

Cholesterol Screening and Dietary Change: Results From a Norwegian Campaign

Knut-Inge Klepp, PhD, MPH; Leif Edvard Aarø, Dr. Phil.;
Stig Berge Matthiesen, C. Psych.; Rune J. Ulvik, Dr. Med.

ABSTRACT: This study was designed to investigate factors predictive of dietary changes among participants in a cholesterol screening program. A questionnaire was mailed to all participants 1-2 weeks after the initial cholesterol screening and then again one year later. The participation rate of each survey exceeded 90%. Demographic variables and

psychosocial factors believed to be predictive of eating behavior changes were assessed at baseline. The results demonstrated that subjects with the highest cholesterol levels were strongly motivated to change their dietary habits and that one year later, these participants reported significantly more dietary changes than did participants with lower cholesterol levels.

Cardiovascular disease is the leading cause of death in Norway and in most other industrialized countries. Epidemiological studies provide strong evidence that increasing blood cholesterol levels causes increased risk for coronary heart disease and that lowering elevated cholesterol levels will reduce the risk of heart disease.¹ Reducing the dietary intake of saturated fat while increasing consumption of complex carbohydrates can be an effective way of lowering elevated cholesterol levels.² As a result of such studies,

cholesterol screening programs and nutrition education campaigns have appeared in a number of countries, including Norway, over the past few years.

Cholesterol testing with brief dietary counselling has the potential to reach large audiences, to promote improved nutrition, and to reduce cardiovascular risk at the population level. So far, a few studies have demonstrated some positive effects of such an approach, reporting a significant lower blood cholesterol level among participants when compared to unexposed control groups.³⁻⁵ We do not know much, however, about factors predictive of successful dietary changes following such large-scale cholesterol screening programs.

In 1988 a national cholesterol screening program and nutrition education campaign were initiated by the National Norwegian Public Health Association. The goal was to educate health personnel regarding cholesterol, diet, and heart disease and to provide the general public with an opportunity to have their cholesterol measured and to receive dietary counselling by trained health personnel. As part of this national effort, the general public of the city of Bergen was

Knut-Inge Klepp, PhD is a Professor, Center for Health Promotion Research, University of Bergen, Østteingate 3, 5007 Bergen, Norway. Leif Edvard Aarø, Dr. Phil. is a Professor, Center for Health Promotion Research, University of Bergen, Østteingate 3, 5007 Bergen, Norway. Stig Berge Matthiesen, C. Psych. is an Associate Professor, Center for Health Promotion Research, University of Bergen, Østteingate 3, 5007 Bergen, Norway. Rune J. Ulvik, Dr. Med. is a Professor, Laboratory for Clinical Biochemistry, Haukeland Hospital, 5021 Bergen, Norway.

Address correspondence to Knut-Inge Klepp, PhD, Division of Epidemiology, University of Minnesota, Sutte 300, 1300 South Second St, Minneapolis, MN 55454.

A year after the initial screening, participants received a second questionnaire, assessing dietary changes during the past year.

invited for a cholesterol screening one Saturday in October 1988. Participants received the results of their cholesterol screenings and were immediately given nutritional information by trained health personnel. This nutrition counselling lasted only a few minutes and consisted mainly of advice on how to reduce the overall fat content in the diet. These dietary recommendations were consistent with guidelines from the Norwegian National Nutrition Council, recommending increased consumption of fish (particularly fish with a high fat content), whole-wheat flour and cereals, potatoes, fruit and vegetables, skimmed and low-fat milk, and lean meat.⁶ Pamphlets presenting the nutritional recommendations and explaining how to interpret cholesterol-test results were handed out. Participants also had the opportunity to ask questions of the trained health personnel.

In order to evaluate the impact of this local event, a short questionnaire was mailed to all 354 participants 1-2 weeks after the initial cholesterol screening. Results from this survey have previously been published elsewhere.⁷ In summary, it was found that the mean cholesterol level in this group of self-selected participants was 259 mg/dl with one of five participants having a cholesterol level of 310 mg/dl or higher. As many as 79% of the participants reported perceiving the campaign as informative and beneficial. At baseline participants with an educational background equivalent to nine or less years of compulsory school reported more often than did subjects with higher levels of education that they perceived the campaign to be informative and beneficial. As a result of the campaign, a majority of the participants reported being more motivated to make dietary changes, and those with the highest cholesterol levels were most likely to report planned changes in their

diet. In terms of negative outcomes, 6% reported an immediate reaction, when told of his or her cholesterol level, as one of fear. Those feeling most alarmed and those with the highest levels of cholesterol stated more often that they planned to change their diet, and these participants were as positive towards the campaign as were the other participants.⁷

A year after the initial screening, participants received a second questionnaire, assessing dietary changes during the past year. This paper presents the results from this one-year follow-up study. In particular, baseline demographic and psychosocial factors predictive of future eating behavior changes are presented.

METHODS

Subjects participating in the initial cholesterol screening in 1988 were informed about the event through local mass media. Approximately 450 people attended the event, and of these, 354 subjects had their cholesterol measured (done on a first come, first served basis). The baseline survey was mailed home to each of the subjects who had cholesterol measured. Of these, 336 subjects (94.9%) completed and returned the questionnaire. A year later, in October 1989, a short questionnaire was again mailed to the 354 subjects who had initially had their cholesterol measured. This time, as many as 328 subjects participated (92.7%), and of these, 318 had also participated in the baseline survey. Thus, the cohort sample consisted of 89.9% (N=318) of the total eligible population.

The baseline questionnaire consisted of a number of questions assessing factors believed to be predictive of future eating behavior changes. The design of these questions was guided by the theoretical frameworks provided by the Health Belief Model⁸ and Social Cognitive Theory¹⁰ and included the following constructs:

1. Perceived risk: One question regarding whether or not subjects perceived their own cholesterol levels to be high compared to those of other people their own age (1=very low level; 5=very high level);
2. Perceived susceptibility for heart disease: One question concerning how likely it was for them, if continuing their current life-style, to have premature heart disease (1=not likely at all; 3=very likely);
3. Outcome expectations of dietary

TABLE 1
Range, Sample Size, Mean Values/Percent,
Standard Deviation (S.D.), and Cronbach's Alpha Statistics
for Predictor Variables Collected in 1988

	Range	N	Mean/%	S.D.	Alpha
Gender (% males)		318	52.5		
Marital status (% married)		314	80.9		
Education (% college)		313	31.0		
Smoking (% daily smokers)		318	18.2		
Age	13-78	315	51.4	13.6	
Perceived risk	1-5	275	2.9	1.0	
Perceived susceptibility	1-3	291	1.6	.6	
Outcome expectations	1-7	304	5.5	1.1	.69
Value of risk reduction	1-7	306	5.8	1.4	.55
Motivation for changing diet	1-5	318	3.7	1.4	.73
Barriers to dietary change	1-10	303	3.9	2.0	.55
Self-efficacy	1-7	310	4.7	1.7	.63
Social support	1-3	316	2.2	.6	
Cholesterol level (mmol/l)	2.9-11.4	318	6.7	1.6	

changes: Two questions assessing perceived likelihood of reduced cholesterol level and reduced risk for heart disease resulting from a reduced dietary fat intake (each question ranging from 1=not likely at all to 4=most definite);

4. Value of heart disease risk reduction: Two questions assessing the importance of reducing one's cholesterol level or one's risk for heart disease (each question ranging from 1=not important to 4=very important);
5. Motivation for dietary changes: Two questions regarding subject's motivation to adopt a healthier diet (each question ranging from 1=disagree to 3=agree);
6. Perceived barriers to changing diet: Three questions regarding taste, cost, and preparation time as potential barriers to healthy eating (each question ranging from 1=not at all to 4=to a large degree);
7. Self-efficacy: Three questions assessing the degree to which a subject felt confident in his or her abilities to change his or her own diet (particularly reducing the intake of dietary fat) (each question ranging from 1=disagree to 3=agree);
8. Social support: One question about the frequency with which the subject had discussed his or her cholesterol level and his or her reactions with others (1=no one; 3=several people).

In addition to these theoretically derived factors, demographic variables including gender, age, educational level, and marital status were collected through the baseline questionnaire, as was smoking status. Serum cholesterol levels were obtained directly from the test results. The range of all these predictor variables collected in 1988, their mean values, standard deviation, sample size, and Cronbach's alpha statistics for the scales are presented in Table 1.

At baseline, serum cholesterol levels were obtained from testing fingerprick capillary blood in one of three dry-chemistry Reflotron instruments from Boehringer Mannheim, Germany. Prior to testing, the internal consistency between these Reflotron instruments had been tested for cholesterol levels in the range from 108 to 410 mg/dl. The internal consistency was found to be satisfactory. Furthermore, an acceptable accuracy of this method was confirmed by testing sera with a defined cholesterol content in the range of 124-278 mg/dl obtained from the National Bureau of Standards, London; from the Nordic Reference Committee's quality program, Copenhagen; and from the Norwegian Quality Control Program, Oslo.

The dependent measure, self-reported dietary changes, was obtained in 1989 by asking subjects whether, during the past year, they had begun eating more or less of 13 frequently consumed food items particu-

TABLE 2
Gender Differences and Pearson's Correlations Coefficients (PC)
Between the Predictor Variables Collected
in 1988 and the 1989 Dietary Change Score

	Males		Females	
	Mean	PC	Mean	PC
Marital status	1.8	.07	1.8	.11
Education	1.6	.01	1.5	.06
Smoking	1.4	-.02	1.5	-.04
Age	3.2	.08	3.1	.03
Perceived risk	2.9	.27 **	3.0	.37 **
Perceived susceptibility of CVD	1.6	.06	1.6	.05
Outcome expectations	5.4	.05	5.6	.04
Value of risk reduction ²	5.6	.31 **	6.0	.24 *
Motivation for changing diet	3.7	.25 **	3.8	.37 **
Barriers to dietary change ¹	3.6	.06	4.1	.21 *
Self-efficacy	4.6	.22 *	4.8	.25 *
Social support ¹	2.1	.07	2.3	.29 **
Cholesterol level ²	6.5	.31 **	6.9	.27 **
Gender difference for mean values:	¹ p<0.05	² p<0.01		
Pearson's correlations coefficients:	*p<0.01	**p<0.001		

larly high or low in fat content. Respondents were given a positive score if they reported eating or drinking more low-fat or skimmed milk, light margarine, vegetable oils and baked/ poached fish, or if they reported eating or drinking less whole-fat milk, cheese, eggs, cakes or sweets, butter, potato chips, hot dogs or hamburgers, and french fries. Responses were recoded to create a score ranging from zero to five, in which 0=no health-enhancing dietary changes to 5=at least six positive dietary changes over the past year. Participants were also asked, both in 1988 and in 1989, how frequently they ate these same food items (responses ranged from 1=several times a day to 5=seldom or never). By subtracting the 1988 scores from the 1989 scores, we obtained another dietary change measure that was significantly correlated with our dependent measure ($r=0.35$; $p<0.001$). A similar self-administered questionnaire assessing dietary habits among Norwegian adults has previously demonstrated a high degree of reproducibility.¹¹

Due to time constraints, the research questionnaire used in this study was not pilot-tested. The instrument was, however, submitted to extensive peer review prior to the study, and whenever applicable, previously tested questions were employed.

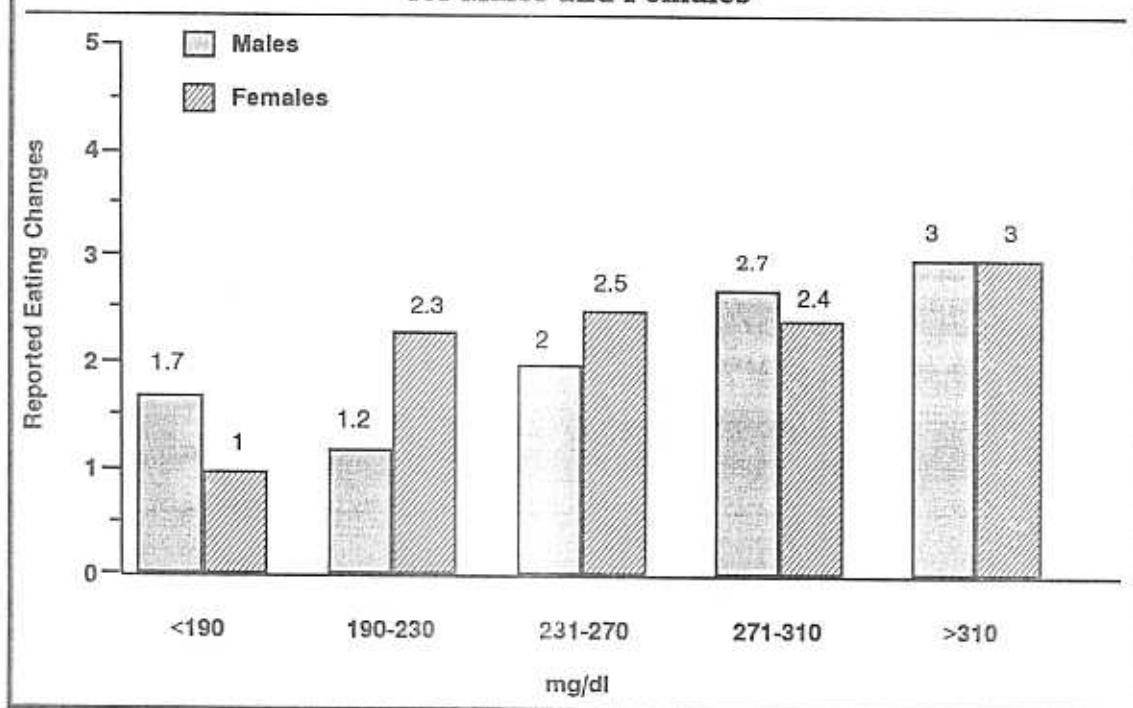
Data are analyzed using the Statistical Package for Social Sciences-PC. F- and T-tests for differences in mean values, Pearson's correlations coefficients, Cronbach's alpha statistics, and stepwise multiple regression analysis are presented.

RESULTS

As can be seen in Table 1, our sample consisted of 53% males, and the average age of the participants was 51.4 years. The large majority (81%) were married, and a relatively large proportion had college level educations (31%). Smokers were clearly underrepresented because only 18% of the participants reported regular smoking.

The mean number of reported dietary changes was 2.1 ± 1.7 vs. 2.4 ± 1.7 (n.s.) for men and women respectively. More baked/ poached fish and fewer eggs, cakes and sweets, hot dogs and hamburgers, and less butter were the dietary changes reported most often. As can be seen in Table 2, participating women had, on the average, somewhat higher baseline cholesterol values than did participating men. Women also reported risk reduction to be more important than did men and had more often discussed their test results with friends and family than had men. Finally, women more often perceived taste, cost, and the prepara-

FIGURE 1
Dietary Change Score by Baseline Cholesterol Category
for Males and Females



tion time of healthy foods to be potential barriers for changing their dietary habits than did participating men.

Neither smoking behavior nor any of the demographic variables were significantly predictive of future dietary changes for men or women. Subjects with the highest cholesterol levels reported being much more motivated to change their dietary habits in the following year than did subjects with low cholesterol levels (4.4 vs. 2.7; $F=18.2$; $p<0.0001$). As can be seen in Figure 1, a year later, subjects with the highest cholesterol levels reported that they actually had changed their diets to a greater extent than had participants with lower cholesterol levels ($F=8.3$; $p>0.0001$). Other factors strongly predictive of dietary changes for both genders were baseline perceived risk, perceived importance of risk reduction and self-efficacy (Table 2). In addition, social support and barriers to dietary changes were both significantly correlated with the self-reported dietary change score for women (Table 2).

These variables, with the exception of baseline cholesterol level, were entered into

a stepwise multiple regression analysis predicting the dietary change score (baseline cholesterol level was excluded as it was highly correlated to perceived risk ($r=0.75$; $p<0.001$)). Due to small sample size, this multivariate analysis was conducted for both genders combined. As can be seen in Table 3, perceived risk was the strongest predictor of the observed variance in the 1989 dietary change score. In addition, self-efficacy and perceived barriers to changing diet contributed significantly. Overall, these three factors explained 15.4% of the observed variance of the dietary change score.

DISCUSSION

This study was designed to investigate what factors would be predictive of future dietary changes among participants in a cholesterol screening program in the city of Bergen, Norway. Selection of factors collected at baseline was guided by the theoretical frameworks provided by the Health Belief Model and the Social Cognitive Theory. The results demonstrated that subjects with the highest cholesterol levels were those

TABLE 3
Stepwise Multiple Regression of Baseline Variables as
Predictors of Reported 1989 Dietary Change Score

	B	Beta	T	R ²	p-value
Perceived risk	.538	.297	4.59	.112	.000
Self-efficacy	.182	.174	2.70	.138	.008
Barriers to dietary change	.121	.143	2.24	.154	.026

most motivated to change their dietary habits, particularly to reduce the fat content of the diet, and that one year later, these participants reported actually having changed their diets significantly more than did participants with lower cholesterol levels. In addition to seeing oneself as being at risk in having a high cholesterol level, being confident of one's own ability to change one's diet (self-efficacy) and knowing how to deal with barriers to a healthier diet were significant predictors of reported dietary changes. Barriers to dietary changes were first of all associated with dietary changes among women, as was social support. In this sample of a mostly middle-aged and married population, women are those likely to be doing most of the cooking, and men would therefore be less inclined to worry about barriers such as food preparation.

Gender, age, marital status, level of education, and smoking status did not seem to be important factors with regard to implementing dietary changes. Subjects with lower levels of formal education tend to comply less often with health behavior recommendations. The fact that we saw no such difference in this study might support the assumption that cholesterol screening followed by nutrition education is particularly appealing to this group generally difficult to reach through traditional forms of health education. This hypothesis is somewhat supported by our earlier finding that subjects with an educational background equivalent to nine or less years of compulsory school at baseline said they perceived the campaign as very informative and beneficial.

These results indicate that in order to enhance the likelihood of cholesterol screening programs being followed by actual dietary changes, nutrition counselling should focus on the importance of personal risk reduction and on teaching skills to increase

perceived competence with respect to healthy eating. Food preparation courses and small group discussions might be particularly attractive and effective tools for subjects who have just learned they need to change their diets. Such courses should be designed to encourage active participation by the participants (in terms of what types of foods to prepare and how best to reduce dietary fat and increase intake of complex carbohydrates) in order to make participants able to deal with barriers to healthy eating relevant to their own social and cultural settings. Being part of such a group would also help provide social support and increased communication regarding cholesterol, diet, and risk reduction. By recruiting participants to such courses as people learn their own cholesterol levels, health education can take advantage of the fact that subjects tend to focus on their own personal health when having their cholesterol measured. Thus, using this "teachable moment," participants might be more likely to sign up for such a course and more receptive to dietary information. Furthermore, those feeling alarmed and reacting with fear when learning their cholesterol levels will have an opportunity to deal with these feelings in a safe and supportive environment.

Because it is likely that only those most interested and motivated would sign up for such courses or discussion groups, it is important that all subjects participating in cholesterol screening programs also receive counselling by trained personnel. At a minimum, such counselling should include information regarding the meaning and interpretation of any given test result, potential sources of error, and individual variability with respect to test results. It should also provide easy-to-understand dietary recommendations and present further sources of information, including educational classes and discussion groups.

Participation rate in this study was high compared to most other studies relying on mailed questionnaires (the cohort consisted of 90% of the overall eligible population). We were also able to identify significant predictor variables obtained one year prior to assessing dietary changes, thus reducing the problems of inference typical for cross-sectional studies. The design employed in this study was a one-group-only design. Subjects who participated were self-selected and were most likely more health conscious and health interested than was the general adult population. Thus, members of this group might have changed their diets independent of the cholesterol screening program. However, participants with the highest baseline cholesterol values reported having changed their diets the most. For this group, it is likely that the cholesterol screening program has increased the level of dietary changes that took place, although this group could also be the most motivated to overestimate dietary changes.

The dependent measure reported on in this study is a self-reported dietary change measure. This measure was significantly associated with another dietary change measure obtained by comparing reported frequency of selected food items in 1988 and 1989. Notice that the 1988 dietary frequency measure was obtained some weeks after the initial cholesterol screening and therefore is not seen as a true dietary baseline measure. Unfortunately, we were not able to more accurately assess participants' eating patterns, including total fat and saturated fat intake levels. Furthermore, no validity or reliability testing of the instrument has been conducted. A reproducibility study of a similar instrument showed, however, that food items used habitually had the highest reproducibility.¹¹ The dietary change measure employed in this study was created to quickly evaluate specific components of the intervention and even with this measure, important differences were observed. Finally, because only one to three questions were used to operationalize the theoretical constructs employed in this study, the results ought to be interpreted critically. Similar studies aimed at replicating our findings in other social settings, using a more stringent research design and improved nutritional intake measures, are encouraged.

CONCLUSIONS

In spite of identified methodological weaknesses regarding design and measurement issues, the results obtained in this study indicate that subjects with the highest cholesterol levels were strongly motivated to change their dietary habits. One year later, these participants reported that they actually had changed their diets to a greater extent than had participants with lower cholesterol levels. Being confident of one's own ability to change the diet and seeing risk reduction as very important were factors that enhanced the likelihood of dietary changes. For women, being able to talk to others about cholesterol levels and knowing how to deal with barriers to dietary changes were also significant predictors of dietary changes. ■

REFERENCES

1. National Institutes of Health Consensus Development Conference: Lowering blood cholesterol to prevent heart disease. *JAMA* 1985; 253:2080-2086.
2. Hjermann I, Velve Byre K, Holme I, et al: Effect of diet and smoking intervention on the incidence of coronary heart disease. Report from the Oslo Study Group of a randomized trial in healthy men. *Lancet* 1981; 2:1303-1310.
3. Flesland, Halvorsen R, Solheim BG, et al: Serum-cholesterol level and motivation for dietary changes in Norwegian blood donors. (Nor) *Tidsskr Nor Laegeforen* 1990; 110:2226-2229.
4. Murray DM, Luepker RV, Pirie PL, et al: Systematic risk factor screening and education: A community-wide approach to prevention of coronary heart disease. *Prev Med* 1986; 15:661-672.
5. van Beurden E, James R, Dunn T, et al: Risk assessment and dietary counselling for cholesterol reduction. *Health Education Research* 1990; 4(5):445-450.
6. Johansson L: The Norwegian diet and nutrition and food policy. Report from the Norwegian National Nutrition Council, Oslo 1987.
7. Matthiesen SB, Klepp KI, Aarø LE, et al: The Norwegian cholesterol campaign: Evaluation of local action. (Nor) *Tidsskr Nor Laegeforen* 1990; 110:983-988.
8. Becker MH: *The Health Belief Model and Personal Health Behavior*. New Jersey: C.B. Slack, 1974.
9. Rosenstock IM, Strecher VJ, Becker MH: Social Learning Theory and the Health Belief Model. *Health Educ Q* 1988; 15(2):175-183.
10. Bandura A: *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood-Cliffs, New Jersey: Prentice-Hall, 1986.
11. Jacobsen BK, Bønna KH: The reproducibility of dietary data from a self-administered questionnaire. The Troms Study. *Int J Epidemiol* 1990; 19(2):349-353.