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Disparities in Cholesterol Screening: Falling Short of a National Health Objective

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Background. The objective of this study was to determine whether the Year 2000 national health objective for cholesterol screening was attained and to identify disparities in cholesterol screening across racial or ethnic and socioeconomic groups.

Methods. Using data from 149,692 persons interviewed by the 1999 Behavioral Risk Factor Surveillance System, we estimated the proportion of adults age ≥20 years who were screened for high blood cholesterol within the preceding 5 years.

Results. Overall, an estimated 70.8% of the U.S. population was screened for cholesterol, falling short of the Year 2000 objective of 75%. Screening prevalence was lowest at ages 20–44 years (58.2%), in contrast to ages 45–64 years (81.9%) and ≥65 years (87.1%). Screening prevalence was also low among Asian or Pacific Islanders (62.7%) and Hispanics (60.7%), particularly Hispanic men (55.3%). After multivariate adjustment, Asian Pacific Islanders were significantly less likely to be screened compared with white non-Hispanics (OR = 0.76, 95% CI 0.65, 0.89). The likelihood of screening decreased with decreasing income level ($P < 0.05$) and persons with health insurance were 1.6 times more likely to have been screened during the past 5 years than adults with no insurance ($P < 0.05$).

Conclusions. Significant disparities in cholesterol screening exist across age, gender, racial or ethnic, and socioeconomic groups in the United States. As we look to attain the objectives of Healthy People 2010, state and local health officials and policy makers should be aware of these disparities in order to design and target effective cholesterol screening programs and cardiovascular disease prevention programs to those most in need.

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INTRODUCTION

High blood cholesterol (HBC) is a major modifiable risk factor for heart disease. In 1985 the National Heart, Lung, and Blood Institute initiated the National Cholesterol Education Program to reduce the HBC prevalence in the United States [*1*]. One approach to reducing blood cholesterol levels in the general population is through increased awareness of HBC as a risk factor for heart disease among the public; screening is one method to heighten public awareness and reinforce educational messages concerning cholesterol [*2,3*]. The National Cholesterol Education Program recommends that all adults age ≥20 years be screened for HBC at least once every 5 years.

In the mid-1980s the percentage of the U.S. population that received cholesterol screening was quite low. In 1985, results from the Cholesterol Awareness Survey indicated that 35% of the U.S. public had been screened for HBC [*1*]. By 1988 the estimated proportion of adults age ≥20 years who were screened within the preceding 5 years was 51.2% [*4*]. In 1990, "Healthy People 2000" was released, with one of its national objectives being to increase to 75% by the Year 2000 the proportion of adults age ≥18 years who had had their blood cholesterol checked within the preceding 5 years [*5*]. In 1995, a midcourse progress report of "Healthy People 2000" noted that progress was being made with respect to lowering HBC. Indeed, data from the Third National Health and Nutrition Examination Survey showed a significant drop in the average cholesterol level between the late 1970s and 1980s and the early 1990s [*6*].

These general findings of progress in the control of cholesterol notwithstanding, studies from the early

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1990s noted disparities in cholesterol screening by socioeconomic status and race/ethnicity [7]. In 1998 the President's Initiative on Race moved to eliminate racial and ethnic disparities in health. In the present study we use data from the 1999 Behavioral Risk Factor Surveillance System (BRFSS) to examine progress made toward attaining the Year 2000 objective for cholesterol screening; in addition, we identify disparities in screening for HBC across age, gender, racial or ethnic, and socioeconomic groups.

METHODS

The BRFSS is a state-based surveillance system supported by the Centers for Disease Control and Prevention. A detailed description of the survey design and random sampling procedures is available elsewhere [8]. Briefly, the surveillance system collects data on the many behaviors and conditions that place adults (age ≥18 years) at risk for chronic disease including cardiovascular disease. Trained interviewers collect data on a monthly basis using an independent probability sample of households with telephones among the noninstitutionalized U.S. population. Multiple attempts are made to contact a household before substituting another household. After contacting a household, the interviewer randomly selects an adult age 18 years or older for the interview. In 1999, data were collected from 159,989 persons with a response rate of 68.4% [9].

In the 1999 survey, respondents were asked whether they had ever had their blood cholesterol checked and, if so, the time that had elapsed since they last had their cholesterol checked. Those who reported being screened within the preceding 5 years were classified as having been screened for HBC. Race or ethnicity was coded as white non-Hispanic, black non-Hispanic, other non-Hispanic, white Hispanic, black Hispanic, other Hispanic, Asian or Pacific Islander, and American Indian or Alaska Native.

For this analysis, data were analyzed for 149,692 (93.6% of total persons interviewed by BRFSS) persons age ≥20 years with complete information for age, race, and gender who responded to the cholesterol questions and resided in the 50 states, District of Columbia, or Puerto Rico in 1999. The data were weighted to account for the age, race, and gender distribution in each state. A Cochran–Mantel–Haenszel χ^2 test was used to compare differences in categorical variables across groups. Logistic regression was used to obtain odds ratios (ORs) and 95% confidence intervals (CIs). SUDAAN 7.0 (Research Triangle Institute, 1996) was used to account for the complex sampling design and to achieve accurate variance estimates. All statistical inferences were based on a significance level of $P \leq 0.05$.

RESULTS

Gender distributions within each of the racial or ethnic groups were similar (Table 1). A greater proportion of Hispanics were age <65 years compared with white non-Hispanics. Also, the proportion of adults with <12 years of education, no health insurance, and a household income <$15,000 was greater among Hispanics than the other racial or ethnic groups.

In 1999, an estimated 70.8% of the U.S. population age ≥20 years had been screened for HBC within the

TABLE 1

Demographic and Socioeconomic Characteristics by Racial or Ethnic Group—Behavioral Risk Factor Surveillance System, 1999

	WNH (N = 120,193)	BNH (N = 11,493)	ONH (N = 997)	WH (N = 7,714)	BH (N = 1,099)	OH (N = 3,599)	API (N = 2,531)	AIAN (N = 2,066)
Men (%)	47.8	43.7	52.3	47.5	51.3	54.2	55.0	53.8
Age, years (%)								
20–44	46.9	56.5	53.9	64.3	64.3	71.5	64.3	58.2
45–64	31.9	30.2	30.1	25.1	26.6	22.6	27.3	31.3
≥65	21.2	13.4	16.1	10.6	9.1	5.9	8.4	10.5
Education, years (%)								
<12	9.6	17.1	13.3	37.0	40.5	37.5	4.3	18.3
≥12	90.4	82.9	86.7	63.0	59.5	62.5	95.7	81.7
Health insurance (%)								
None	9.8	18.2	20.1	30.3	28.5	35.1	13.7	26.7
Any	90.2	81.8	79.9	69.7	71.5	64.9	86.3	73.3
Income (%)								
<$15,000	7.5	16.2	12.3	23.7	33.5	20.6	10.1	13.6
$15,000–24,999	14.3	22.3	21.6	23.2	25.1	25.2	18.6	23.5
$25,000–49,999	31.7	31.5	28.6	23.3	16.9	24.6	29.1	32.2
≥$50,000	31.9	15.5	25.1	14.1	6.0	11.3	37.0	19.0
Not available	14.6	14.5	12.5	15.7	18.5	18.4	11.7	12.5

Note. WNH, white non-Hispanic; BNH, black non-Hispanic; ONH, other non-Hispanic; WH, white Hispanic; BH, black Hispanic; OH, other Hispanic; API, Asian or Pacific Islander; AIAN, American Indian or Alaska Native.

preceding 5 years. As shown in Table 2, women were significantly more likely to be screened than men (73.1% vs 68.4%). Screening prevalence was lowest among Hispanics (white Hispanic, 62.1%; black Hispanic, 61.3%; other Hispanic, 56.6%) and highest among white non-Hispanics (73.1%). In fact, the screening prevalence among Hispanic men (55.3%) was 34% lower than that of white non-Hispanic men (74.7%). However, after adjustment for age, education, health insurance, and income, none of the Hispanic groups had a significantly lower prevalence of screening than the referent group, white non-Hispanics. In contrast, Asian Pacific Islanders were significantly less likely to have been screened compared with white non-Hispanics after adjustment for these sociodemographic characteristics. Overall by age, screening prevalence was lowest among those ages 20–44 years and highest among those age ≥65 years.

Differences in cholesterol screening prevalence were also observed across three socioeconomic measures: education, health insurance, and annual household income (Table 2). After multivariate adjustment, persons with ≥12 years of education were 1.5 times (95% CI 1.39, 1.61) as likely to have been screened for HBC as those with <12 years of education. Persons who reported no health insurance had a significantly lower screening prevalence than those who reported coverage (45.0% vs 75.0%). Cholesterol screening also increased significantly with increasing income level; after multivariate adjustment, persons with income ≥$50,000 were more likely to have been screened than those with income <$15,000 (OR = 1.85, 95% CI 1.73, 1.98).

Within racial or ethnic groups, screening prevalence for HBC was lower among those ages 20–44 years and with lower income (Table 3). Among all persons with incomes <$25,000, Hispanics ages 20–44 years had a lower screening prevalence than white non-Hispanics and black non-Hispanics of the same age group. In all three ethnic groups, young persons ages 20–44 years with incomes <$15,000 had almost half the screening prevalence of older adults ages ≥65 with incomes of $50,000 or more (white non-Hispanic, 48% vs 93%; black non-Hispanic, 46% vs 93%; and Hispanic, 37% vs 81%, respectively). Among those ages ≥65 years, for both white non-Hispanics and Hispanics, the percentage of persons screened for HBC was >80% across all income levels; among black non-Hispanics in this age

TABLE 2

Percentage of Persons Screened for High Blood Cholesterol within the Preceding 5 Years in the United States by Population Characteristics—Behavioral Risk Factor Surveillance System, 1999

	N interviewed	% Screened for HBC[a]	OR[b] (95% CI)
Gender			
Men	61,052	68.4	1.00 (referent)
Women	88,640	73.1	1.23 (1.19, 1.28)
Race/ethnicity			
White, non-Hispanic	120,193	73.1	1.00
Black, non-Hispanic	11,493	69.9	1.20 (1.11, 1.29)
White, Hispanic	7,714	62.1	1.12 (1.02, 1.23)
Black, Hispanic	1,099	61.3	1.15 (0.90, 1.47)
Other, Hispanic	3,599	56.6	1.02 (0.89, 1.18)
Asian or Pacific Islander	2,531	62.7	0.76 (0.65, 0.89)
American Indian or Alaska Native	2,066	65.2	1.05 (0.86, 1.29)
Other, non-Hispanic	997	67.8	1.00 (0.79, 1.27)
Age, years			
20–44	72,320	58.2	1.00
45–64	47,874	81.9	3.16 (2.99, 3.33)
≥65	29,498	87.1	5.12 (4.76, 5.51)
Education, years			
<12	19,078	62.5	1.00
≥12	130,614	72.2	1.50 (1.39, 1.61)
Health insurance			
None	18,282	45.0	1.00
Any	131,206	75.0	2.36 (2.21, 2.52)
Income			
<$15,000	17,332	61.3	1.00
$15,000–$24,999	25,871	64.6	0.99 (0.92, 1.06)
$25,000–$49,999	46,560	69.5	1.19 (1.12, 1.26)
≥$50,000	37,832	78.8	1.85 (1.73, 1.98)

[a] Weighted percentage.
[b] Odds ratios (OR) adjusted for all variables shown.

TABLE 3

Percentage[a] of Persons Screened for High Blood Cholesterol within the Preceding 5 Years by Income According to Race/Ethnicity and Age—Behavioral Risk Factor Surveillance System, 1999

	White, non-Hispanic			Black, non-Hispanic			Hispanic		
Income	20–44 years N^b (%[a])	45–64 years N (%)	≥65 years N (%)	20–44 years N (%)	45–64 years N (%)	≥65 years N (%)	20–44 years N (%)	45–64 years N (%)	≥65 years N (%)
<$15,000	3,746 (47.9)	3,233 (70.0)	4,669 (81.5)	897 (45.6)	596 (76.4)	451 (76.5)	1,466 (37.3)	862 (66.7)	682 (87.6)
$15,000–$24,999	8,163 (47.9)	4,960 (77.2)	6,129 (87.3)	1,673 (56.9)	697 (74.6)	377 (89.3)	1,882 (45.8)	662 (71.7)	275 (84.5)
$25,000–$49,999	20,474 (56.9)	12,314 (80.8)	5,737 (90.1)	2,274 (64.5)	967 (83.4)	196 (86.7)	2,069 (60.3)	702 (82.5)	158 (86.3)
≥$50,000	17,138 (69.4)	13,811 (88.1)	2,361 (92.9)	995 (77.3)	557 (90.0)	49 (93.1)	1,021 (73.3)	462 (87.6)	48 (80.5)

[a] Weighted percentage screened for HBC.
[b] Number interviewed.

range it was >80% in the top three income groups (≥$15,000).

DISCUSSION

Although significant progress has been made since the mid-1980s in screening the U.S. population for cholesterol [*10*], our report suggests that as a whole the country did not attain the Year 2000 objective of 75%; however, certain groups, including those ages 65 years and older and those with health insurance, did meet the Year 2000 objective. Additionally, we identified significant disparities in cholesterol screening prevalence between the young and the old, men and women, and groups with low and with high socioeconomic status and across racial or ethnic groups. These patterns are consistent with patterns of cardiovascular disease mortality and morbidity among minority populations and groups with low socioeconomic status. For example, mortality rates for cardiovascular disease in the National Longitudinal Mortality Study decreased steadily with increasing income and education among both men and women ages 25–64 years after adjustment for age and race [*11*]. In addition, in the Evans County study, black men overall and white men of low socioeconomic status had poorer survival from ischemic heart disease than white men of higher socioeconomic status [*12*].

Substantial differences in screening prevalence were observed between the young and the old. This may be partly due to conflicting recommendations within the medical community regarding cholesterol screening. While the National Cholesterol Education Program, "Healthy People 2000," and "Healthy People 2010" health objectives recommend the screening of all adults age ≥20 once every 5 years, the American College of Physicians [*13*] and the U.S. Preventive Services Task Force [*14*] recommend screening only for men ages 35–65 years and women ages 45–65 years. These two latter health agencies recommend screening among younger adults only when a family history or physical examination suggests a familial lipoprotein disorder or when at least two other risk factors that may increase the risk for heart disease are present. Due to the conflicting recommendations of national health agencies, the analyses were repeated, restricting the sample to men ages 35–65 years and women ages 45–65 years. While the percentages of persons screened were higher (83% for men and 89% for women), the trends in screening were similar to those observed for all adults. The proportion of women screened was greater than that for men and differences across racial or ethnic and income groups persisted. In addition, there were few differences in the groups that attained the Year 2000 national health objective. Since the release of American College of Physicians and U.S. Preventive Services guidelines, recent data [*15*] suggest that screening young adults may be prudent. Cholesterol measurement among young adults is important for reducing the risk of future heart disease [*3*]. It is evident that the atherogenic process begins in early childhood and progresses between the ages of 20 and 45 [*16*]. In addition, the Johns Hopkins Precursors Study has demonstrated that serum cholesterol levels of young adults predict mortality from both cardiovascular disease and all causes 30–40 years after baseline measurement, independent of other cardiovascular disease risk factors [*17*]. Thus, the observed low prevalence of cholesterol screening among persons age <45 years is of particular concern.

One of the advantages of using the BRFSS includes the large sample size, approximately 160,000 persons per year. This enables the examination of screening rates across groups not previously examined, including Asian Pacific Islanders, American Indian Alaska Natives, and black Hispanics. Indeed the present analysis noted substantial differences in screening prevalence by race and ethnicity; both Hispanics and Asian Pacific Islanders had a substantially lower prevalence of screening than their white non-Hispanic counterparts. However, with the adjustment for differences in age, gender, socioeconomic status, and health insurance these differences disappeared for Hispanics, suggesting

that lower socioeconomic status and lack of health insurance explain the low prevalence of screening among Hispanic Americans. The findings among Asian Pacific Islanders suggest that other factors may account for lower screening prevalence among this segment of the population. In any event, additional efforts are needed to address the low screening prevalence among minority groups, particularly racial and ethnic minorities of low socioeconomic status.

Recently published data from the BRFSS indicate substantial variation in cholesterol screening by state [*18*]. While the majority of states experienced increases in screening during the 1990s, seven states experienced a decline in cholesterol screening. Additional studies should examine whether the states experiencing declines in screening are also the states with substantial Asian Pacific Islander and Hispanic populations.

The results of this analysis are subject to at least two limitations. First, these data are self-reported. Conceivably, some participants were screened for elevated cholesterol but did not know they had been, and thus we may have underestimated the prevalence of screening for HBC [*19*]. Reliability and validity estimates for several BRFSS self-report measures have been described [*19–21*]. Second, the BRFSS is a telephone-based survey. Persons of low socioeconomic status, who are less likely to have been screened, are also less likely to have a telephone and thus may not be included. Therefore, we may be overestimating the prevalence of screening for HBC, and we may also be underestimating the differences in screening by socioeconomic status.

In conclusion, the overall prevalence of cholesterol screening in the United States in 1999 was slightly less than the Year 2000 national health objective of 75%. The national objective was attained in some subpopulations, including persons ages 65 years and older and those with health insurance and with income ≥$50,000; however, the proportion screened did not reach the objective for many groups, including Asian Pacific Islanders. Our results provide evidence of the need to focus cholesterol screening programs on minority populations and on those with lower socioeconomic status. In particular, programs that target young adults, men, persons with low incomes, and those with no health insurance coverage are needed. State and local public health officials, health insurers, and other policy makers need to recognize that these groups may be underscreened in their own communities and design effective, targeted programs that will help eliminate racial and ethnic disparities in cardiovascular disease by the Year 2010 while attaining the Year 2010 objective for cholesterol screening of 80%.

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