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## HEART DISEASE AND STROKE IN AN ELDERLY WELFARE POPULATION\*

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THE title of my contribution, "Heart Disease and Stroke in an Elderly Welfare Population," is in a sense misleading; the accent should be heavy on "stroke" and light on "heart disease." However, the distinction between the two should not be taken too seriously because the fundamental hypothesis that we were testing in our research was that those factors and characteristics which lead to coronary heart disease in middle age are precisely the same factors that lead to stroke a decade or two later.

Let me tell you a little about how the work came about because I think it indicates how research methods can be put to community use and how research in a community can be done—not callously and simply to gather information—but as a serious attempt to help some segments of the community.

In 1963 the late Raymond Hilliard, director of the Cook County, Ill., Department of Public Aid discovered that a large part of all the money he was spending for Old Age Assistance (OAA) was going to pay the bills of persons who had strokes. He was amazed at this and came to the Chicago Heart Association and said: "Is there anything we can do to treat these poor stroke patients more effectively?" He was informed that there was not. His next question was, "Is there anything we can do in order to prevent stroke among these unfortunate elderly people?" At that point he was told, "We do not know." He uttered a cry of anguish which moved me very much and said something to this effect, "God dammit, let's find out how we can prevent stroke."

And so this work originated in cooperation between the Chicago Heart Association and the Cook County Department of Public Aid.

The primary aim of this prospective study of stroke has been to

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\*Presented as part of a *Community Health Conference on Heart Disease in the Community* held by the New York Heart Association at The Waldorf-Astoria, New York, N.Y., October 25, 1972.

identify factors associated with risk of stroke among elderly patients in Cook County, Ill. A stratified probability sample of 4,800 persons was selected from the population of persons between the ages of 65 and 74 who were receiving old age assistance in Cook County, Ill.

The sampling fractions were deliberately adjusted so that there would be equal numbers of men and women and of whites and blacks in our group. Initial examinations were completed in approximately 75% of all these people during 1965-1970. From three to five years of follow-up are now available on the approximately 3,000 persons who had no evidence of stroke at the initial examination.

Subjects were screened every six months by field workers, who followed a detailed protocol in questioning and observing these subjects for possible neurologic examinations and disabilities. A neurologist examined the subject if the screening tests suggested that a new stroke or transient ischemic attack might have occurred. Data on end points were also obtained from death certificates, hospital charts, and medical records.

Since we examined this group at the beginning of the study, 198 new strokes developed during a period of three to five years. This alone should tell you how common this disorder is.

The annual incidence of stroke has been slightly over 2½%, with some variation by race and sex. The risk of stroke in this population was surprisingly not related to serum cholesterol, obesity, or cigarette smoking. However, risk of stroke was significantly and markedly increased among persons with even mild elevation of blood pressure, those with clinically detectable diabetes or glucose-tolerance curves indicative of mild diabetes, and also those with evidence of atherosclerosis outside the carotid and cranial circulation.

The three-year incidence of stroke in persons who had neither high blood pressure, peripheral atherosclerosis, nor a history of diabetes at initial examination, in comparison to persons who had one of these three, and to persons who had two or three conditions was significantly diminished. The incidence of stroke in those with no risk factors at all was 20 per 1,000. Among those with one risk factor it was 41 per 1,000. Among those with two or more risk factors it was 99 per 1,000.

These results indicate that elderly persons with an exceptionally high risk of stroke can be identified, and that this goal can be accomplished by reasonably brief, readily available, noninvasive procedures.

At least one of the risk factors, hypertension, is potentially modifiable by present means of therapy.

That is a summary of what we did, and at this point I go back to discuss other aspects of the study which, I hope, will be of some interest and value.

I want first to point out that of those people who had been on OAA for less than one month at the time we encountered them, many showed evidence of recent loss of weight because of their reluctance to go on welfare.

This I throw out as a challenge to people who are always talking about people who, they believe, are just waiting to go on welfare and live off the public dollar. These older people often starved themselves for weeks and months in a vain attempt to avoid getting on the welfare rolls.

Another point that I should like to make is that by employing field workers who were trained to make a diagnosis of stroke, we developed a novel approach to working with nonphysicians. We identified a group of women who had completed high school, who had had some experience in working with the public, and who wanted jobs of the kind we had to offer. In a period of four weeks these women learned to administer medical questionnaires, and to perform limited physical examinations that compared well with those done by physicians. When we compared the examinations of these high school graduates who learned how to take histories and give questionnaires with the observations of board-certified neurologists, we came to the conclusion that the agreement between the two was substantial enough to let us go on with our study.\*

So much for those who claim that people cannot be trained to do some of those highly specialized things which doctors believe only they can accomplish. The results have been published in part, and they should show how well people with a high school education, high motivation, and good training can perform. To see these women checking for evidence of illness with tact, empathy, and competence was to me a profound and important experience.

Of those older persons whom we asked to participate in the study, more than two thirds accepted. We had good acceptance among many of the various ethnic and racial groups in Chicago. One exception was

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\*Shekelle, R. B., Klawans, H., and Ostfeld, A. M.: A screening procedure for stroke. *Amer. J. Public Health* 62:2, 177-81, 1962.

TABLE I. PREVALENCE PER 1,000 POPULATION OF CORONARY HEART DISEASE AND CEREBRAL VASCULAR DISEASE

<i>Categories</i>	<i>White men No.: 660</i>	<i>Black men No.: 853</i>	<i>White women No.: 681</i>	<i>Black women No.: 947</i>
CHD	250	398	282	314
MI	183	356	170	243
AP	67	42	112	71
HHD	115	239	158	370
Stroke	459	607	350	602

In this table the terms MI, AP, and HHD mean, respectively, myocardial infarction, angina pectoris, and hypertensive disease.

older Jewish people. We did not know what this meant. We had assumed that in this group we should find an extraordinarily high completion rate because of their well-known respect for physicians and the methods of science. The reason for the relatively high refusal rate among older Jews was, as we later found out, that they refused to admit that they were on public assistance. Admitting that they were on public assistance implied that their relatives and particularly their children were not successful enough to take care of them, and they believed that was a disgrace.

The diet of these older persons varied enormously and tended to be highly idiosyncratic. We encountered patients who lived mostly on crackers and milk and others who lived on stewed tomatoes and bread. You can understand one reason for these peculiar dietary habits when I tell you that in 1963 and 1964, when the study started, the average monthly welfare check for each one of these recipients of Old Age Assistance was \$92.71 per month. That was all there was to be spent for rent, food, clothing, carfare, and everything else. The loss of a sweater, a pot, a pan, a dish, or a glass was a serious loss to these elderly people. The persons who helped us and we ourselves began to get an understanding of what real poverty is in our central cities.

I present now some numerical data and a few more points about the study.

Table I indicates the prevalence per thousand persons who had coronary heart disease (CHD) and cerebral vascular disease (CVD) at the initial examination of the group. It shows also the number of these disorders among white and black men, among white and black women. As always, there were substantial differences between the sexes and

TABLE II. PREVALENCE PER 1,000 POPULATION OF SINGLE CORONARY HEART DISEASE RISK FACTORS

<i>Risk factors</i>	<i>White men</i>	<i>Black men</i>	<i>White women</i>	<i>Black women</i>
Obesity	201	325	512	548
High blood pressure	323	376	373	464
Cholesterol*	141	181	278	383
Cho†	325	314	501	437
Cigarette smoking	502	402	243	172

\*Serum cholesterol above 250 mg./dl.

†Plasma glucose above 205 mg./dl. one hour after administration orally of 50 gm. glucose.

TABLE III. PREVALENCE PER 1,000 OF MULTIPLE CORONARY HEART DISEASE RISK FACTORS AT INITIAL EXAMINATION AMONG SUBJECTS WITHOUT CLINICAL CORONARY HEART DISEASE

	<i>White men</i> <i>N = 309</i>	<i>Black men</i> <i>N = 292</i>	<i>White women</i> <i>N = 328</i>	<i>Black women</i> <i>N = 429</i>
None or one only	330	346	222	228
Two only	314	304	350	301
Three or more	356	350	426	471

rates in the prevalence of these disorders. I use race here only in the sense that it is a commonly used term.

Table II indicates the prevalence of known risk factors for coronary heart disease among the groups. As I said earlier, we began by assuming that coronary risk factors were also relevant to cerebral vascular disease. The table shows the extraordinarily high prevalence of high blood pressure, high cholesterol, cigarette smoking, overweight, and all of the coronary risk factors we observed in this elderly group.

One of the things that we learned in a pilot study among these elderly people was that what they considered illness was very different from what we and our staff considered illness. These older people as a group assumed that chest pain, shortness of breath, cough, and swollen ankles were all perfectly natural accompaniments of growing old and not manifestations of disease. They did not believe, by and large, that the presence of these symptoms in themselves necessitated a visit to a physician or to a hospital.

There were only two manifestations which these people regularly considered as serious and necessitating medical care. These were, sur-

TABLE IV. DISTRIBUTION BY TYPE OF TREATMENT FOR DIABETES MELLITUS IN PATIENTS WITH DIABETES MELLITUS BY HISTORY AT INITIAL EXAMINATION

<i>Type of treatment</i>	<i>White men</i>	<i>Black men</i>	<i>White women</i>	<i>Black women</i>
		<i>Rates per 1,000</i>		
None	618	657	467	440
Diet only	167	67	73	194
Oral medication	167	194	339	258
Insulin	49	82	121	109

TABLE V. DISTRIBUTION BY TYPE OF TREATMENT FOR HYPERTENSION, SUBJECTS WITH SYSTOLIC PRESSURE 160 AND/OR DIASTOLIC PRESSURE 95 MM. HG AT INITIAL EXAMINATION

<i>Type of treatment</i>	<i>White men</i>	<i>Black men</i>	<i>White women</i>	<i>Black women</i>
		<i>Rates per 1,000</i>		
None	877	812	737	645
Diet only	4	22	25	10
Medication	118	165	237	344

prisingly: 1) giddiness, lightheadedness, and vertigo, and 2) any kind of change in bowel function.

Table III is self-explanatory. It indicates the numbers of people who had none or one only of the risk factors, the prevalence per 1,000 of those who had two risk factors, and the prevalence per 1,000 of those who had three or four risk factors. These indicate, of course, a huge reservoir of risk factors threatening every moment to strike these people down with heart disease or with stroke.

Table IV indicates the distribution by type of treatment for diabetes among subjects with diabetes mellitus by history at initial examination. It should be noted that the prevalence rate of those who were getting absolutely no treatment for diabetes was about 600 per 1,000 and that the prevalence rate of those who were getting some kind of treatment was substantially smaller than for those who were getting no kind of treatment or, to put it simply, good care was not being provided for the frequent cases of diabetes in this population.

The same thing is true of hypertension. According to Table V about eight of 10 of these elderly people who had high blood pressure were getting no treatment at all, and the proportion getting some kind of treatment was about two of 10.

TABLE VI. THREE-YEAR INCIDENCE OF STROKE

<i>Category</i>	<i>No.</i>	<i>No. of strokes</i>	<i>3-year rate /100</i>
White men	582	26	50
Black men	729	51	82
White women	619	37	62
Black women	818	73	94

TABLE VII.

<i>Diagnostic category</i>	<i>Frequency</i>	<i>Per cent</i>
Infarction	155	79.8
Hemorrhage	23	11.6
Embolus	2	1.0
Unknown	15	7.6

Table VI shows the three-year incidence of stroke. We found, as others have, that although stroke is reasonably common among whites, it is even more of a public health problem among blacks. The incidence rates are substantially and significantly higher among blacks than among whites, and they are probably related in part to the fact that the blood pressures of the black persons in our group were substantially higher than the pressures among white persons.

Table VII simply indicates that the predominant kind of stroke occurring among these older persons was infarction caused by thrombosis, that hemorrhagic stroke was unusual, and that emboli occurred so infrequently as to be relatively unimportant as a cause of stroke.

This is quite different from the incidence of stroke that one sees among younger patients in hospitals, where hemorrhage is much more common. However, among these older persons the more important problem is the cerebral infarction caused by thrombosis and not the more dramatic cerebral hemorrhage.

Table VIII shows that those who had peripheral atherosclerosis were about twice as likely to develop a stroke in the three-year follow-up period as those who did not have it, which may mean, very simply, that those who have atherosclerotic plaques in their legs are also likely to have the same thing in their carotid and cranial vessels. The term PA, which you will see here frequently, simply means peripheral atherosclerosis. The same thing would have been true had I included tables on

TABLE VIII. THREE-YEAR INCIDENCE OF STROKE BY DIAGNOSIS OF PERIPHERAL ATHEROSCLEROSIS

<i>Categories</i>	<i>No.</i>	<i>Stroke</i>	<i>Rate</i>
P.A. present	245	24	125
P.A. absent	2,503	163	72

TABLE IX. THREE-YEAR INCIDENCE OF STROKE

<i>Category</i>	<i>No.</i>	<i>No. of strokes</i>	<i>3-year rate /1,000</i>
Probable TIA*	175	27	137
Possible TIA	405	44	114
TIA absent	2,166	116	62

\*Transient ischemic attacks.

hypertensive heart disease, which appeared to predispose to stroke and for coronary heart disease, which also appeared to be related to stroke significantly.

In this elderly group elevated blood cholesterol, triglycerides, and cigarette smoking were not risk factors for stroke. They may, however, be risk factors among younger persons with stroke.

I should like to point out to you in Table IX that persons who had transient ischemic attacks (TIA) or little strokes which are completely reversible were much more likely to develop strokes than those who did not.

I have a few more comments to make about this elderly group.

First, the transient ischemic attack which has generally been considered the immediate harbinger of completed stroke had an average duration of 3.4 years in this group. When we diagnosed stroke, in other words, transient ischemic attacks were present in this group for a long period before a stroke occurred. The immediate implication of this is that there is time to do something about preventing a completed stroke in persons who suffer transient ischemic attacks.

We also observed that any kind of recurring symptoms in the central nervous system had almost as ominous a meaning as transient ischemic attacks. Older persons who had repeated attacks of true vertigo or light-headedness were almost as likely to develop a stroke as those who had more typical TIA with full-blown evidence of transient hemiparesis.

One third of the elderly people who developed strokes did not con-



sult a physician, and that includes a substantial number of people who were suddenly unable to move an arm or a leg.

When I asked these older people: "Why didn't you see a doctor?" they said they thought the paralysis was arthritis or that they had caught a cold in part of their bodies because they had left a window open at night. Apparently a substantial proportion of these elderly persons had no idea of what a stroke was and did not even consult a physician about it.

One sixth of all the patients suffering from stroke who saw a doctor did not go into a hospital at the recommendation of the doctor. Why these physicians did not hospitalize these elderly patients with stroke I do not know, but it suggests that the care these people received was inadequate.

The last point that I want to make before summarizing will be interesting and perhaps disturbing to surgeons. In about half of those persons who had transient ischemic attacks before a stroke, the completed stroke occurred in some vascular system other than the one involved in the transient ischemic attacks. This emphasizes that cerebral atherosclerosis is a diffuse disease, and that taking out or bypassing one big plaque in the aorta or the carotid may not have the beneficial effect that is often expected.

#### SUMMARY

We have found an incidence of more than 2% per year of stroke in this older group. There were risk factors in this group identifiable by trained persons who had no education beyond high school.

We observed also that transient ischemic attacks characteristically had a long duration, allowing time for the physician to do something about the prevention of stroke. The best measure, I now think, would be to lower the blood pressure.

We found that any recurrent symptoms attributable to the central nervous system had almost as ominous a prognosis as full-blown transient ischemic attacks, and we observed that the treatment of hypertension and diabetes among this group was shockingly poor, even though it appears that control of blood pressure would probably have been beneficial to them.

We noted also that these persons' knowledge of what TIA and stroke were was limited, which indicated the need for major programs of public education.