Barriers to Cholesterol Testing in a Rural Community

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Background. The purpose of this study was to investigate the factors that determine whether residents in a rural community have their cholesterol tested.

Methods. A population-based survey was conducted in 1987 as part of a community-oriented primary care project that sought to define and address the causes of and burden caused by increased cardiovascular disease in an economically depressed agricultural region of New York. All of the residents living in two towns in the region who were over 16 years of age and who lived in their homes year-round were surveyed. Demographic information was obtained from the participants, as well as information about previous cholesterol testing and their cardiovascular-risk knowledge and behaviors. The serum cholesterol of each participant was measured.

Results. Of the 557 households contacted, 508 (91%) households participated. A total of 1063 persons over 16 years of age were surveyed, and 973 (92%) were screened for cholesterol. Overall, 24% reported prior cholesterol testing. Logistic regression analysis identified several independent factors that were associated with a reduced likelihood of ever having had a cholesterol test. These factors included: (1) age under 45 years, (2) having less than 12 years of education, (3) having an income of less than $10,000, (4) not having health insurance, (5) not having visited a physician within the previous year, and (6) practicing three or more high-risk cardiovascular behaviors. The participants' cardiovascular knowledge made no independent contribution to having had their cholesterol levels tested.

Conclusions. Many of the factors that prevent cholesterol testing are socially determined. The results of this study suggest that financial and social barriers are two of the major obstacles to residents of rural communities having their cholesterol levels tested.

Key words. Cholesterol; primary prevention; socioeconomic factors. *J Fam Pract 1991; 32:614-618.*

A high serum cholesterol level is a major modifiable cardiovascular risk factor. Nevertheless, only 46% of those questioned in 1986 in a national telephone survey sponsored by the National Heart, Lung, and Blood Institute reported having had their cholesterol level checked, and only 7% knew their level.[1] While the report noted that screening had increased from 35% of the population as determined by a 1983 survey, these numbers are inadequate because clinically significant hypercholesterolemia (over 240 mg/dL) affects 25% of the population.[2] To implement an effective public health strategy that would lower the cholesterol levels of people in the United States, a better understanding of the barriers to widespread cholesterol testing is needed.

Few population studies have addressed factors affecting screening for hypercholesterolemia. In the study reported above,[1] increased likelihood of prior cholesterol testing was associated with increased knowledge about the role of cholesterol in cardiovascular disease. Between 1983 and 1986, the percentage of people in the United States who believed cholesterol was an important health concern increased from 64% to 72%, as did the percentage of people who changed their diet in response to this concern (14% to 23%). In a Minneapolis population,[3] race was found to be a predictor of knowledge of elevated cholesterol; black men were less likely than white men to know whether their cholesterol level was elevated.

Several community-based studies have identified various factors that are associated with the health behaviors of their residents and whether they receive preventive care. In the 1987 National Health Interview survey,[4] women were less likely than men to have received screening for colon cancer, and blacks were less likely than whites to have received any cancer screening test. Increasing age is associated both with less screening for breast and cervical cancer[5,6] and with fewer preventive health care behaviors.[6] The poor receive less preventive care,[7,8]

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as do underinsured and uninsured persons.[5,9] In England, Calnan[6] also found that lower social class (measured by occupation) was associated with less preventive health care and behaviors; however, the probability that respondents who performed one preventive health care behavior would perform another was low. He suggested[6] that there was a need to develop a model of health care behavior that accommodated both general structural factors and specific health beliefs.

Because of a paucity of relevant community-based studies, antecedents of cholesterol testing in a rural area were investigated. Following Calnan's suggestions,[6] both general structural factors and factors related specifically to cardiovascular risk were examined. Rural areas are of special interest because people living there have increased levels of cardiovascular risk.[10] Rural populations also have greater numbers of underinsured and uninsured persons[11] and make less use of Medicaid,[12] which further compromises access to care. Additionally, reduced access to health education and medical care probably results in less cardiovascular awareness and more risk.

Methods

This population-based study was conducted as part of a community-oriented primary care (COPC) project that sought to define and address the increased burden of cardiovascular death experienced in an economically depressed agricultural region of central New York State. In 1980, 20% of the population of Delaware County, a sparsely populated dairy farming region, lived at 125% or less of the poverty level and 40% lived at 200% or less. Between 1984 and 1987, 20% of county dairy farms closed. The entire population of adults aged 16 years or older in two demographically similar and representative towns in central Delaware county (Meredith and Kortright) were surveyed and screened on a house-to-house basis from July through November of 1987. The towns were selected for the COPC project because of their location within the geographic service area of the hospital that sponsored the project. The survey was conducted by three community health workers (a nurse and two medical students) who were trained in survey administration and blood pressure and cholesterol measurement. A pilot survey and screening for the project was conducted in an adjacent town by these health care workers.

All residents aged 16 years or older who lived in the town year-round were included in the study. Households were contacted either by telephone or by leaflets. The program was explained by the health care worker, and an appointment was made by telephone or an approximate time of revisit was indicated in the leaflet. Homes where all eligible subjects were not initially available were returned to at times convenient for those initially missed. Households where no one was at home at the time of the first visit were returned to three times before being discounted. Household identification was accomplished by enumerating households on town planning maps.

In addition to obtaining cholesterol and blood pressure measurements, health workers elicited survey information including standard demographics (age, sex, marital status, family size, occupation, employment status, insurance status, household income, and level of education), height and weight, the number of health care provider visits within the previous year, and whether the participant had ever had his or her cholesterol tested. Questions were asked about habits relevant to cardiovascular health including the participant's history of tobacco use, dietary intake of salt, eggs, and red meat (as an index of cholesterol consumption), and level of leisure exercise. Knowledge about cardiovascular risk factors was assessed by asking respondents to list the cardiovascular risk factors known to them.

Blood samples for cholesterol testing were obtained in the participants' homes and were drawn by finger stick and collected in capillary tubes. Samples were refrigerated immediately and analyzed within 24 hours using the Kodak Ektachem DT 60 analyzer (Eastman Kodak Company, Rochester, NY). Blood pressure was measured (two readings, 5 minutes apart) using a mercury sphygmomanometer at the end of the interview, by which time the subject had been sitting for at least 30 minutes.

To facilitate clinical interpretation, the socioeconomic and behavioral characteristics were dichotomized for this report. Living in a state of poverty was defined as having a family income of less than $10,000, or for households with five or more members, having a family income of less than $20,000. A high cholesterol diet was defined as eating more than two eggs and two meals that included red meat each week. Questions about the amount of eggs and red meat consumed were used as a brief indicator of cholesterol consumption, based on the widely publicized recommendations of the American Heart Association's Healthy Heart Program. A "salty" diet was defined as use of a saltshaker at meals "often" or "always." Persons who performed no vigorous exercise (ie, exercise to the point of shortness of breath, for example, running, swimming, and or playing basketball) during leisure time were characterized as having little leisure exercise. Obesity was defined as a body mass index (weight [kg]/height [cm^2]) greater than 26.

People who reported practicing at least three of the four cardiovascular risk behaviors (smoking, low leisure activity, salty diet, and high cholesterol diet) were identified as having high cardiovascular risk behavior. People

who could name fewer than three cardiovascular risk factors were considered to have low cardiovascular risk-factor knowledge. Participants were said to have no insurance if they had to pay for provider visits mostly or totally out of their pockets.

The relation between history of cholesterol testing and other variables was examined using chi-square tests or *t* tests. Logistic regression was used to examine the adjusted independent effect of variables of interest (age, sex, insurance, number of visits to a provider, level of education, income, cholesterol level, cardiovascular risk factor knowledge, and cardiovascular risk behaviors) on history of cholesterol testing.

Results

Of the 557 households identified in the survey, 508 (91%) participated. There were 1063 persons over the age of 16 years living in those households, of whom 1036 (97%) completed the questionnaire and 973 (92%) were screened for high serum cholesterol levels. For the whole population, the mean age was 47 years (standard deviation [SD] = 18.2 years) and the mean cholesterol level was 5.1 mmol/L (199 mg/dL) (SD = 41).

A history of cholesterol testing was reported by 251 people (23.6%). Those who reported any prior testing were older (mean age 55 years vs 45 years, *t* test, $P < .0001$) and had higher cholesterol levels (5.5 mmol/L [213 mg/dL vs 195], *t* test, $P < .0001$).

Table 1 shows the relation between a history of having previously had a cholesterol test and the other categorical variables of interest. The prevalence of cholesterol testing was lower in those under the age of 45 years. In this youngest group (16 to 45 years of age) 14% of those who had visited a provider in the previous year reported having had their cholesterol tested. Poverty, lack of insurance, not visiting a provider within the previous year, eating a high cholesterol or salty diet, not being obese, and having a lower cholesterol were all associated with fewer reported cholesterol tests in this study.

Table 2 summarizes the results of the logistic regression analysis of the effects of risk factors on a patient's history of cholesterol testing. Age under 45 years, cholesterol under 6.2 mmol/L (240 mg/dL), female sex, poverty, less than 12 years of education, lack of insurance, not visiting a provider within the previous year, and having three or more high-risk cardiovascular behaviors all made statistically significant independent contributions to predicting a participant having had fewer tests for cholesterol. When the "visits to a provider" variable was excluded from the analysis (Table 2), the effect of no insurance increased, and female sex no longer made a statistically significant contribution. The contribution of other variables did not change significantly.

Table 1. Prevalence of Factors Examined in Study and Their Relation to History of Any Cholesterol Testing

Factor	Number (and percent of total with factor present)	Number (and percent of those with factor present) with History of Any Cholesterol Testing	P*
Age (y)			
16–45	522 (49.2)	69 (14)	—
46–64	316 (29.7)	111 (35)	—
≥65	224 (21)	71 (32)	<.0001
Female sex	536 (50.4)	121 (23)	.333
<12 Years of education	271 (25.5)	57 (22)	.247
Poverty	322 (31)	53 (17)	<.0001
No insurance	453 (43.6)	75 (17)	<.0001
No provider visits	290 (27.9)	29 (10)	<.0001
High-risk behaviors			
High cholesterol diet	342 (32.9)	67 (20)	.023
Salty diet	464 (45.5)	85 (18)	<.0001
Smoker	272 (26.1)	57 (21)	.158
No vigorous exercise	896 (86.5)	211 (24)	.254
≥3 high risk behaviors	305 (28.7)	49 (16)	<.0001
Obese	505 (47.5)	142 (28)	.003
Cholesterol			
≥240	147 (15.1)	55 (37)	—
200–239	308 (31.7)	89 (29)	—
<200	518 (53.2)	93 (18)	.0001
Low cardiovascular risk knowledge	218 (20.9)	58 (27)	.366
Any cholesterol testing	251 (24.2)		

**P denotes probability that the proportion of those with history of any cholesterol testing in those with factor present was different from that expected (24.2%). Chi square, degrees of freedom = 1; except for age group and cholesterol level, degrees of freedom = 2.*

NOTE: Percentages are not always based on the same totals because not all respondents answered all questions.

Table 2. Logistic Regression of Factors Affecting History of Any Cholesterol Testing (N = 970)

Variable	All Variables Included Adjusted Odds Ratio (95% CI)	Provider Visit Excluded Adjusted Odds Ratio (95% CI)
Age <45 years	0.60 (0.50–0.72)	0.57 (0.48–0.69)
Female sex	0.84 (0.71–0.98)	0.88 (0.76–1.04)
<12 years of education	0.77 (0.63–0.93)	0.79 (0.65–0.95)
Poverty	0.83 (0.68–0.99)	0.83 (0.68–0.99)
No insurance	0.82 (0.69–0.97)	0.77 (0.65–0.91)
No provider visit	0.57 (0.45–0.71)	— —
≥3 High risk behaviors	0.72 (0.59–0.87)	0.72 (0.59–0.87)
Not obese	0.90 (0.77–1.07)	0.90 (0.77–1.05)
Cholesterol <240	0.79 (0.64–0.97)	0.79 (0.64–0.97)
Low cardiovascular risk knowledge	1.11 (0.92–1.35)	1.08 (0.90 1.31)

CI denotes confidence interval.

Discussion

It is well documented that the poor and the less educated,[13–19] as well as those who lack insurance,[20,21] are at higher risk for cardiovascular disease. In this population, the socioeconomically disadvantaged were least likely to have their cholesterol tested. These results are congruent with the phenomenon of "reverse targeting" reported by Woolhandler and Himmelstein[9] for other preventive measures. They found that those at highest risk for disease were least likely to be screened. The low cholesterol testing prevalence of 24%, compared with the 46% found in a national survey in 1986,[1] reflects the relative disadvantage of the community as a whole. The behavioral risk-factor surveillance for 1987[22] found that in New York State as a whole, only 33% reported ever having had their cholesterol checked.

These results suggest that lack of insurance reduces cholesterol testing directly as well as indirectly, since lack of insurance also reduces office visits.[12,20,23] Thus, when visits to a provider were excluded from the analysis, the effect of no insurance was increased. Also, the measure of no insurance reflects only whether people pay for their provider visits. Since cholesterol testing is usually an additional charge, the financial barrier to testing is probably underrepresented in this report. Patients and providers may refrain from preventive care not covered by insurance.[24]

The finding that those who had fewer than three cardiovascular risk behaviors were also more likely to have had a cholesterol test is not surprising. It suggests that people with health beliefs that motivate them to reduce their general level of cardiovascular risk will also seek to measure their level of jeopardy. While the origins of health beliefs are multifactorial, studies on preventive behavior[8] and access to care[25,26] suggest that health beliefs are largely a function of socioeconomic status. Those who are educationally and financially less privileged are less likely to have healthful beliefs and behavior. For example, the educational gradient in cigarette smoking in the United States is increasing.[27]

The absence of the effect of cardiovascular risk-factor knowledge on testing suggests that the association of increased education with increased cholesterol measurement reflects a socioeconomic rather than a knowledge effect. In other words, less education is a measure of social class disadvantage that results in direct and indirect barriers to preventive care. In this study the presumed effects of education on knowledge of cardiovascular risk factors had no measurable effect on cholesterol testing. It is also possible that the question on cardiovascular knowledge that was designed for this study did not accurately assess cardiovascular knowledge.

The low prevalence of cholesterol testing in those under 45 years of age is of concern because preventive efforts started earlier than age 45 years are likely to be more effective than those started later.[28] This low prevalence was not confounded by whether the respondent had visited a provider or by the subject's cholesterol level. This suggests that health care professionals also assign a lower priority to cholesterol testing in those under the age of 45 years. The relation between age and cholesterol screening contrasts with the inverse relation between age and cervical and breast cancer screening.[5,6] Thus, age is not an immutable barrier, and cholesterol screening in younger groups could be effectively promoted.

A number of biases may have affected the results. The use of dichotomies (to facilitate interpretation and the use of risk ratios) may have led to misclassification bias. Similar results were obtained, however, when more complete categorical or continuous versions of the variables were used. There was no verification of patient responses to questionnaire items such as smoking status or provider visits. The definition of high cholesterol consumption used in this study, while lacking precision, serves as an indicator of the extent to which people had responded to recommendations by the American Heart Association on two publicized sources of cholesterol and animal fat. The relation of reported cardiovascular risk behaviors and provider visits to reported cholesterol testing suggests that the measures have some validity.

Recall bias may operate selectively for different groups. Thus, the poor and uninsured may selectively underreport cholesterol testing. Adjustment for factors that might mediate this, such as cardiovascular risk-factor knowledge and education, makes this less likely. Of interest is our finding that those with elevated cholesterol levels at the time of screening were more likely to report prior cholesterol testing. It is possible that people are correctly selected either by themselves or by their physicians for cholesterol testing. More than likely, however, this is recall bias resulting from the stimulus of a prior high cholesterol measurement.

These results were obtained in a rural population undergoing significant economic hardship and change, and during a period of widespread education about cholesterol as a risk factor for cardiovascular disease. Over the following year (1988), New York as a whole reported that cholesterol testing increased by 17%, to 50% statewide.[23] Thus, the prevalence figures reported here may not be generalizable. The barriers to cholesterol testing found in this study are similar to those reported for other preventive procedures,[5–9] however, which suggests that these findings are generalizable.

Many of the factors that were identified as decreasing the likelihood of cholesterol testing are seen in per-

sons whose access to preventive care is limited by social factors. This is a population already known to be at increased risk of cardiovascular disease.[13–19] The lack of access to preventive efforts such as screening and treatment of hyperlipidemia found in groups already at higher risk is likely to widen the social gradients of cardiovascular morbidity and mortality. Since this problem may be viewed as a socially, rather than an individually, mediated one, it is appropriate that efforts to address it should be focused on systemic solutions that assure access to preventive care.

The Public Health Service in its recently released objectives for the nation's health in the year 2000[29] calls for a reduction in US coronary heart disease deaths by 35% over the next 10 years. More specifically, it calls for 75% of adults to have had their blood cholesterol checked within the 5 preceding years, and a doubling of the number of persons with high cholesterol who are aware of their condition. Further, the objectives include "reducing health disparities among Americans" and "achieving access to preventive services for all Americans." To meet these goals and reduce the heavy burden of cardiovascular disease in this country, removal of financial barriers to preventive services for all segments of the population will be an important early requirement.

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