
Cholesterol Screening in a Community Health Promotion Program: Epidemiologic Results from a Biracial Population

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Synopsis

The prevalence and interrelationship of high blood cholesterol levels with other cardiovascular disease risk factors were studied in a biracial suburb of New York City.

Participants in community-based screenings to determine blood cholesterol levels have been predominantly white women in older age groups, highly educated and nonsmokers. To reach a more representative segment of a local population and

promote healthy lifestyle behaviors, cholesterol screenings were conducted within an ongoing health promotion program in Mount Vernon, NY.

Plasma cholesterol levels were determined for 5,011 participants, including 2,308 whites and 1,778 blacks. Of the men, 29 percent had high cholesterol levels; among women, it was 27 percent. Of the men with high levels, half had levels greater than 200 milligrams per deciliter, as did 55 percent of the women.

After statistical adjustments were made for age and other risk factors for high blood cholesterol, mean cholesterol levels were higher for whites than blacks. The level for white men was 204 milligrams per deciliter; for women, 212. For black men, the level was 199 milligrams per deciliter; for women, 208, $P < .10$. Hispanic men had levels of 199, $P < .10$. The levels for Hispanic women (203 milligrams per deciliter) were significantly lower than that of white women.

Among whites who smoked more than 1 pack of cigarettes per day, mean cholesterol levels were 11 milligrams per deciliter higher than for those who never smoked or were light smokers (0, 1-20 cigarettes per day, $P < .10$). There were too few who smoked more than 1 pack to test this association adequately among blacks.

The mean cholesterol levels for hypertensive black men were 10 milligrams per deciliter greater than for black men with normal blood pressure ($P < .10$).

HIGH BLOOD CHOLESTEROL levels, elevated blood pressure, and cigarette smoking are three modifiable risk factors for coronary heart disease (CHD). The high cholesterol levels are associated with high-fat diets, cigarette smoking, and lack of exercise. The major objective of population-based cholesterol screenings is to identify persons with high cholesterol levels and other CHD risk factors and to encourage them to adopt healthier lifestyle

behaviors such as smoking cessation, increased exercise, and low-fat diets. Screenings are usually performed by research and health care organizations, hospitals, businesses, private physicians, or other health professionals.

There is often a large gap between the knowledge of healthful behaviors and actual lifestyles (1). Studies of cholesterol screenings have shown that regardless of geographic area, persons who partici-

Table 1. Demographic characteristics of screening participants by percentages, Mount Vernon, NY, CARES Study, 1989-90

Characteristics	Men				Women			
	Black (N = 523)	White (N = 987)	Hispanic (N = 123)	Other ¹ (N = 144)	Black (N = 1,255)	White (N = 1,321)	Hispanic (N = 203)	Other (N = 211)
Age (years):								
18-30	20.8	9.0	15.8	23.2	21.8	7.3	29.4	24.6
31-40	20.8	21.5	18.0	35.5	20.3	12.9	31.1	26.2
41-50	23.0	19.0	17.6	18.1	22.5	12.3	19.8	22.5
51-60	17.5	15.1	16.2	16.7	15.0	16.8	14.7	17.3
61-70	9.7	19.6	17.2	5.1	12.5	26.4	4.0	4.7
Older than 70	8.2	15.9	15.3	1.4	7.8	24.2	1.1	4.7
Education (years of school):								
1-12	17.6	18.8	25.3	25.8	18.0	22.8	27.4	30.2
12	30.4	32.4	24.3	27.2	35.4	43.1	34.8	23.5
13-15	33.5	22.7	32.0	18.4	25.6	16.3	23.2	21.2
16 or more	18.5	26.0	18.4	28.7	21.0	17.8	11.6	25.2
Marital status:								
Single	27.6	18.4	14.0	20.4	32.3	17.2	26.2	18.2
Married	49.5	69.4	71.0	73.0	32.2	50.8	51.4	63.6
Other ²	22.8	12.1	14.9	6.5	35.5	32.0	28.3	18.2

¹Includes Asians, American Indians, and others.

²Divorced, separated, widowed.

Table 2. Method by which participants were notified about times and locations of cholesterol screenings¹

Medium	Men				Women			
	White		Black		White		Black	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Flyer	323	32.7	156	29.8	414	31.3	438	34.9
Posters	166	16.8	99	18.9	189	15.1	171	12.9
Newspaper	245	24.8	58	11.1	188	15.0	421	31.9
Radio	11	1.1	11	2.1	41	3.3	18	1.4
Video	6	0.6	4	0.8	8	0.6	6	0.5
Cable TV	16	1.6	9	1.7	16	1.2	21	1.7
Word of mouth	253	25.6	148	28.3	313	23.7	338	26.9
Church	29	2.9	46	8.8	128	9.7	124	9.9

¹ Includes multiple responses.

pate in screenings have been predominantly white women in older age groups who have never smoked and are highly educated (2-5). Reasons offered by people who attend cholesterol screenings include consciousness of their health or concern about previously determined high cholesterol levels. Factors associated with a reduced probability of ever having had a cholesterol test include age younger than 45, less than high school education, low income, lack of health insurance, and not having visited a physician within a year (6).

To reach segments of the population that do not have access to cholesterol screenings or are not motivated to have their cholesterol levels determined, screenings were conducted during the Mount Vernon Cholesterol Awareness, Risk Education, and Screening (CARES) Community Intervention Study. The CARES program was designed to

encourage cholesterol determination, educate participants on CHD risk factors, educate local physicians on cholesterol management, and promote healthful lifestyles through an ongoing campaign involving community leaders and media.

This is a report on the cholesterol levels of the adults who were screened and the relationship between cigarette smoking and hypertension with elevated cholesterol levels among black men and women and white men and women. The levels for Hispanic participants, who were predominantly Puerto Rican or Dominican, are also reported.

Population and Methods

Mount Vernon is a biracial community of 66,153 residents (48,903 ages 18 and older) located 13 miles north of midtown New York City (7). In

1990, 55 percent of the population were black, 40 percent were white, and 7 percent were of Hispanic origin. The median age was 34 years. Nine percent of families had incomes below the poverty level.

The Mount Vernon CARES program was a collaborative health promotion conducted by the American Health Foundation (AHF) and health, civic, industrial, and religious organizations that serve the residents of Mount Vernon (8). Notices of the cholesterol screenings were provided by the collaborating organizations, employers, local television and radio stations, and newspapers.

Two large screenings were conducted in September 1989 and March 1990 at 14 sites over a period of 14 days. The sites, chosen by a community advisory board and American Health Foundation staff members, were located primarily within lower income census tracts. They included five churches, the city hall, two low-income apartment complexes, a health center, a hospital, the post office, one business site, a YMHA, and a YMCA. The screenings were free to all participants.

There were 3,601 participants at the first screening in 1989 and 1,410 different participants at the subsequent screening in 1990. Sixty-four percent of participants at both screenings were Mount Vernon residents (6.5 percent of the adult population), and 36 percent of the participants were either employed in Mount Vernon or lived in adjacent communities. Since there were few demographic differences between the first and second set of participants, the results are presented in aggregate.

Each screening participant completed a brief self-administered questionnaire that included questions on age, height, body weight, race or ethnicity, smoking status, and medical history such as physician-diagnosed diabetes mellitus, previous nonfatal heart attack, and hypertension. Blood was drawn by a certified phlebotomy technician using the fingerstick method and collected by capillary action into vials containing lithium heparin as an anticoagulant. Levels of plasma cholesterol, defined as serum cholesterol multiplied by 1.03, were determined by AHF staff technicians trained by the Kodak company using Kodak portable analyzers (4). The methodology for AHF screenings has been previously described (2). Analyzers were calibrated to a single lot number of reagents by AHF staff members and then sent to each testing site where calibration was confirmed and a series of control fluids analyzed.

Plasma cholesterol levels that were considered desirable, moderate, or high were defined according to guidelines established by the National Cho-

'Factors associated with a reduced probability of ever having had a cholesterol test include age younger than 45, less than high school education, low income, lack of health insurance, and not having visited a physician within a year.'

lesterol Education Program (desirable—less than 200 milligrams per deciliter [mg per dl]; moderate—200–239 mg per dl; high—240 mg per dl or more, or 200–239 mg per dl and 2 or more existing CHD risk factors) (9). (A Consensus Conference statement from the National Institutes of Health defines risk levels by blood cholesterol rather than by serum or plasma cholesterol and agrees with the aforementioned levels (10)). All participants received dietary counseling by a nutritionist, and persons at high risk were referred for a followup workshop that provided further nutrition counseling and subsequent re-testing of cholesterol levels.

The questionnaire data were tabulated by frequencies and percentages. Mean plasma cholesterol levels, standard errors, and 95 percent confidence intervals were calculated separately for men and women. Analysis of covariance (ANCOVA) was used to determine the effects of race, cigarette smoking, and hypertension on cholesterol levels using the general linear models procedure of the Statistical Analysis System (11). The nonlinear association between age and cholesterol was modeled using a linear and quadratic term for age in the ANCOVA analysis (2–3).

Results

The basic sociodemographic characteristics of participants are shown in table 1. There were equal proportions of white and black women, whereas white men were considerably more numerous than black men. Men were slightly younger than women; 48 ± 2 years compared with 50 ± 3 years; 45 ± 3 for black men, 45 ± 4 for black women; 52 ± 2 for white men, 57 ± 3 for white women. There were few differences in educational level among men, whereas black and Asian women were more highly educated than other women.

More blacks than whites reported having CHD risk factors. Twenty-seven percent of black men and 22 percent of black women reported currently

Table 3. Mean plasma cholesterol levels¹ in men and women, Mount Vernon CARES Study

Race	Men			Women		
	Number	Mean level	CI	Number	Mean level	CI
Black	522	199	196, 203	1,254	208	206, 210
White	996	204	202, 207	1,321	212	210, 214
Hispanic..	123	199	192, 206	203	203	198, 208

¹ Adjusted for age, body mass (weight² divided by height), hypertension, myocardial infarction, diabetes, and cigarette smoking.
NOTE: CI = 95 percent confidence interval.

Table 4. Cigarette smoking and mean plasma cholesterol levels¹ in men and women, ages 18–60, Mount Vernon CARES Study

Race and cigarettes per day	Men			Women		
	Number	Mean	CI	Number	Mean	CI
Black:						
0–20	396	197	194, 201	918	195	193, 197
21 or more	32	192	180, 206	49	197	187, 207
White:						
0–20	574	203	200, 206	587	206	203, 209
21 or more	56	214	205, 223	60	217	208, 226
Hispanic:						
0–20	105	194	187, 202	186	189	184, 194
21 or more	5	199	165, 233	6	199	170, 229

¹ Adjusted for age, body mass, hypertension, myocardial infarction, diabetes.
NOTE: CI = 95 percent confidence interval.

‘Studies of cholesterol screenings have shown that, regardless of location, participants were predominantly nonsmoking, more highly educated white women in older age groups as opposed to other residents from their communities.’

smoking cigarettes, compared with 19 percent of white men and 18 percent of white women. Nearly 7 percent of blacks and 5 percent of whites had been diagnosed with diabetes, 4 percent of blacks and 3 percent of whites had a history of hypertension, and 4 percent of blacks and 5 percent of whites had a previous nonfatal myocardial infarction.

Most participants were informed of the locations and times of the screenings by written promotional

materials distributed by the Mount Vernon CARES organizations. The materials included flyers, posters, and newspapers (table 2). The flyers and posters were equally effective in informing blacks and whites, and men and women, whereas newspaper advertisements were more effective in reaching white men and black women. One quarter of the participants became aware of the screenings through word of mouth from neighbors or employers, and nearly 10 percent of women were informed by church announcements. The educational level of the participants did not affect the method by which they were notified.

Fifty percent of men and 55 percent of women had plasma cholesterol levels of 200 mg per dl or more. Sixteen percent of men had cholesterol levels of 240 mg per dl or more (whites, 17 percent, blacks, 16 percent), and 13 percent had levels between 200 and 239 mg per dl as well as two or more CHD risk factors (whites, 16 percent, blacks, 13 percent). Among women, 24 percent had high cholesterol levels (whites, 30 percent; blacks, 20 percent) and 3 percent had intermediate levels with two or more CHD risk factors. The age-adjusted mean cholesterol levels of white men were 5 mg per dl higher and white women 4 mg per dl higher than the levels for blacks ($P < .10$) (table 3).

Among participants younger than age 60, whites who smoked more than 1 pack of cigarettes per day had mean levels 11 mg per dl higher than light smokers (1–20 cigarettes per day) and non-smokers ($P < .10$) (table 4). There were no statistical differences in cholesterol levels among black men and women by smoking status, although there were too few blacks who smoked more than one pack of cigarettes per day to test this association adequately. Among black men with a history of hypertension, mean cholesterol levels were 10 mg per dl higher than normotensive black men ($P < .10$) (table 5). Higher cholesterol levels were also observed for Hispanic women with high blood pressure.

Discussion

Population-based cholesterol screenings are usually held in shopping malls, hospitals, supermarkets, office buildings, or other locations that are often not accessible to all members of a community. Studies of cholesterol screenings have shown that, regardless of location, participants were predominantly nonsmoking, more highly educated white women in older age groups as opposed to other residents from their communities (2–6). Re-

cent efforts have been undertaken, however, to reach greater numbers of minority group members. For example, Wiist and Flack describe a cholesterol screening in a pilot education program conducted in six black churches by trained members of those churches (12).

The screening participants in Mount Vernon had sociodemographic characteristics similar to those reported in other studies; however, half of the Mount Vernon participants were blacks or other minorities, and a large number of high-risk persons attended. The program identified 1,300 persons (26 percent) with high cholesterol levels and provided them with nutritional advice and referral for further dietary counselling.

Higher mean cholesterol values were found for some race-sex groups. Racial differences in average blood cholesterol levels have been reported by some investigators. In Minnesota, lower cholesterol levels were found for black participants (13), whereas the National Health and Nutrition Examination Survey II found similar percentages of blacks and whites with high cholesterol levels (14). The adjusted cholesterol levels of white men and women in Mount Vernon were slightly higher than those of blacks, but the differences were not statistically significant.

A recent cholesterol screening of 562 participants who were interviewed in an urban black community in east Baltimore, MD, found that 35 percent of participants had high cholesterol levels (15). The Mount Vernon CARES data showed that although the mean ages and sex distributions of black men and women were similar to the Baltimore participants, only 26 percent of Mount Vernon black participants had high cholesterol levels. The lower proportion of high risk people detected in Mount Vernon may reflect differences in recruitment methods, socioeconomic status, geographic variation, or the comparability and validity of self-reported risk factor data versus personal interview. For example, self-selection bias in east Baltimore was minimized by holding screenings during Sunday church services and on Friday evenings and Saturday mornings at other locations (15).

The association between cigarette smoking and higher cholesterol levels among whites has been well established in several studies (16). We have shown previously that cholesterol levels rise with the increasing number of cigarettes smoked per day for men and women younger than age 60 (17). This association may reflect the higher intake of dietary fat among smokers (18), or the metabolic effects of cigarette smoke metabolites (19). No associations

Table 5. Hypertension and mean plasma cholesterol levels¹ in men and women, Mount Vernon CARES Study

Race and BP level	Men			Women		
	Number	Mean	CI	Number	Mean	CI
Black:						
Normal .	360	195	191, 199	776	201	198, 204
High ...	162	205	199, 212	478	205	187, 207
White:						
Normal .	736	206	204, 208	945	218	216, 221
High ...	250	207	198, 212	376	221	216, 225
Hispanic:						
Normal .	97	197	189, 204	156	187	181, 193
High ...	26	198	182, 213	47	203	193, 214

¹ Adjusted for age, body mass, cigarette smoking, myocardial infarction, diabetes.

NOTE: BP = blood pressure; CI = 95 percent confidence interval.

between cigarette smoking and cholesterol levels were observed among blacks, although there were too few heavy smokers (more than 1 pack per day) to examine this association with statistical precision.

High blood cholesterol levels have been observed among whites with hypertension (20), although this association may be most pronounced among younger men and older women (21). In Mount Vernon, there were little differences in cholesterol levels for whites, whereas black men who reported physician-diagnosed hypertension had cholesterol levels 10 mg per dl higher than those with normal blood pressure ($P > .10$). The levels for Hispanic women with hypertension were elevated by 16 mg per dl ($P < .10$). In east Baltimore, higher cholesterol levels were also found among hypertensive black men (15). Our findings should be interpreted cautiously, since the data on hypertension was obtained from self-reporting.

Persons with high cholesterol levels often have other CHD risk factors such as hypertension and cigarette smoking. Among black communities, increased surveillance and treatment of persons with hypertension and high levels of blood cholesterol through health promotion programs might be an effective means to reduce morbidity and mortality from CHD.

References

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