now be taken in order to make possible, and perhaps even self-evident, the evaluation of future general programs for the control of adult heart disease.

Summary

Selected data from the first 1,494 examinations performed at the Albany

Cardiovascular Health Center are presented to indicate the types of evaluations which should be performed in the development of a new and complex problem in the public health field. Examples of both long-range and short-term objectives are considered, indicating the next steps which are suggested by the data. The importance of proving the value of yardsticks used for program evaluation is mentioned.

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Commissioned Corps Nurse Officer Examinations

The Personnel Division of the Public Health Service announces that examinations are to be given for nurse officers in the Commissioned Corps on April 26, 27, and 28, 1955, in various parts of the country. The examinations include oral interviews, physical examination, and comprehensive objective written examinations.

The two options offered are clinical nursing, including nursing education, and public health nursing. The former is designed for positions as staff nurses, head nurses, or supervisors in Public Health Service hospitals and in the Bethesda Clinical Center. Candidates qualifying with the public health nursing option will be eligible for appointment at the Atlanta Communicable Disease Center, in the Indian Health Service, in Alaska, and in several foreign countries.

Officers in the Service's Commissioned Corps have rank and pay equivalent to those of Naval officers. Entrance pay for the three grades—junior assistant nurse officer, assistant nurse officer, and senior assistant nurse officer—ranges from $3,789 to $5,346 annually, with provision for periodic pay increases and "fringe" benefits.

Applications for these examinations close April 4, 1955. Application forms and further information, including notification of nearest examination center, from Division of Personnel, Public Health Service, Washington 25, D. C.