The Health Burden of Diabetes for the Elderly in Four Communities

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Synopsis

Although diabetes is a common health problem of the elderly, the impact of diabetes on health and functioning in older persons is not well established. The purpose of this analysis was to identify health conditions accompanying diabetes in four samples of community dwelling elderly people. The study samples consisted of 13,601 persons ages 65 or older who participated in the Established Populations for Epidemiologic Studies in the Elderly (EPESE). Extensive interviews were conducted in respondents' homes to obtain information on diabetes and other health conditions, health behaviors, use of health services, and demographic characteristics.

A lifetime history of diabetes was reported by 14 percent of respondents. The prevalence of the disease was higher in blacks than whites, especially among women. Persons with diabetes were more likely to report myocardial infarction, stroke, vision problems, physical disability, incontinence, and nursing home stays than persons without diabetes, but the diabetics were less likely to consume alcohol or tobacco. Those with diabetes were only slightly heavier than those without diabetes at the time of the interview. However, body mass at age 50 was substantially greater among persons with diabetes. Associations between diabetes and other health conditions and behaviors were similar for whites and blacks. These results show that aged persons with diabetes experience substantial comorbidity, which has important ramifications for functioning and survival.

MOST OF OUR KNOWLEDGE of comorbidity and disability among diabetics is based upon observation of nonrepresentative patient samples (*1–9*). Furthermore, those data that are drawn from defined populations contain little or nothing on persons beyond age 74, or derive from meritorious studies whose cohorts are unlikely to be representative of other populations (*10,11*). The result is that little is known about the health burdens of diabetes in those older groups in which the disease is most common. This communication addresses that gap in our knowledge.

In the 1982 National Health Interview Survey, the prevalence of diabetes (based upon self-reports) was 8.8 percent in those 65 through 74 years, with identical prevalences in men and women (*12*). This estimate is consistent with the prevalence reported from the virtually all white population of Framingham, MA (*10*) who were ages 65 or older. By contrast, the National Health and Nutrition Examination Survey II (*13*) defined diabetes with a combination of data from self-reports and blood sugar levels (using criteria defined by the National Diabetes Data Group [*14*]) and reported a prevalence of diabetes of 17 percent among those ages 65–74. Age-adjusted data for the U.S. adult population in 1981 also show

higher prevalences of diabetes among blacks and among those with less than a high school education, less than $7,000 annual family income, living in central cities, and residing in the South (*12*).

Assessment of comorbidity reported in clinical studies suggests that it is usual among elderly diabetics. Studies of patient samples indicate that high blood pressure, peripheral vascular disease, stroke, diseases of the retina and lens, kidneys, and skin are quite prevalent (*15*) among older diabetics. More specifically, as compared with nondiabetic patients, those with diabetes exhibit 25 times more kidney disease and blindness, 20 times more gangrene and vascular insufficiency, 3 times more high blood pressure, 2.5 times as many myocardial infarctions and 2 times as many strokes.

Diabetics are more likely than nondiabetics to experience limitations in functional capacity such as the ability to walk long distances, use stairs, or lift heavy objects (*12*), and to rate their health as poor (*16*). In any case, it is not difficult to understand why the economic burden of diabetes is estimated at from 25 to 30 million hospital days per year and $8 to $10 billion in direct medical costs per annum (*1–9*). Because the prevalence of diabetes is highest in those 65 or older, and because the growth rate of the American population is greatest in this same age group (*17*), physicians and other health professionals will find the older diabetic patient requiring an increasing proportion of their patient care responsibility in the years to come.

Objectives

The purpose of this paper is to describe the health burden of diabetes in four defined populations of community dwelling persons ages 65 or older. Its principal objectives are (*a*) to identify correlates of diabetes in elderly persons, (*b*) to determine whether relationships between diabetes and other factors vary by sex, and (*c*) to ascertain whether the correlates of diabetes are different for whites and blacks. The following specific hypotheses guided these analyses:

1. Chronic conditions, physical disability, and incontinence will occur more frequently in persons with diabetes than without;
2. Rates of visual and hearing impairment will be elevated in diabetic compared with nondiabetic persons;
3. Health care services will be used more frequently by persons with diabetes than by those without diabetes;
4. Diabetic persons have probably been warned more frequently and vehemently about smoking and drinking, and therefore they will engage less in these behaviors than will nondiabetic persons;
5. Diabetic respondents will be heavier than nondiabetic respondents;
6. Blacks, particularly black women, will be more likely to be diabetic than whites.

The four samples in this study differ widely in sociodemographic characteristics (*18,19*). Estimates of the burden of diabetes in these various populations may provide useful information for those providing health care, hospital and home care, and health insurance for older populations.

Materials and Methods

Study samples. The study samples are composed of community-dwelling elderly persons living in one of four locations—New Haven, CT, East Boston, MA, Iowa and Washington Counties in rural Iowa, and Durham and four surrounding counties in North Carolina. The four studies constitute the Established Populations for Epidemiologic Studies of the Elderly (EPESE), a collaborative project funded by the Epidemiology, Demography, Biometry Program of the National Institute on Aging. This analysis includes data collected at all four sites.

Sampling frames. At each site, eligible persons were noninstitutionalized and ages 65 years or older at the baseline interviews (1981–83 for East Boston, Iowa, and New Haven; 1985 for Durham). In East Boston and Iowa, all persons ages 65 or older were enumerated whereas the New Haven and Durham studies used multistage cluster sampling frames. In East Boston, of 4,562 eligible people, 3,812 (84 percent) took part in the baseline survey. In Iowa, interviews were conducted for 3,673 of 4,601 eligible (80 percent).

The New Haven sampling frame was designed to identify a study sample representative of the New Haven elderly population. The frame included samples drawn from three housing strata reflecting the most common types of housing for those 65 and older—(*a*) public housing, which is age- and income-restricted, (*b*) private housing, which is age-restricted, and (*c*) houses and apartments in the private community. In public housing, all eligible persons were interviewed, whereas women were subsampled in both the private and community strata. Of a total of 3,337 eligible, 2,812 (82 percent) persons participated in the baseline survey.

Like the New Haven sample, the North Carolina

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sample was designated to identify a representative elderly population. A majority (55 percent) were elderly black people living in the Counties of Durham, Franklin, Granville, Vance, and Warren. A four-stage sampling design was conducted as follows:

- selection of primary units composed of 1980 Census-defined areas;
- selection of smaller geographic areas; or listing units, within the primary sampling units;
- selection of housing units, within listing units, including a preliminary categorization for each unit as black or nonblack; and
- screening of households to identify eligible household members. Of a total of 5,234 eligible persons, 4,164 (80 percent) participated. Most of the New Haven blacks were born in these same North Carolina counties.

Interview schedule: items and scoring techniques. Baseline surveys consisted of structured face to face interviews that took a little more than an hour to complete and were conducted in respondents' homes. Data were collected on respondents' demographic characteristics, medical history, cognitive and physical functioning, health habits, use of health care, and use of medications. All efforts were made to obtain information directly from respondents. When this was not possible, interviews were held with proxies. Proxies were not asked questions on cognitive functioning, depressive symptoms, self-rated health, or sleep problems. In East Boston, New Haven, and Durham, proxy interviews were conducted only for those persons who were unable to respond for themselves because of illness or other extenuating circumstances. The proportion of interviews completed by proxies was less than 5 percent at each site. In Iowa, shortened forms of the interview were given if respondents were seriously ill or refused to take part in an extensive personal interview; they numbered 576. Only those 3,097 respondents who completed the full form of the interview were included in this analysis.

Measures.

Diabetes. Medical history of diabetes was based on respondents' answers to a question—had a physician or other health professional ever told them they had diabetes, sugar in the urine, or high blood sugar. Response categories were "yes," "suspect-possible," or "no." Respondents in the "suspect-possible" category were excluded from the analysis.

Respondents at all four sites were asked about current medications. Names of drugs were copied from the pharmacist's label on the medication container by our interviewers. In Iowa and New Haven, diabetic respondents were asked specifically whether they were attempting to control their diabetes with medications, special diets, or weight control. The age when diabetes had been diagnosed was queried only in Iowa and New Haven.

Chronic conditions. Respondents were similarly asked about their medical history of stroke, myocardial infarction, cancer, and hip fracture. Responses of "suspect-possible" were excluded. Angina and intermittent claudication were assessed by means of the London School of Hygiene Cardiovascular Questionnaire (*20*).

Blood pressure. The methods and criteria used by the Hypertension Detection and Follow-Up Program (HDFP) were used to measure blood pressure (*21*). Levels were determined by averaging the first two readings taken during the interview. People were considered to be hypertensive if any one of the following conditions was met: average systolic pressure of 140 or more millimeters of mercury (mmHg), average diastolic pressure of 90 or more mmHg, currently taking antihypertensive medications.

Physical disability. Three different scales were used to assess physical disability: (*a*) a modified version of the Katz Activities of Daily Living (ADL) scale (*22*), (*b*) a portion of the Rosow Breslau Scale of gross-mobility function (*23*), and (*c*) a physical performance scale developed by Nagi (*24*). A summary measure incorporating information from all three scales was used to classify people as having major disability versus minor or no disability (*25*).

Table 1. Lifetime prevalence of self-reported diabetes[1] by age, sex, and site, and by race, sex, and site, Established Populations for Epidemiologic Studies of the Elderly (baseline sample of [2]13,601)

Age group (years)	New Haven[3] Men N=1,147	New Haven[3] Women N=1,621	East Boston Men N=1,434	East Boston Women N=2,321	Iowa Men N=1,126	Iowa Women N=1,902	North Carolina[3] Men N=1,424	North Carolina[3] Women N=2,626
	Percent of all persons with diabetes							
All ages combined	12.9	13.7	16.0	14.8	10.5	9.6	15.3	15.9
65–74	13.0	14.9	17.5	14.3	10.7	9.5	16.5	18.0
75–84	12.8	13.7	13.1	16.3	10.8	10.2	13.3	12.8
85 or older	11.7	6.7	14.1	13.3	7.1	7.3	11.2	13.3
	Percent of whites with diabetes[4]							
Total number	935	1,246	...	...	...	...	635	1,184
All ages combined	12.4	12.4	...	...	...	...	13.6	11.2
65–74	12.0	13.1	...	...	...	...	15.5	12.6
75–84	13.5	12.7	...	...	...	...	9.5	8.0
85 or older	12.3	7.1	...	...	...	...	11.0	13.2
	Percent of blacks with diabetes[5]							
Total number	184	332	...	...	...	...	775	1,426
All ages combined	16.0	20.8	...	...	...	...	18.6	24.5
65–74	17.8	21.3	...	...	...	...	18.6	27.9
75–84	12.4	23.2	...	...	...	...	20.0	21.3
85 or older	6.9	3.5	...	...	...	...	11.5	13.4

[1] Respondents who answered "suspect" to diabetes question excluded.
[2] Baseline surveys conducted in East Boston, Iowa, and New Haven in 1981-83; 1985 in North Carolina.
[3] Percentages are weighted to represent population estimates.
[4] Nonwhites excluded.
[5] Nonblacks excluded.

Incontinence. This condition was defined as a response of "some of the time," "most of the time," or "all of the time" to the question, "How often do you have difficulty holding your urine until you can get to a toilet"?

Vision and hearing problems. Person were considered to have vision problems if they reported difficulty recognizing a friend across the street or across the room or if they were unable to read ordinary newspaper print or headlines (with glasses or contact lenses, if necessary). They were considered to have hearing problems if they reported difficulty hearing or understanding what a person said without seeing the face in a quiet room.

Health behaviors. Smoking status was based on answers to questions regarding current and past smoking. Alcohol consumption was based upon answers to questions regarding consumption of beer, wine, and hard liquor during the month before the interview. Respondents were considered to be drinkers if they reported any consumption, and nondrinkers if they reported none. Quantity of alcohol consumed was determined by multiplying the frequency of consumption by the usual quantity consumed at each time.

Self-rated health. Respondents were asked either to rate their current health (New Haven and North Carolina) or to compare their health with that of most people their age (Iowa and East Boston). Respondents were considered to be in good health if they rated their health as "excellent" or "good."

Weight and height. Respondents were asked about their current weight and height and about their weight at ages 50 and 25. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. Obesity was defined as BMI of more than 27.3 for men and BMI of more 27.8 for women, as recommended by the National Institutes of Health Consensus Conference on Obesity (*26*).

Use of health services. This was based on answers to two questions—Have you been in a hospital at least overnight in the past 12 months? and Have you ever been in a nursing home as a patient?

Data analysis. All analyses were conducted separately for each of the four sites. Associations between diabetes and other indicators of health and functioning were assessed separately for men and women. For dichotomous outcome variables prevalence ratios,

Table 2. Prevalence ratios describing the association between self-reported diabetes and history of chronic conditions, by sex, and site, Established Populations for Epidemiologic Studies of the Elderly (baseline sample of 13,601)

Condition	New Haven[1]		East Boston		Iowa		North Carolina[1]	
	Men	Women	Men	Women	Men	Women	Men	Women
Myocardial infarction	[2]1.55	[2]2.13	[2]1.52	[2]2.37	1.30	[2]2.27	1.24	[2]2.20
Stroke	[3]1.83	[2]2.27	[2]1.87	[2]2.56	[2]2.61	1.41	1.35	[2]3.67
Hypertension	1.05	1.15	1.10	[2]1.13	[3]1.20	[2]1.17	[2]1.18	[2]1.15
Angina	1.23	[3]1.83	[2]1.81	[2]2.32	0.43	1.22	1.61	[3]1.56
Intermittent claudication	[2]2.63	1.14	[4]1.67	[2,4]2.90	[4]1.32	[2,4]6.29	0.42	[2]2.78
Cancer	0.60	0.96	1.21	1.07	1.33	[2]1.51	1.05	1.16
Hip fracture	1.88	0.87	1.26	0.73	1.48	0.69	1.05	0.76
Perceived health status[5]	1.18	[2]1.59	1.18	[2]1.50	[2]1.47	[2]1.81	[2]1.34	[2]1.54

[1] Significance testing from RTI Logit.
[2] $P \leq .01$.
[3] $P \leq .05$.
[4] Significance testing from Fisher's Exact Test.
[5] Fair, poor or bad versus excellent or good.

Table 3. Prevalence ratios describing the associations between self-reported diabetes and disability and between diabetes and sensory impairments, by sex and site, Established Populations for Epidemiologic Studies of the Elderly (baseline sample of 13,601)

Disability	New Haven[1]		East Boston		Iowa		North Carolina[1]	
	Men	Women	Men	Women	Men	Women	Men	Women
Major disability	[2]1.77	[2]1.44	[2]1.52	[2]1.47	[3]1.32	[2]1.49	[3]1.31	[2]1.38
Incontinence[4]	1.27	[2]1.71	[3]1.27	[2]1.41	1.27	[3]1.21	[2]1.33	[2]1.43
Vision problems:								
Can't see friend across street	[3]2.32	[3]1.41	[3]1.54	[2]1.73	1.72	[2]1.86	1.00	[2]1.74
Can't read newspaper print	[2]3.27	[3]1.81	[3]1.51	[2]1.80	1.59	[2]1.60	1.24	[2]1.92
Can't hear in quiet room	1.39	1.17	1.05	[2]1.82	0.80	1.13	1.01	[3]1.34

[1] Significance testing from RTI Logit.
[2] $P \leq .01$
[3] $P \leq .05$.
[4] Some, most, or all of the time versus never or hardly ever.

Table 4. Prevalence ratios describing the associations between self-reported diabetes and health behaviors and use of services by sex and site, Established Populations for Epidemiologic Studies of the Elderly (baseline sample of 13,601)

Condition	New Haven[1]		East Boston		Iowa		North Carolina[1]	
	Men	Women	Men	Women	Men	Women	Men	Women
Any alcohol last month	[2]0.70	[2]0.60	[2]0.84	[2]0.65	0.97	[2]0.62	[3]0.74	[2]0.47
Smokes now	0.98	0.69	[2]0.70	[2]0.62	[3]0.51	0.61	1.02	0.78
Smoked ever	1.14	0.98	0.91	0.90	1.16	[3]1.55	1.03	[2]0.78
Services:								
Hospitalized past year	[2]1.70	[2]2.03	[2]1.45	[2]1.43	[3]1.37	[2]1.59	1.25	[2]1.79
Nursing home ever	2.00	0.92	[2,4]3.30	[4]2.01	[2]3.20	1.11	1.46	0.85

[1] Significance testing from RTI Logit.
[2] $P \leq .01$.
[3] $P \leq .05$.
[4] Significance testing with Fisher's Exact Test.

which compare the prevalence of each hypothesized correlate of diabetes in diabetic respondents to the prevalence of that correlate in nondiabetic respondents, were estimated. Chi-square statistics were used to test for statistical significance. For continuous outcome measures, means were computed, and *t*-tests were used for significance testing. Race-specific analyses were performed in New Haven and North Carolina only, because only these two sites had large enough number of blacks to make such analyses feasible. Members of other minority groups were excluded from race-specific analysis (Durham, 30; New Haven 71).

Because these two sites used complex sampling schemes, sampling weights were applied to the analyses to draw inferences regarding the larger populations from which the study samples were drawn. Statistical testing incorporated the sampling

Table 5. Mean levels of body mass index (BMI) and weight by self-reported diabetes, sex, and site, Established Populations for Epidemiologic Studies of the Elderly (baseline sample of 13,601)

	New Haven[1]				East Boston				Iowa				North Carolina[1]			
	Men, diabetes		Women, diabetes		Men, diabetes		Women, diabetes		Men, diabetes		Women, diabetes		Men, diabetes		Women, diabetes	
Characteristic	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Weight at baseline	168.9	164.1	148.6	142.2	168.8	[2]164.6	155.3	[3]145.4	177.5	[2]172.4	152.0	[3]142.3	179.1	[3]171.0	155.8	[3]144.7
BMI[4] at baseline	26.4	25.7	26.6	25.4	26.9	[2]26.2	28.8	[3]26.7	26.0	25.4	26.2	[3]24.7	26.5	[3]25.2	27.2	[3]25.1
BMI[4] at age 50	27.3	[2]25.8	28.7	[3]25.3	28.6	[3]26.0	29.9	[3]26.3	26.9	[3]24.8	27.0	[3]24.6	27.0	[3]25.2	28.6	[3]24.6
BMI[4] at age 25	23.6	23.1	23.4	[3]21.9	23.8	23.3	24.4	[3]22.7	22.9	22.8	22.5	[3]21.6	23.0	22.7	22.4	[3]21.4

[1] Significance testing from SURREGR.
[2] $P \leq .05$.
[3] $P \leq .01$.
[4] Kg/m^2 = Weight in kilograms divided by square of height in meters.

designs into the variance estimation. This was done using software designed specifically for variance estimation with complex survey data (RTI Logit and SURREGR). The East Boston and Iowa data were analyzed as population studies with no weighting.

Results

The respective mean ages of the persons in the samples were East Boston, 71.0; Iowa, 73.3; New Haven, 72.3; North Carolina, 71.4 years. The prevalence of diabetes varied from a low of 9.6 percent in Iowa women to a high of 16 percent in East Boston men (table 1). In general, across the samples, the prevalence of diabetes was similar for men and women and did not vary systematically by age. Women in New Haven and both men and women in Iowa exhibited lower prevalence of diabetes at ages 85 or older than at earlier ages. Blacks were generally more likely to report a history of diabetes than were whites, in particular among women. North Carolina blacks reported more diabetes than New Haven blacks in most of the age-sex categories.

Chronic conditions. As indicated in table 2, cardiovascular conditions were generally more common in diabetics than in nondiabetics in both sexes, across the sites. Note that the associations between diabetes and hypertension were weaker than the associations between diabetes and other cardiovascular conditions. Prevalence ratios for cardiovascular conditions were generally greater for women than for men. By contrast, hip fracture was positively associated with diabetes among men, but negatively in women. Respondents with a history of diabetes were less likely to perceive their health status as excellent or good than were nondiabetics, especially among women.

Physical disability and urinary incontinence. People who reported a history of diabetes were approximately 1.5 times more likely than nondiabetics to report major physical disability (table 3). This relationship held for each of the site- and sex-specific strata. Similarly, persons with diabetes had a greater likelihood of reporting urinary incontinence than did nondiabetic people.

Sensory impairments. Persons reporting diabetes were between 1.5 and 3 times more likely to report visual problems than were persons who did not report diabetes (table 3). Diabetic respondents were nonsignificantly more likely than nondiabetic respondents to report difficulty in hearing.

Health behaviors. Diabetic persons were less likely than nondiabetic persons to report consumption of alcohol during the past month. This relationship was somewhat weaker in Iowa than in the other sites. In East Boston and Iowa, diabetic respondents who did consume alcohol consumed less than nondiabetic respondents (data not shown). Diabetic respondents were generally less likely to report current smoking than were nondiabetic respondents; however, there were no differences in terms of past smoking behavior (table 4).

Use of services. Diabetic persons were generally more likely to report hospitalizations during the past year than were nondiabetic persons. Diabetic men, but not diabetic women, were significantly more likely than nondiabetic persons to report ever spending time in a nursing home (table 4).

Table 6. Summary of race-specific effects in New Haven and North Carolina populations, association of diabetes with other conditions

Condition	New Haven[1]						North Carolina[1]					
	Men			Women			Men			Women		
	Crude	White	Black	Crude	White	Black	Crude	White	Black	Crude	White	Black
Myocardial infarction	[2]1.55	[2]1.60	1.68	[2]2.13	[2]2.44	2.16	1.24	1.21	1.51	[2]2.20	[2]2.29	1.91
Stroke	[3]1.83	[3]1.91	1.32	[2]2.27	1.51	[3]2.71	1.35	1.46	1.24	[2]3.67	[2]2.84	[2]4.36
Hypertension	1.05	1.03	1.19	1.15	1.11	1.17	[2]1.18	[3]1.26	1.06	[2]1.15	[2]1.19	[3]1.08
Angina	1.23	1.50	0.35	[3]1.83	[3]2.25	0.90	1.61	2.01	1.10	[3]1.56	1.64	1.18
Intermittent claudication	[2]2.63	1.51	. . .	1.14	1.39	0.62	0.42	0.51	0.36	[2]2.78	2.13	[3]3.29
Cancer	0.60	0.67	0.44	0.96	0.94	1.06	1.05	1.06	1.51	1.16	1.46	1.19
Hip fracture	1.88	[3]2.96	. . .	0.87	1.10	0.29	1.05	0.62	1.96	0.76	0.73	1.44
Perceived health status[4]	1.18	[3]1.32	0.85	[2]1.59	[2]1.66	1.22	[2]1.34	1.28	[2]1.36	[2]1.54	[2]1.55	[2]1.38
Major disability	[2]1.77	[2]1.65	[2]2.42	[2]1.44	[3]1.37	1.44	[3]1.31	1.07	[2]1.57	[2]1.38	[2]1.43	[2]1.30
Incontinence	1.27	1.41	0.67	[2]1.71	[2]1.66	1.68	[2]1.33	1.09	[2]1.54	[2]1.43	[2]1.57	1.28
Vision:												
Can't see friend across street	[3]2.35	[3]2.45	1.84	[3]1.41	[2]1.56	1.56	1.00	1.26	0.68	[2]1.74	[3]1.84	[2]1.99
Can't read newspaper	[2]3.27	[2]3.88	1.46	[3]1.81	[3]1.78	[2]2.77	1.24	1.00	1.25	[2]1.92	[2]1.82	[2]1.80
Can't hear in quiet room	1.39	1.36	1.09	1.17	1.27	1.75	1.01	1.08	0.80	[3]1.34	[3]1.58	1.19
Any alcohol last month	[2]0.70	[2]0.70	0.76	[2]0.60	[2]0.62	0.61	[3]0.74	0.83	[2]0.62	[2]0.47	[3]0.56	[2]0.46
Smokes now	0.98	0.81	1.76	0.69	0.78	0.56	1.02	1.05	0.95	0.78	0.91	0.84
Smoked ever	1.14	1.09	[3]1.71	0.98	0.93	1.35	1.03	1.03	1.07	[2].78	0.84	0.87
Obese	[3]1.34	1.17	[2]2.74	1.21	1.24	0.96	[2]1.64	[3]1.67	[2]1.56	[2]1.62	[2]1.57	[2]1.28
Hospitalized past year	[2]1.70	[2]1.80	1.52	[2]2.03	[2]2.02	[3]2.43	1.25	1.14	1.39	[2]1.79	[3]1.60	[2]2.02
Nursing home ever	2.00	[3]2.52	. . .	0.92	1.15	0.18	1.46	2.13	0.52	0.85	0.86	1.86

[1] Significance testing from RTI Logit.
[2] $P \leq .01$.
[3] $P \leq .05$.
[4] Bad, poor, fair versus excellent, good.

Weight. As expected, respondents with diabetes were generally heavier than respondents without diabetes at the time of the baseline interview (table 5). Differences were somewhat larger for women than for men. Overall, the amount of excess weight reported by diabetic respondents was smaller than might have been expected from previous work (*15*). Note that differences in body mass between diabetic and nondiabetic respondents were greater at age 50 than at the time of the interview or at age 25.

Black-white differences in New Haven and North Carolina. Generally, associations between diabetes and other health conditions or behaviors were similar for whites and blacks (table 6). However, there were several exceptions. The association between diabetes and myocardial infarction was somewhat stronger for white women than for black women in both New Haven and North Carolina. By contrast, there were stronger associations between diabetes and stroke in both populations of black women than in white women. Angina was reported more frequently by white diabetic than by white nondiabetic respondents of both sexes, whereas the prevalence of angina was not elevated in black diabetic respondents. Diabetes conferred greater risk for disability among black men than among white men, whereas the impact of diabetes on visual disability was greater for white than for black men.

Differences between New Haven and North Carolina blacks. Prevalence ratios for stroke were higher among black women in North Carolina than in New Haven. Among men, disability and visual problems exhibited higher prevalence ratios in New Haven, while in North Carolina prevalence ratios for men were higher for angina and cancer.

Discussion

Since the prevalence of diabetes is based on self-report, there is room for error in our estimates. There is good reason, however, to believe that the self-reports are relatively accurate. Data from the Iowa and New Haven sites bear upon this issue. In Iowa only 1 woman of 1,720 who denied diabetes was on antidiabetic medication. Ninety-three percent of the diabetic men and 96 percent of the diabetic women remembered the year when they were first diagnosed with diabetes. Ninety-one percent of the diabetic men

and 95 percent of the diabetic women reporting diabetes also acknowledged some form of treatment for diabetes. In the New Haven population, 93 percent of the diabetic men and 94 percent of the diabetic women reported that they were attempting to control their diabetes with one or more of the following approaches: oral medication, insulin, weight control, and special diets.

Some of those characterized as nondiabetic may have had diabetes. We cannot specify the rates at which this occurred. Classifying diabetics incorrectly as nondiabetics would have caused us to underestimate the differences in comorbidity between diabetics and controls. Thus the burden of diabetes in these populations may be even greater than our data show.

In cross-sectional studies such as this, one can specify correlations, but not causality, since we do not know whether diabetes or the other morbidity occurred first. Because all four populations are being followed by annual collection of data, longitudinal results will help illuminate what is in this report.

Since the diagnosis of diabetes is based upon self-report only, we cannot distinguish noninsulin dependent diabetes from insulin dependent diabetes. Given the older age of this sample, it is highly likely that the vast majority of respondents who said they had diabetes had noninsulin dependent diabetes.

The prevalence of diabetes in this report is higher than noted in earlier studies based on self-report (*10,12*), particularly in New Haven, East Boston, and North Carolina. Because prevalence data in all these studies were collected at about the same time as other studies, 1980–82, differences cannot be accounted for by growing awareness of the disease. The small male-female differences in prevalence and the higher rates among blacks, especially black women, are not unexpected.

Although diabetic respondents were more adipose than nondiabetic respondents at the baseline examination, they reported even more excess adiposity at age 50. Adiposity at age 50 may predict the subsequent development of diabetes. This observed difference in the weight differential at two different time points may also reflect greater survivorship in those able to lose weight, or loss of weight with development of diabetes. Note that the association between body mass and diabetes was more consistent for women than for men. It might have been useful to examine the relationship of exercise with the presence of diabetes; this was not possible, however, because questions on exercise were not asked consistently across the four sites.

Generally, the patterns of association between diabetes and comorbidity were similar for blacks and whites. Notable exceptions were the associations with stroke, myocardial infarction, angina, disability, and visual impairments. Among blacks, diabetes was more closely associated with stroke (women only) and with disability (men only). Angina, myocardial infarction, and visual loss (men only) were more characteristic of white diabetic respondents. Among blacks 85 or older, the prevalence of diabetes was very much lower than that reported for earlier ages. No such trend is apparent among whites, suggesting higher mortality rates among black diabetics before age 85.

'In four different populations with a considerable range in ethnic composition, geographic location, type of housing, and income, diabetes was a highly prevalent condition.'

The prevalence of diabetes was greater in North Carolina blacks than in New Haven blacks for most age-sex categories. Differences between black diabetics in New Haven and North Carolina are presented only as a matter of interest and to promote further research in this area. A definitive study of such differences would compare those who are long-term residents of North Carolina with those who specifically report that they migrated from North Carolina to New Haven.

Summary

In general, the hypotheses presented earlier were confirmed. In four different populations with a considerable range in ethnic composition, geographic location, type of housing, and income, diabetes was a highly prevalent condition.

- Diabetes was more common in blacks than whites, and among blacks, more prevalent in North Carolina than in New Haven.
- Chronic conditions, particularly cardiovascular diseases, as well as physical disability and incontinence, occurred more frequently in diabetics than in nondiabetics in each of the four populations reported in the study.
- Rates of visual, but not auditory disability were more prevalent in diabetics than nondiabetics.
- Health care services were used more frequently by diabetics, particularly men, than nondiabetics.
- Diabetics drank less alcohol and were less likely to be current smokers than nondiabetics.

• Diabetics were heavier than nondiabetics and the difference in weight was greater at age 50 than at ages of 65 and older.
• The prevalence of diabetes in the 85 and older groups was lower than in those ages 65–84, among New Haven women, and in both sexes in Iowa. Black men and women at 85 and older also reported diabetes much less frequently then those at younger ages. Selective survivorship of nondiabetics is the most likely explanation.
• Relationships between diabetes and comorbidity were generally similar for blacks and whites.

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