Evaluating South Carolina's Community Cardiovascular Disease Prevention Project

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Synopsis

A community cardiovascular disease prevention program was undertaken as a cooperative effort of the South Carolina Department of Health and Environmental Control and the Centers for Disease Control of the Public Health Service.

As part of the evaluation of the project, a large scale community health survey was conducted by the State and Federal agencies. The successful design and implementation of the survey, which included telephone and in-home interviews as well as clinical assessments of participants, is described.

Interview response rates were adequate, although physical assessments were completed on only 61 percent of those interviewed. Households without telephones were difficult and costly to identify, and young adults were difficult to locate for survey participation.

The survey produced baseline data for program planning and for measuring the success of ongoing intervention efforts. Survey data also have been used to estimate the prevalence of selected cardiovascular disease risk factors.

ALTHOUGH MORTALITY RATES are declining, cardiovascular diseases remain the leading cause of death in the United States and account for half of all deaths (*1*). The decline in mortality is due in part to the modification of risk factors such as high blood pressure, elevated blood cholesterol, and cigarette smoking in the population.

Several community research and demonstration projects in cardiovascular disease prevention have produced positive changes in risk factor prevalence (*2–6*). Measuring these changes and attributing them to specific interventions require complex evaluation methodologies. These studies have developed extensive evaluation designs to establish baseline profiles of the population and to measure changes over time.

To determine the feasibility of implementing this type of program in a public health, rather than an academic setting, the South Carolina Department of Health and Environmental Control, in cooperation with the Centers for Disease Control, initiated a 5-year demonstration project to develop, implement, and evaluate a community-based public health program for cardiovascular disease prevention. The long range goal of the project is to reduce cardiovascular disease morbidity and mortality. The short range (5-year) goals are to reduce either the prevalence or severity, or both, of three

major risk factors—high blood pressure, elevated blood cholesterol, and cigarette smoking.

The project consists of three phases. Phase I is the Baseline Assessment Phase that includes a community health survey to obtain baseline data on risk factors and health practices related to cardiovascular disease. Phase II, the Intervention Phase, involves all segments of the community in an effort to create an environment that promotes cardiovascular health and assists in lifestyle changes. Phase III, the Followup Phase, repeats the community health survey in the fifth year to determine health status changes. We will describe the methods used in Phase I to establish a baseline community profile, and we will present preliminary results of the investigation into the three major risk factors in the study.

Methods

Overview. Anderson and Florence are two communities in South Carolina that are demographically similar but geographically separated by approximately 200 miles. The geographic areas of the study were delineated by the telephone exchanges of the two communities that extended beyond the city limits but did not encompass the entire counties. We determined from calculations of the sample size that if we followed a cohort of 1,500 people in each community over 5 years, we could detect (with greater than 99 percent power) a total serum cholesterol change of 7.0 milligrams per deciliter or a blood pressure change of 2.0 millimeters of mercury in the two communities. Because we estimated that 20 percent of the study population (23 percent in Anderson and 15 percent in Florence) were without telephones, study participants were chosen from households with and without residential telephones in order to obtain a sample representative of the entire adult population ages 18 and older.

Participants were selected by random digit dialing for households with telephones and by simple random selection from city directories for the nontelephone households. Interviews were conducted with a 102-question instrument specifically designed for this project. Each participant completed the interview and then was asked to participate in a physical assessment that included a blood sample, pulse measurement, blood pressure measurement, and anthropometric measurements. The interview period for the survey was June 1, 1987, through October 31, 1987, with the physical assessments completed by January 30, 1988.

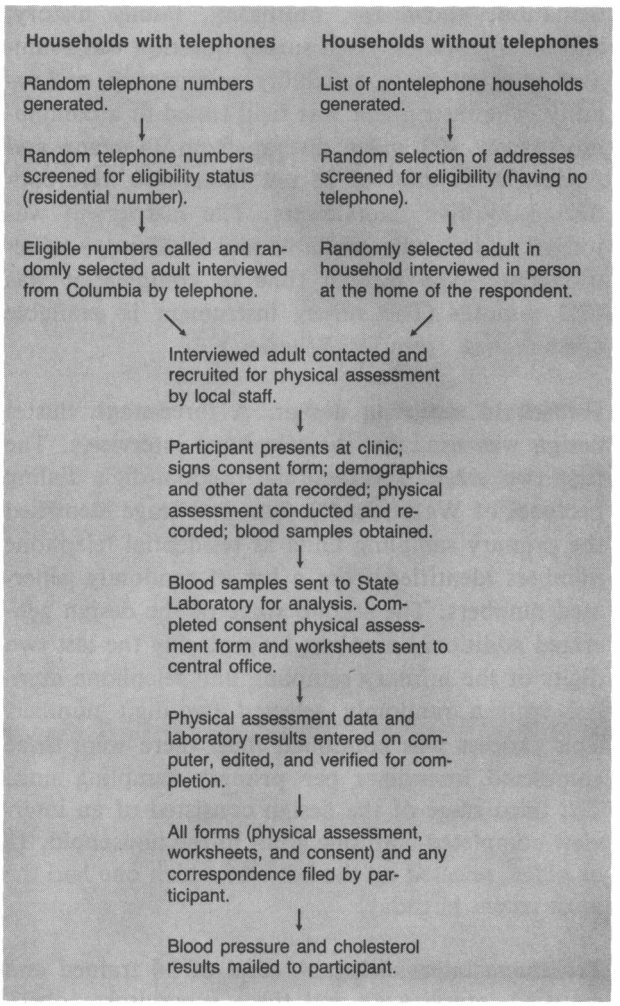
Interview instrument. The questionnaire contained six parts: behaviors, program awareness and participation, knowledge, morbidity, family history, and demographics. Each survey question was evaluated as to rationale, reliability, consistency, and validity. The instrument was field tested in a community about 100 miles distant from Florence and Anderson. A total of 25 test interviews were conducted by five interviewers. The instrument was judged to be understandable and inoffensive to respondents. The median time to complete it was 17.5 minutes (The survey instrument is available upon request from Dr. Wheeler.)

Household sampling design. A three-stage cluster design was used for the telephone interviews. The first two stages followed the random-digit dialing protocol of Waksberg (*7*). The first stage identified the primary sampling units as residential telephone numbers identified from a list of randomly generated numbers. The second stage of the design generated additional numbers by replacing the last two digits of the primary sampling unit telephone number with a randomly selected two-digit number. This process was continued until there were three completed interviews per primary sampling unit. The third stage of the design consisted of an interview completed with one adult in the household, 18 or older, selected on the basis of which one had the most recent birthday.

Telephone interviewing. A total of 30 trained and certified interviewers and three supervisors constituted the survey team. Interview periods were scheduled to maintain a ratio of at least one supervisor for every five interviewers. All interviewers and supervisors participated in a 16-hour training session that included an explanation of the survey and questionnaire, as well as interviewing techniques and survey protocol. Each interviewer also completed 20 practice interviews. Throughout the interview period, interviewers were evaluated for completion rate, interview technique, voice personality, enunciation of questions, ability to handle difficult situations, and general knowledge of the survey. Interviewers also were evaluated on correct selection of respondents, coding completion of the questionnaire, and accurate completion of telephone log sheets. Interviews were conducted from a central location (Columbia, SC) and interviewer assignments were varied between the two study sites.

Interviewers read the questions as written without interpretation and recorded responses according

South Carolina cardiovascular disease prevention project survey protocol



to item-by-item coding instructions. Interviewers also completed a scheduling sheet for the physical asessment portion of the survey. Before abandoning a telephone number, a minimum of seven attempts per telephone number were made on different days and at different times. Refusal conversion techniques consisting of multiple attempts and strategies were used to convince reluctant respondents to participate. After completion of the interviews, supervisors edited the forms for completeness, correct respondent selection, correct coding, and responses requiring interpretation.

Several quality control measures were used with the telephone interviews. First, supervisors listened to randomly selected interviews. In addition, supervisors reinterviewed a randomly selected 10 percent of the respondents. If the supervisor determined that the incorrect respondent had been interviewed, for whatever reason, the incorrect interview was removed from the data set and a new interview completed with the correct respondent. If individual responses (such as race or sex) not normally variable over time were detected as being incorrect, these responses were corrected by the supervisor. In addition to these checks on the respondent and selected responses, each telephone call was documented by telephone company records and attributed to the appropriate interviewer to ensure that the reported call was made.

Nontelephone sampling design. The sampling design for the interviews in households without a telephone paralleled the telephone sampling design (see chart). City directories and telephone company records were used to create a list of residential addresses not known to have a household telephone. A sample (frame) of 120 residences was randomly selected and screened by an interviewer who visited the household and inquired about the existence of a working telephone at that address. An eligible address was defined as a household without a working telephone. If the place did indeed have a working telephone, it was considered ineligible and was replaced in the next sample frame. This process was continued until at least 100 interviews were completed in each community. The next stage involved the random selection of the adult within the household who had most recently had a birthday. The selection was made with a procedure similar to that of the telephone interview respondent selection.

Nontelephone interviewing. Six interviewers and two supervisors completed the nontelephone household interviews. Local interviewers familiar with neighborhoods were used to minimize travel costs. Interviewers and supervisors participated in the same training session as the telephone interviewers, as well as a 6-hour session on face to face interviewing techniques. Interviewers were evaluated in a manner similar to that used for telephone interviewers.

Interview data were collected, coded, and assigned a final disposition similar to that of the telephone interviews. Multiple interview attempts, refusal conversion attempts, and interviewer evaluation were comparable to the procedures for telephone interviewers. Ten percent of the respondents were randomly selected for repeat interviews by a second interviewer. In addition, all interviews were confirmed as completed by written correspondence with the respondent.

Physical assessments. Each physical assessment clinic had a staff of supervisors, receptionist, recruiters, and laboratory technologists. Each member of the clinic staff participated in 16 hours of training that included protocol review and individual measurement techniques. Interviewers were trained and certified by the Hypertension Detection and Follow-up Program Protocol (*8*). Interviewers were certified in the use of random zero manometers and completed at least 50 measurements with a second examiner and teaching stethoscope (Y-tube with two earpieces) before beginning the survey. Although all clinic staff members were trained in physical assessment procedures, the laboratory technologists completed all phlebotomies.

Each participant in the interview phase of the survey was requested to participate in the physical assessment phase. The physical assessment appointment sheet completed during the interview was used for contact and recruitment. Multiple attempts at recruitment were made with the respondents. Participants could make appointments at the clinic at any time between 7 a.m. and 10 p.m. If necessary, transportation to the clinic was provided at no cost to the participant. The assessment could be completed at the participant's residence or place of work, if that was necessary. Recruitment procedures included verification of interview participation, explanation of the assessment process, arrangement of a convenient appointment time, request for an 8-hour fast, and request for blood pressure medication to be brought to the assessment.

At the clinic, identification of each participant was verified, the assessment process was explained, and a consent form signed. The physical assessment form that was completed on each participant included name, mailing address, name and telephone number of a person knowing the participant's whereabouts, sex, race, date of birth, length of time since last caloric intake, and documentation of blood pressure medication. For participants on blood pressure medication, the interviewer identified the drug and recorded the name and classification of the medication.

The radial pulse was then measured on the right wrist. The pulse obliteration point was calculated using a standard sphygmomanometer. Blood pressure was measured using the random zero mercury sphygmomanometer and the Hypertension Detection and Follow-up Program Protocol (*8*). Measurements were repeated twice at 30-second intervals.

Weight was measured with standardized spring platform floor scales. Each participant was weighed to the nearest pound twice without shoes or heavy clothing. A third measure was taken if the first two did not agree within 1 pound. Height was recorded to the nearest inch on the physical assessment form. At the clinic sites, a height chart mounted on the wall was used for height determination. In the home and worksites, a metal tape measure was used to measure height. Girth measurements of waist and hips were obtained with a cloth tape measure.

Two blood samples (one 13 ml SST tube and one 7 ml EDTA tube) were obtained from each participant. Blood drawing protocol included gloves and proper needle and tube disposal. The blood in the SST tube was allowed to clot and centrifuged within 1 hour after collection. The serum was transferred to a labeled 7 ml serum transfer tube. Both tubes were stored under refrigeration and were shipped in cold packs to the laboratory on the day they were collected. Blood samples were analyzed by the South Carolina State Laboratory for

Table 1. Demographic comparison of total population with participants in interviews and physical assessments, 1987-88 South Carolina community health survey

Groups	Total population		Interviews		Physical assessments	
	Number	Percent	Number	Percent	Number	Percent
White men:						
18–24 years	6,129	5.9	163	3.0	63	2.0
25–34.....	8,643	8.4	372	6.8	193	6.0
35–44.....	6,861	6.2	387	7.1	235	7.3
45–54.....	5,822	5.3	239	4.4	156	4.9
55–64.....	4,939	4.5	242	4.4	181	5.7
65 and older	4,159	3.8	220	4.0	149	4.6
White women:						
18–24 years	6,581	6.0	238	4.4	84	2.6
25–34.....	9,047	8.2	484	8.9	249	7.8
35–44.....	7,018	6.4	557	10.2	331	10.3
45–54.....	6,096	5.5	373	6.8	244	7.6
55–64.....	5,825	5.3	360	6.6	233	7.3
65 and older	6,760	6.1	518	9.5	287	9.0
Black men:						
18–24 years	2,527	2.3	44	0.9	15	0.5
25–34.....	2,965	2.7	97	1.9	52	1.7
35–44.....	1,835	1.7	89	1.7	57	1.8
45–54.....	1,402	1.3	49	1.0	34	1.1
55–64.....	1,247	1.1	45	0.8	27	0.8
65 and older	1,133	1.0	49	1.0	29	1.0
Black women:						
18–24 years	3,035	2.8	112	2.1	60	1.9
25–34.....	3,652	3.3	235	4.4	147	4.6
35–44.....	2,251	2.0	171	3.2	110	3.5
45–54.....	1,781	1.6	115	2.1	80	2.5
55–64.....	1,734	1.6	89	1.7	57	2.1
65 and older	2,031	1.8	171	3.2	106	3.3
Totals..	103,473	100.0	5,419	100.0	3,179	100.0

Table 2. Percentage distribution by demographic characteristics of those interviewed compared with those completing both the interview and physical assessment, 1987–88 South Carolina community health survey

Characteristic	Interview only (N = 2,296)	Interview and assessment (N = 3,179)	Completed assessment
Ages (years):			
18–24	15.0	7.0	39.6
25–34	24.4	20.2	53.6
35–44	21.0	23.1	60.8
45–54	11.7	16.1	65.8
55–64	10.6	15.6	67.5
65 and older	17.3	18.0	59.6
Race-sex:			
White men	28.5	30.7	60.1
White women	49.2	44.9	56.0
Black men	7.1	6.7	57.1
Black women	15.2	17.6	61.8
Household income:			
Less than $15,000	35.6	36.1	59.7
$15,000-$35,000	41.7	40.0	58.2
More than $35,000	22.7	24.0	60.8
Employment status:			
Employed	64.2	62.2	57.2
Not employed	37.8	35.8	59.2
Education:			
Less than high school	61.5	60.7	57.9
Some college or technical school	21.4	19.9	56.5
College graduate	17.2	19.4	61.0
Marital status:			
Married	60.1	56.7	59.5
Not married	39.9	43.3	56.0

total cholesterol (*9*), high density lipoprotein cholesterol (*10*), triglycerides (*11*), glycosylated hemoglobin (*12*), blood glucose (*13*), apolipoprotein A-I and apolipoprotein B (*14*). Low density lipoprotein cholesterol was estimated using the formula proposed by Friedewald and colleagues (*15*).

As a quality control measure, 10 percent of the physical assessment participants were randomly selected for repeat blood pressure measurement by a second examiner. In addition, each clinic site was assessed on a weekly basis. The inspections were unannounced and were scheduled to ensure that each staff person would be evaluated. Standard quality control methods for the laboratory procedures were incorporated by the State laboratory.

Data Management

Data from telephone interviews, nontelephone interviews, physical assessments, and laboratory tests were merged into one data set, edited, and programmed into a SAS data set for statistical applications (*16*). To compensate for sources of variation in selection probabilities and nonresponse within age, race, and sex groups, a weighting factor was calculated for each participant. The weight reflects the number of people in the population which the participant represents as a member of the sample. Since the telephone household interviews and the non-telephone household interviews involved two different sampling schemes, two different weighting calculations were used.

For the telephone households, factors for calculation of weights were the number of adults in the selected household divided by the number of telephone numbers associated with that household, the actual number of participants per cluster size, and the 1980 Census count for each of 12 age-race-sex categories, divided by the sum of weights among survey participants in the same age-race-sex category. Factors for calculating weights for the nontelephone households were the number of addresses selected for a specific sampling frame divided by the number of eligible addresses in the frame, the number of adults in the household, and the 1980 Census population count for each of 12 age-race-sex categories divided by the sum of weights among survey participants in that age-race-sex category.

Results

A total of 5,489 telephone and in-person interviews were completed, totalling almost 40 percent of calls made or addresses checked. More than 60 percent of the attempts resulted in unanswered calls, nonexistent addresses, or other disqualifying circumstances. Of the total, 5,419 provided complete demographic identification.

Interviews by telephone were completed on 5,245 adults in the two areas (2,492 in Anderson and 2,753 in Florence). Interviews in nontelephone households were completed on 244 adults (102 in Anderson and 142 in Florence).

Two response rates were derived using different methods of calculation. The upper bound response rate, or cooperation rate, assumes that all unknowns are ineligible for participation. This rate represents the ratio of completed interviews to the total number of eligible respondents contacted (the sum of completed interviews, refusals and terminations. The upper bound response rate was 83.7 percent for all interviews (83.2 percent for telephone and 93.9 percent for nontelephone). The CASRO response rate (*17*) assumes that a proportion of the unknowns are eligible to participate. This rate represents the ratio of completed interviews to the sum of completed interviews, refusals, and a standard fraction of numbers which were

working, but for which an interview was not completed. The CASRO response rate was 71.2 percent for all interviews (71.0 percent for telephone households and 93.7 percent for nontelephone households).

Physical assessments were completed on 3,193 (61.0 percent) of the persons interviewed. Of these, 3,179 provided complete demographic data. Although participation rates for physical assessment were not as high as desired, table 1 shows that the demographic makeup of interview and physical assessment participants was similar to the total adult population. Young adults, ages 18–24, were the most under-represented group. Sampling fractions ranged from 0.0103 for white men ages 18–24 to 0.0532 for black women ages 65 and older. The 18–24-year-olds represented the lowest fraction in each race-sex group.

Since 2,296 persons were not successfully recruited for physical assessment, only interview data were available on these participants. For the 2,271 respondents with complete demographic data, as shown in table 2, younger persons were slightly underrepresented, but other demographic variables were similar for the two groups. Self-reported risk factor data also were similar for the two groups; no differences were observed in self-reported cholesterol measurement, current cigarette smoking, sedentary lifestyle, and obesity. Participation rates were similar in both communities.

While the physical assessment nonresponse bias did not seem significant, there were noticeable differences in the demographic characteristics of study participants with and without household telephones. Nontelephone households were more than twice as likely to be black or to have annual household incomes less than $15,000 and were nearly twice as likely to have lower educational levels. Differences also were observed in risk factor prevalence since nontelephone participants were more likely to be current cigarette smokers, have hypertension, and have a sedentary lifestyle. The prevalence of obesity and blood cholesterol levels were similar.

A total of 498 call-backs were conducted as quality control on the completed interviews. In all, 12 interviews were replaced when it was determined that the incorrect respondent had been interviewed. Seven interviews were removed from the system and were not replaced, five because of incorrect respondent selection and two because respondents were underage .

Quality control for blood pressure measurement (repeat measures by a second examiner) was monitored throughout the survey period, and results were discussed with the examiners. No significant differences were detected. Laboratory quality control measures were completed according to analytical protocol. Coefficients of variation were less than 5 percent for all tests performed, with the exception of high density lipoprotein cholesterol, which was 6.8 percent.

Table 3. Percentages of selected cardiovascular disease risk factors by age, race, and sex, 1987-88 South Carolina community health survey

Group	High blood pressure[1]	High blood cholesterol[2]	Cigarette smoking[3]	Sedentary lifestyle[4]	Overweight[5]
Men	28.5	17.1	34.5	37.3	26.0
Women	25.9	19.3	24.7	44.4	28.5
Whites	25.3	18.2	29.0	36.9	24.3
Men	28.0	16.4	33.6	35.0	26.1
Women	23.0	19.9	24.6	38.6	22.6
Blacks	32.8	18.5	30.2	54.2	36.8
Men	30.6	19.8	37.7	44.9	25.6
Women	34.8	17.6	24.4	61.4	45.6
Age (years):					
18–24	6.2	7.7	26.3	32.0	16.5
25–34	7.6	10.3	31.2	34.4	21.0
35–44	24.5	14.5	37.3	41.3	29.4
45–54	40.1	24.7	31.6	45.6	31.3
55–64	43.6	33.3	24.2	46.8	34.9
65 and older	61.1	34.3	17.5	53.2	35.6
Totals	27.1	18.3	29.3	41.1	27.3

[1] 140/90 mm Hg or greater or currently being medically treated for hypertension, or both.
[2] 240 mg per dl or higher.
[3] Self-reported current smoking.
[4] Self-reported physical inactivity.
[5] Body Mass Index is equal to or greater than 27.8 for men and 27.3 for women.

The cost estimates for completing interviews and physical assessments include direct costs only. The telephone interview cost of $10 per interview includes interviewer and supervisor salaries, as well as long distance telephone costs. The $61.92 per household face-to-face interview cost includes interviewer and supervisor salaries, as well as travel reimbursement. The physical assessment cost of $34.11 per person includes recruitment, clinic staff salaries, and laboratory assays.

Activity	Total cost	Number completed	Unit cost
Telephone interview	$ 52,453	5,246	$10.00
Household interview	16,672	245	61.92
Physical assessment	109,227	3,202	34.11

Survey data were used to calculate prevalence estimates of selected cardiovascular disease risk factors. The prevalence of high levels of blood pressure, cholesterol, cigarette smoking, sedentary lifestyle, and obesity are presented by age, race, sex, and race-sex in table 3. Rates were similar for the two study areas and are combined in this

paper. Several of the risk factors are more prevalent among blacks, with cigarette smoking greatest among black males, and hypertension, obesity, and sedentary lifestyle most prevalent among black females. Observed results are comparable to other population surveys (*18–21*), given differences in the demographics of the study populations.

Conclusions

Our experience indicates that a State health department can successfully conduct a community health survey as part of the evaluation of a community-based disease prevention program. The quasi-experimental design commonly used by public health programs was selected for this project (*22*). The major limitation of this design is the inability to control activities and events that occur in the reference community. With that concern in mind, the South Carolina Cardiovascular Disease Prevention Project will use the baseline survey results for program planning, follow the cohort for 4 years, repeat the interviews and physical assessments in the final year of the project, and analyze the followup results to determine the success of intervention activities.

Although the survey sample was representative of the population, the response rate was not as high as desired. Young adults ages 18-24 were the least likely to participate. This group was difficult to attract even with vigorous recruitment. These findings suggest the need for widespread publicity about the survey, multiple contacts with the selected persons as well as written correspondence concerning the importance of participation.

The decision to include nontelephone households was important but costly. The sampling plan was expensive and yielded a small number of interviews for the effort. The majority of the screened addresses were ineligible because a telephone was present in the household. Unless the study population includes a very high proportion of nontelephone households, it may not be necessary to include such a sample. Rather, the data may be statistically adjusted to account for nontelephone households. The physical assessment component was also quite expensive but necessary because of the significant numbers of unaware hypertensives and people with high blood cholesterol levels and the inaccurate self-reporting of anthropometric measurements.

The successful completion of the baseline survey for the South Carolina Cardiovascular Disease Prevention Project provides the State with a valuable resource for epidemiologic investigation of cardiovascular disease, as well as data needed for program evaluation. The decision to incorporate such an elaborate methodology by a State or local government agency should be well thought out before initiation. If a survey is warranted, it is hoped that other State or local health departments or both will review these results, learn from our shortcomings, and build upon our successes in an effort to reduce unnecessary and premature mortality and morbidity from cardiovascular disease.

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Association Between Exercise and Other Preventive Health Behaviors Among Diabetics

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Synopsis

Two hundred and seventy patients were studied to investigate the cross sectional association between exercise and other preventive health behaviors in a diabetic population. Patients included both insulin and noninsulin dependent diabetics and were recruited from the Family Practice and Pediatrics Clinics at Bowman Gray School of Medicine. During screening, patients underwent a physical examination as well as completing a survey to assess exercise and health behavior habits. Three exercise groups were compared: (a) patients who expended more than 600 kilocalories per week during exercise, (b) patients who expended 600 kilocalories or less, and (c) patients who did not exercise.

The mean body weights of both exercise groups were found to be less than the nonexercise group, and the heavy exercise group also had a lower mean body mass index. Heavy exercisers reported greater caloric intakes than both moderate and nonexercisers. There were no differences found concerning the composition of their diets among groups.

The heavy exercise group reported wearing their seatbelts a greater percentage of the time and visited the dentist more often compared with the sedentary group. There were no significant differences found among exercise groups concerning blood sugar monitoring, alcohol consumption, smoking, or in obtaining periodic health examinations. It was concluded that exercise was associated with several, but not a majority, of other healthful behaviors in a population of diabetics.

PATIENTS WITH DIABETES MELLITUS are often advised to engage in various forms of physical exercise as part of the management of their disease. Beneficial effects of exercise include improved lipid profiles, lowered blood pressure, and reduced perception of stress and anxiety (*1*). Previous studies have demonstrated that nondiabetic subjects who participate in exercise are also more likely than nonexercising subjects to display other healthful behaviors such as proper weight control, increased seatbelt use, and obtaining periodic health examinations (*2,3*).

Although the physiological benefits of exercise for diabetics are generally accepted, associations between exercise and other healthful behaviors in this population have not been reported. If these relationships can be documented, it would suggest that recommending exercise to patients with diabetes could be a primary target behavior on which to focus when trying to encourage positive lifestyle