As part of a cohort study of the epidemiology of cerebrovascular attacks in an elderly urban poor population, this paper describes the samples in the cohort and how they were studied, data on prevalence of cardiovascular and cerebrovascular diseases, and the adequacy of management of such disorders in this group.

CARDIOVASCULAR AND CEREBROVASCULAR DISEASE IN AN ELDERLY POOR URBAN POPULATION

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IN October, 1965, a cohort study of the epidemiology and natural history of cerebrovascular attacks was begun in an elderly poor urban population. As part of the initial examination of the cohort, special emphasis was placed on the central nervous and cardiovascular systems. Subsequent papers based on this work will deal with the epidemiology and natural history of strokes. This report, however, is limited to three purposes.

1. To describe the samples making up the cohort and the methods employed in studying it.

2. To present data on the prevalence of cerebrovascular (CVD) and cardiovascular diseases and their probable risk factors.

3. To estimate generally the adequacy of management of some of these disorders in the cohort.

Method

Sampling

Three probability samples were selected over a period of 14 months from the population of noninstitutionalized Negro and Caucasian persons who were 65 to 74 years of age and receiving Old Age Assistance (OAA) in Cook County, Illinois. The samples were selected in September, 1965, January, 1966, and November, 1966. At that time, eligibility for OAA required a person to be at least 65 years of age, to have been a resident of Illinois for at least one year, and to meet certain financial criteria which, in effect, stated that the person must be destitute and unable to obtain support from relatives. Persons residing in public institutions for the treatment of tuberculosis or mental illness and inmates of penal or correctional institutions are not eligible for OAA.

The samples were selected from lists which included the name, sex, race, date of birth, and mailing address of each person who received OAA in Cook County during a particular month. Persons on these lists were included in the population to be sampled if they had also received OAA three months previously, were 65 to 74 years of age, Caucasian or Negro, and not receiving aid through Nursing Home Service. Eligible persons were classified by sex and race

into four groups. Sampling fractions were selected so that equal numbers of Caucasian men, Negro men, Caucasian women, and Negro women would be included in the sample. The first sample comprised 880 persons selected from a population of 7,629. The second and third samples comprised 2,200 and 1,700 persons, respectively, from populations numbering 5,813 and 5,320.

Initial Interview

Subjects were clustered geographically by postal zone and, within clusters, put into groups of 8 to 12 persons living in close proximity to one another. These groups were assigned to trained interviewers using random permutations in order to randomize effects of systematic differences among interviewers.

A letter of introduction was mailed to each subject just before assignment to an interviewer. The project was described as a study of the health of older persons with the purpose of learning how to prevent illness and promote good health during old age. Cooperation of the subjects was solicited at the initial interview. The interviewers emphasized that cooperation was entirely voluntary and in no way would affect, positively or negatively, a subject's status with the Department of Public Aid.

If the person agreed, the interviewer completed a standard questionnaire schedule which covered demographic, social, and medical topics, and made an appointment for the subject to be examined at the central office.

Initial Examination

Transportation between home and central office was provided by this project for almost all subjects and ad hoc translators (usually a relative or friend) were obtained for subjects who could not speak English.

Upon arrival at the office, a subject was shown to an individual examination room where street clothes were re-

moved and an examination gown put on. The following procedures or measurements were carried out at the initial examination:

(1) a 12-lead electrocardiogram (ECG) recorded on a Sanborn direct-writing instrument;

(2) response of the arterial pressure to sitting and standing after being supine while the ECG was recorded;

(3) oral administration of 50 gm glucose in a lemon-lime flavored solution to subjects denying a history of diabetes mellitus;

(4) height recorded to the nearest cm with the subject stretched to greatest height while standing against a flat surface;

(5) weight recorded to the nearest hectogram on balance scales;

(6) thickness of skinfold at the level of the tenth rib in the right midaxillary line recorded to the nearest mm using Best's calipers[1];

(7) the Peabody Picture Vocabulary Test,[2] which yields a measure of verbal intelligence;

(8) systolic and diastolic pressures in the left and right arms measured after five minutes of quiet sitting;

(9) specimens of venous and capillary blood drawn one hour after administration of the glucose;

(10) vital capacity and one-second forced expiratory volume recorded on a 9-liter Collins respirometer;

(11) temperature of the skin of the pads of both great toes and bilaterally on the forehead in the distribution of the supraorbital arteries as measured by an infrared thermometer;

(12) examination of the visual fields using the Harrington-Flocks Visual Pattern Screener.[3]

(13) a detailed history, and physical examination with emphasis on the cardiovascular and central nervous systems.

Arterial pressures were measured using the cuff and auscultatory technique. The cuff had a 14 x 40 cm blad-

der, which has been shown[4] to diminish the correlation between brachial circumference and indirect measurements of arterial pressure. The cuff was connected to two independent mercury manometers through toggle valves which, when closed, maintained a constant pressure in the manometer. This arrangement eliminated the need for reading the level of the moving mercury column while simultaneously listening to the Korotkoff sounds. One manometer was used for recording systolic pressure by closing its toggle valve at the point where the first Korotkoff sound was heard; the other manometer was used to record the diastolic pressure at the point where the Korotkoff sounds disappeared (Phase 5). The manometer tubes were specially manufactured with markings at each 5 mm interval. The marks were systematically dropped 2.5 mm below the nominal value, and the observers were instructed to read the meniscus to the lower mark. Thus, for example, if the meniscus were between the 120 and 125 marks, the observer would record "120" and this value would include the range from 117.5 to 122.5.

The medical histories and examinations were performed by three physicians, two of whom stayed with this phase of the project from beginning to end. One physician was an opthalmologist; the other two were internists. One internist and the opthalmologist had received six weeks of special training in neurology under the supervision of the consulting neurologist (J.D.). The other procedures were performed by medical technicians who had been specially trained in these techniques.

Laboratory Procedures

Hemoglobin, hematocrit, blood urea nitrogen, and plasma glucose were measured on all subjects. Protein-bound iodine, total protein and albumin were measured on subjects in the first two samples, and protein electrophoretic patterns were measured on subjects in the first sample only.

At least two 2-ml samples of serum from each subject were placed in sealed vials and stored at −40 C. After the initial examinations were completed, these samples were used to measure total cholesterol, and triglycerides on approximately three-fourths of the subjects. (Funds ran out before analyses on the remaining fourth were completed.) Except for the electrophoretic patterns, hemoglobin and hematocrit, all analyses were performed using standard Autoanalyzer procedures. Pooled samples, blind split samples, and commercial controls were used continuously to monitor quality of the laboratory determinations.*

Diagnostic Categories

Myocardial Infarction — "Definite" myocardial infarction (MI) was diagnosed if there was a "definite" history of MI and/or if the ECG presented clear evidence of MI. A definite history of MI was defined as (1) the sudden—less often gradual—onset of chest pain or discomfort, (2) hospitalization for a period of weeks, and (3) a physician's statement that the subject had had a "heart attack." The electrocardiograms were read by one of the staff internists according to criteria used by the National Health Survey.[5]

"Possible" MI was diagnosed in the absence of clear ECG evidence if there was a history containing any two of the three criteria outlined above for a "definite" history.

Angina Pectoris — "Definite" angina pectoris was diagnosed if there was a clear history of two or more attacks of discomfort or pain across both sides of the anterior chest wall, in the precordium or centrally under the sternum, which

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* Distributions and intercorrelations of all variables measured will be mailed on request to interested readers.

may have then radiated to the arms, shoulders, neck or jaw. The discomfort or pain must have been precipitated by effort—e.g., exercise, emotion, or exposure to cold and wind—lasted for 30 seconds to half an hour, been relieved within minutes after cessation of effort, and spontaneously described as "pressing," "tight," "heavy," "constricting," "crushing," "numbing," or "burning."

"Possible" angina pectoris was diagnosed (1) if there was only one attack meeting all criteria listed above, (2) if the pain or discomfort was described in terms other than those listed above except that lancinating, pleuritic or throbbing pain was excluded, (3) if there was pain or discomfort as in definite angina but it began in any of the sites of radiation mentioned or in the right anterior chest or epigastrium, or (4) if the discomfort or pain subsided despite continued effort.

Angina pectoris was excluded (1) if the discomfort or pain occurred after the cessation of effort or only in relation to meals, posture, or special movements of the body, (2) if the pain was described as stabbing or lancinating in the region of the left breast, or (3) if there was localized or general chest and/or arm pain due to thoracic outlet or hyperabducting syndrome.

Congestive heart failure was diagnosed if there was dyspnea with exertion or at night, if rales were present in the lung bases and if there was cardiac enlargement.

Peripheral arterial disease was diagnosed if any of the following was present at examination: (1) history of intermittent claudication, (2) abnormal changes in skin color with changes in position of the extremity, (3) persistent redness or cyanosis or painful ulceration or gangrene in the absence of other disease of the extremity, (4) abnormally slow return of color after blanching, (5) excessive coldness of an extremity when accompanied by atrophic changes in the skin, or (6) evidence of collateral circulation at the femoral artery.

Hypertensive Heart Disease — This condition was diagnosed if (1) the systolic pressure was 160 and/or the diastolic pressure 100 mm hg, (2) there was at least grade 1 retinopathy, and (3) there was cardiac enlargement as evidenced by the ECG or physical examination.

Completed Stroke—Stroke was diagnosed if there was a clear history of cerebral dysfunction (1) compatible with occlusive or hemorrhagic involvement of one or more neck or intracranial arteries, (2) occurring suddenly, (3) lasting for at least 24 hours, and (4) showing some degree of improvement after the time of maximal involvement. The diagnosis was considered "definite" if neurological signs compatible with the history were found at initial examination; otherwise the stroke was diagnosed as "possible."

Transient Ischemic Attacks (TIA)— This condition was diagnosed if there was a history of two or more episodes of cerebral dysfunction meeting the criteria above but which lasted less than 24 hours with no detectable residua. Excluded from this category were episodes of giddiness, syncope, drop attacks, and histories of only one episode. Symptoms of vertigo were included only if accompanied by other symptoms suggesting a focal cerebral deficit.

Results

Completion Rates

The disposition of subjects at the end of the intake phase is shown in Table 1 for all three samples combined. About 9 per cent of subjects could not be located, 19 per cent refused either the initial interview or examination (mostly the latter), and nearly 6 per cent were deceased before initial contact could be

made. The rate of refusal among white subjects was about double the rate among blacks, and white women refused about a third again more often than white men. A total of 3,141 persons (65.7% of the total sample) completed the initial interview and examination.

Demographic Characteristics of Subjects

Tables 2, 3, and 4 indicate some demographic characteristics of the population.

Prevalence of Cardio- and Cerebrovascular Diseases

Table 5 shows that the prevalence of definite plus suspect coronary heart disease (CHD) at initial examination varied from 25 per cent among Caucasian men to almost 40 per cent among Negro men. Myocardial infarction was more prevalent among black subjects than whites and more prevalent among men than women. Contrary to this pattern, the prevalence of angina pectoris as the only manifestation of CHD was greater among white subjects than blacks, and greater among women than men.

Hypertensive heart disease was diagnosed least frequently in white men (12%) and most frequently in Negro women (37%). This condition occurred more often in women than men and more often in Negroes than Caucasians.

The prevalence of heart disease in general, which includes here definitely abnormal ECG patterns in addition to clinically evident disease, ranged from a low of 35 per cent among white women to a height of 60 per cent among black men and women.

Evidence of stroke by history and/or

Table 1—Disposition of the total sample at termination of the intake phase

Categories	Caucasian men	Negro men	Caucasian women	Negro women	Total
Frequencies					
Examined	660	853	681	947	3,141
Not examined:					
Not located	169	95	103	63	430
Refused interview	60	42	88	24	214
Refused examination	175	99	268	149	691
Deceased	102	75	51	49	277
Other reasons	10	5	10	2	27
Total	1,176	1,169	1,201	1,234	4,780
Rates per 1,000					
Examined	561	730	567	767	657
Not examined:					
Not located	144	81	86	51	90
Refused interview	51	36	73	19	45
Refused examination	149	85	223	121	144
Deceased	87	64	42	40	58
Other reasons	8	4	8	2	6
Total	1,000	1,000	999	1,000	1,000

neurological examination was found in about 11 per cent of all subjects. The prevalence of stroke tended to be greater among black subjects than whites and to be slightly greater among men than women. However, these differences are small in absolute terms when compared to the differences observed for heart disease.

Another 9 to 15 per cent of subjects presented evidence of transient ischemic attacks without completed stroke. The prevalence of this condition also tended to be slightly greater for black subjects

Table 2—Noninstitutionized persons 65 to 74 and receiving Old Age Assistance in Cook County, Illinois, 1965-1967—distribution by place of birth per 1,000 population, by sex and race

Place of birth	Caucasian men N=660	Negro men N=853	Caucasian women N=681	Negro women N=947
East North Central U. S.	355	52	423	35
East South Central U. S.	41	615	32	641
West South Central U. S.	23	192	20	195
Other U. S. including Puerto Rico	167	141	164	129
All non-U. S..	414	0	361	0

Table 3—Distribution of subjects per 1,000 population by years of education

Years of education	Caucasian men N=660	Negro men N=853	Caucasian women N=681	Negro women N=947
0–4	304	524	339	424
5–8	493	370	465	439
9–12	149	92	154	122
More than 12	54	14	42	15

Table 4—Distribution of subjects per 1,000 population by composition of household

Categories	Caucasian men N=660	Negro men N=853	Caucasian women N=681	Negro women N=947
Living with spouse	154	256	90	60
Living with other relative	76	116	208	311
Living with non-relative	116	214	89	163
Living alone	654	414	613	465
Total	1,000	1,000	1,000	999

Table 5—Prevalence per 1,000 population of cardiovascular and cerebrovascular disease at initial examination by sex and race

Categories	Caucasian men N=660	Negro men N=853	Caucasian women N=681	Negro women N=947
Coronary heart disease	250	398	282	314
Myocardial infarction	183	356	170	243
Angina pectoris only	67	42	112	71
Hypertensive heart diseease	115	239	158	370
Any heart disease	459	607	350	602
Completed stroke	104	134	79	127
Transient ischemic attacks without completed stroke	92	118	138	153
Congestive heart failure	59	52	70	65
Peripheral atherosclerosis	156	64	120	71

Table 6—Criteria for coronary heart disease risk factors

Risk factors	Criteria
Obesity	Actual weight ≥ 125 per cent of desirable weight as published by Stamler[6, p. 168], modified for nude measurements at height and weight.
Hypertension	Systolic pressure ≥ 160 and/or diastolic pressure ≥ 95 mm hg
Hypercholesterolemia	Serum cholesterol ≥ 250 mg/dl
Hyperglycemia	Plasma glucose ≥ 205 mg/dl one hour after 50 g oral glucose challenge, or diabetes mellitus by history
Cigarette smoking	Any degree of current use
ECG abnormalities	Criteria used by National Health Survey[5]

than whites, but, contrary to completed stroke, to be greater for women than men.

Prevalence of Risk Factors for Coronary Heart Disease

Previous investigations have shown that several variables are associated prospectively with increased risk of CHD.[6] Some of these risk factors are defined in Table 6 and the prevalence with which they were found among persons without clinical CHD in this population are presented in Table 7. Marked overweight was observed in more than half of the women and in 20 per cent of white men and 32 per cent of black men. The prevalence of hypertensive pressure ranged from 32 per cent among white men to 46 per cent among Negro women. Hypercholesterolemia (which may not be associated with increased risk of CHD in this age group) occurred about twice as frequently in women (28 and 38%, respectively, for Caucasian and Negro women) as in men (14 and 18%). Hyperglycemia, which

Table 7—Prevalence per 1,000 of single CHD risk factors at initial examination among subjects without clinical CHD

Risk factors	Caucasian men N=309– 464	Negro men N=292– 435	Caucasian women N=328– 474	Negro women N=429– 586
Obesity	201	325	512	548
Hypertension	323	376	373	464
Hypercholesterolemia	141	181	278	383
Hyperglycemia	325	314	501	437
Cigarette smoking	502	402	243	172
ECG abnormalities	549	567	450	536

NOTE: The heading of each column shows the minimum and maximum number of observations upon which the prevalence was based. The variation is due primarily to the fact that serum cholesterol was not measured on all subjects. Estimates for the other variables are based on numbers of observations that are maximum.

Table 8—Prevalence per 1,000 of multiple CHD risk factors at initial examination among subjects without clinical CHD

No. of risk factors	Caucasian men N=309	Negro men N=292	Caucasian women N=328	Negro women N=429
None or one only	330	346	222	228
Two only	314	304	350	301
Three or more	356	350	426	471

includes diabetes mellitus by history, occurred in about a third of men and in about half of all women. Current cigarette smoking was more prevalent among men, occurring in 50 per cent of whites and 40 per cent of black men, than among women. The prevalence of current cigarette smoking was 24 and 17 per cent among Caucasian and Negro women, respectively. Over half of all subjects had abnormalities of the ECG.

The prevalence of multiple-risk factors is shown in Table 8. About 35 per cent of men and 45 per cent of women have three or more CHD risk factors, whereas only about a third of men and 22 per cent of women have none or one only.

The frequency with which treatment of diabetes mellitus occurred in persons who reported that this condition had been diagnosed previously by a physician is shown in Table 9. About 45 per cent of women and over 60 per cent of men reported that they were not taking any kind of treatment for diabetes.

Unfortunately, we did not ask subjects whether high blood pressure had ever been diagnosed previously. However, as shown in Table 10, among persons who had hypertensive pressures at initial examination the prevalence of no treatment for hypertension ranged from 64 per cent for Negro women to almost 88 per cent for Caucasian men.

Table 11 shows that the majority of

persons in this population reported having seen a physician within a period of three months preceding the initial examination and 80 per cent had seen a physician within the past year.

Discussion

Some caution is required in extrapolating these results. Since about one-third of the probability sample was not

Table 9—Distribution by type of treatment for diabetes mellitus, subjects with diabetes mellitus by history at initial examination

Type of treatment	Caucasian men	Negro men	Caucasian women	Negro women
Frequencies				
None	63	88	77	109
Diet only	17	9	12	48
Oral medication	17	26	56	64
Insulin	5	11	20	27
Total	102	134	165	248
Rates per 1,000				
None	618	657	467	440
Diet only	167	67	73	194
Oral medication	167	194	339	258
Insulin	49	82	121	109

Table 10—Distribution by type of treatment for hypertension, subjects with systolic pressure 160 and/or diastolic pressure 95 mm hg, at initial examination

Type of treatment	Caucasian men	Negro men	Caucasian women	Negro women
Frequencies				
None	193	290	202	307
Diet only	1	8	7	5
Medication	26	59	65	164
Total	220	357	274	476
Rates per 1,000				
None	877	812	737	645
Diet only	4	22	25	10
Medication	118	165	237	344

Table 11—Distribution of subjects by interval between initial examination and last visit to local medical doctor, persons receiving Old Age Assistance in Cook County, 1965-1967, by sex and race

Interval	Caucasian men	Negro men	Caucasian women	Negro women	Total
		Frequencies			
Within past 3 mo	376	508	452	651	1,987
3 to 12 mo ago	103	151	102	146	502
More than 1 yr ago	133	166	100	126	525
Never visited LMD	43	18	20	17	98
No information	5	10	7	7	29
Total	660	853	681	947	3,141
		Rates per 1,000			
Within past 3 mo	574	603	671	693	638
3 to 12 mo ago	157	179	151	155	161
More than 1 yr ago	203	197	148	134	169
Never visited LMD	66	21	30	18	31

examined, the possibility of substantial bias exists. In addition, the population studied in Cook County, Illinois, may differ significantly from other elderly urban populations. However, it seems likely that the black portion of our cohort, which shares poverty and ghetto-ization with most elderly urban U.S. blacks, does not misrepresent the health status of this universe. The same cannot be said for the white portion of the cohort. Lastly, since we did not enumerate malignant or premalignant disease or examine the musculoskeletal, gastrointestinal, and genitourinary systems, our conclusions are limited to cardio- and cerebrovascular diseases.

The findings presented here document the very high prevalence of cardiovascular and cerebrovascular disease in this cohort. Further, if conditions such as hypertension, diabetes mellitus, and electrocardiographic abnormalities are associated with increased risk of CHD in elderly persons, as they are among middle-aged adults, then at least one-third of those elderly persons who do not

yet have clinically evident CHD are at high risk of this disorder.

Among adults of middle age, a major problem in primary prevention of CHD and CVD is the identification of persons at high risk for these disorders. Since many young and middle-aged adults do not visit physicians regularly, this problem has been met in some places by community screening programs. In this elderly population, however, most persons do visit physicians regularly, and conditions such as hypertension and hyperglycemia can be readily detected at these visits. Yet, the great majority of the hypertensive and diabetic persons in this cohort are receiving no treatment at all for these conditions.

At least two factors may be responsible for the absence of widespread treatment of asymptomatic hypertension and diabetes mellitus among elderly persons. First, there is no compelling evidence that treatment of these disorders will be beneficial so there is no moral imperative to treat them. In addition, maintenance of adequate long-term therapy

poses difficult problems, particularly among the elderly poor. They often do not understand the necessity for taking medications or adhering to a diet when they do not feel "sick." The elderly may not follow advice, may exhibit irascible behavior, and usually require an exorbitant amount of time to listen to all their complaints. They therefore need, in their management, patient perceptive persons who are competent in health education, undisturbed by frequent repetition of directions, and who have both the intelligence and the time to listen for prolonged periods. Medical practice, as currently constituted, is not well equipped to manage these aspects of the treatment situation.

These data suggest two clear needs for successful primary prevention and management of cardiovascular and cerebrovascular disease among older poor persons. First, we need more research aimed at determining the value of current regimens and the elucidation of better primary and secondary prevention of these diseases; and secondly, we require the development of new kinds of health personnel who can provide the health education, the patience, and the time that our harried physicians cannot now give to the elderly poor.

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