Work-Site Cholesterol Screening and Dietary Intervention: The Staff Healthy Heart Project

ABSTRACT

Objectives. The Staff Healthy Heart Project was established to run a work-site cholesterol screening project and a randomized controlled trial of dietary interventions.

Methods. Screening was offered to all staff at six Australian hospitals. Participants with blood cholesterol of 5.2 mmol/L (200 mg/dL) or above were randomly allocated to receive screening only (control group), a self-help package, or a nutrition course. Participants were seen 3 and 6 months after intervention to measure blood cholesterol and dietary changes.

Results. Eighty percent of available staff (n = 2638) were screened. Of those eligible, 67% (n = 683) entered the trial. Follow-up measures of blood cholesterol and dietary intake were obtained for 63% and 38% of trial participants, respectively. A reduction in reported dietary fat was found for all groups, but there were no significant differences between groups. Reported dietary fiber rose by 0.6 g/MJ/day for those in the nutrition course. There were no changes in total blood or high-density lipoprotein cholesterol.

Conclusions. Cholesterol reduction was not demonstrated, but this result is difficult to interpret given the poor ongoing participation rates. Strategies to improve ongoing participation in work-site projects are needed to achieve adequate assessment of dietary interventions used in cholesterol screening. (*Am J Public Health.* 1994;84:779–782)

Alexandra Barratt, MBBS, MPH, Robert Reznik, MD, MBBS, MSc, Les Irwig, PhD, MBBCh, America Cuff, BSc, Judy M. Simpson, PhD, BSc, Brian Oldenburg, PhD, BSc, John Horvath, MBBS, FRACP, and David Sullivan, MBBS, FRACP, FRCPA, for the Steering Committee of the Staff Healthy Heart Project

Introduction

Cholesterol levels are higher than desirable (above 5.2 mmol/L or 200 mg/dL) in approximately half of all adults in Australia and the United States.[1,2] Regular cholesterol checks for all adults have been recommended,[3,4] and work-site cholesterol screening has become a popular strategy for achieving this objective.[5] However, work-site studies often have major methodological problems, including lack of evaluation, and low participation rates.[5,6] Very few work-site cholesterol screening programs have been evaluated by randomized controlled trials, and these have yielded conflicting results, ranging from a net cholesterol reduction of 6.4% in the treatment group in a study of 145 participants[7] to no significant effect in a study of 2489 subjects.[8] Participation rates vary widely (e.g., from 35%[8] to 86%[9]), as do dropout rates (e.g., from 12%[10] to 43%[7]). These problems have made it difficult to draw conclusions about the efficacy of work-site cholesterol screening.

The Staff Healthy Heart Project was established to examine the feasibility of conducting a large work-site cholesterol screening project and to evaluate by randomized controlled trial two dietary interventions to lower cholesterol.

Methods

The project was conducted between 1988 and 1991 at the Royal Prince Alfred Hospital, a tertiary referral center and teaching hospital in Sydney, and at five nearby smaller hospitals. At the outset, a steering committee of 16 members was established to be responsible for the design and implementation of the study. The committee had representatives of senior management staff, the major on-site unions, and the Sports and Social Club at the Royal Prince Alfred Hospital, as well as members representing medical, health promotion, and research interests.

Screening

Two health educators took a mobile screening unit to all major work areas during day and night shifts. Screening was free. Participation was estimated from staff lists supplied by the personnel departments and represents the proportion of staff screened after vacant, "frozen," casual, and off-site positions were deducted from total staff numbers.

Cholesterol was measured by rapid dry chemistry analysis, using the Boehringer-Mannheim Reflotron system. This sample was used for screening purposes only and was available in 3 minutes. Participants' weight and height (without shoes), systolic and diastolic blood pressure (according to standard guidelines[11]), and exercise and smoking habits (elicited by standard questions[1]) were also mea-

Alexandra Barratt, Les Irwig, Judy M. Simpson, and Brian Oldenburg are with the Department of Public Health, University of Sydney, Sydney, NSW, Australia. Robert Reznik is with the Public Health Unit for Central and Southern Sydney. America Cuff, John Horvath, and David Sullivan are with the Royal Prince Alfred Hospital, Sydney.

Requests for reprints should be sent to Alexandra Barratt, MBBS, MPH, Department of Public Health, A27, University of Sydney, Sydney, NSW, Australia 2006.

This paper was accepted September 10, 1993.

Editor's Note. See related editorial by Nestle (p 713) in this issue.

sured. Limited sociodemographic data were collected. Results were reviewed with each participant, and brief advice was given based on pamphlets supplied by the National Heart Foundation. Participants with blood pressure above 140/90 were referred for medical care.

Trial of Dietary Interventions

Eligible employees were those who had cholesterol levels at screening of 5.2 mmol/L or above, were permanent staff, and were fluent in English. Participants were allocated at random in a ratio of 3:3:1 to the control group (screening only) and two intervention groups (self-help package and nutrition course, respectively). For ethical reasons, participants whose screening cholesterol was 7 mmol/L or above were allocated only to intervention groups.

At baseline, venous blood was analyzed for total and high-density lipoprotein cholesterol level at the Biochemistry Department at the Royal Prince Alfred Hospital. All participants were asked to complete a 179-item quantitative food frequency questionnaire (FREQPAN[12]).

Participants were asked (in up to two letters and two phone calls) to attend follow-ups 3 and 6 months after intervention. Blood cholesterol was measured as at baseline, and participants were weighed. A repeat food frequency questionnaire was administered at the 6-month follow-up only. Results of all cholesterol tests were mailed to all participants.

The dietary interventions were consistent with dietary recommendations to reduce total and saturated fat and increase fiber intake.[13] The self-help package, "Food for a Healthy Heart," was a low-intensity intervention. The package included a workbook with educational material and aids to behavior change such as quizzes, shopping guidelines and recipes, a 3-minute video outlining the principles of a healthy heart diet, and a monitoring sheet of suggested dietary behavior changes. The nutrition course, "More Fiber, Less Fat," consisted of five 1-hour sessions led by a dietitian, with 12 to 15 participants per class. The educational content was similar to that of the self-help package, but the sessions provided an opportunity to demonstrate and discuss a standardized series of topics, including the fat and fiber content of foods, food labeling, why people eat too much fat and not enough fiber, and barriers to dietary change. Participants in the sessions were able to taste low-fat, high-fiber recipes. A workbook included information and activities for each session. Participants were consulted about their preferred times to attend and were advised of class times by mail and telephone. Half an hour of paid time off work to attend each class was negotiated.

Participants with a body mass index ([weight in kilograms]/[height in meters]^2) of more than 25 were classified as overweight, and those with a body mass index of more than 30 as obese. The food frequency data were coded and adjusted for serving size according to FREQPAN guidelines.[12] Nutrients were expressed as a proportion of total energy to adjust for differences in energy intake. Changes in nutrient intake, weight, and cholesterol were calculated for each individual at each follow-up attended, and the mean change and 95% confidence interval were calculated for each intervention group. Each intervention group was compared with the control group for significant differences, except for changes in blood cholesterol. For blood cholesterol, comparisons were made to take into account the allocation of people with cholesterol levels of 7 mmol/L or above to intervention groups only (the control group was compared with a subset of the self-help group who had screening cholesterol levels of less than 7 mmol/L [self-help package—low], and the whole of the self-help group was compared with the whole of the nutrition course group). The original allocation to experimental groups was preserved for all analyses. Differences between groups were tested with chi-square and *t* tests for independent samples for categorical and continuous data, respectively. Two-sided tests of significance at the .05 level were used throughout. The Keys[14,15] and Hegsted[16,17] equations were used to predict the mean change in blood cholesterol from the observed dietary changes for each intervention group.

Results

Results of Screening

A total of 2638 people, approximately 80% of available staff, were screened. The median age was 35 years (range = 15–79, mean = 36.8, SD = 11.5), and 73% of the participants were female. Most (70%) spoke only English; more than 40 other languages were spoken, most commonly Greek, Yugoslav, Chinese languages, Italian, and Spanish.

With respect to cholesterol, 47% of the men and 42% of the women had levels of 5.2 mmol/L or above, and 7% of the men and 5% of the women had levels of 7 mmol/L or above. Almost half (47%) of the men, and 36% of the women, were overweight; 10% of the men and 12% of the women were obese. Over half the sample (53% of the men and 57% of the women) reported engaging in no regular vigorous exercise (e.g., football, keep-fit classes) in the preceding 2 weeks. A quarter of the women and 30% of the men reported current smoking. Only a small proportion (7% of the men and 3% of the women) were found to have high blood pressure (diastolic pressure above 90 mm Hg).

Results from the Trial of Dietary Interventions

Of those eligible for the trial, 67% (n = 683) agreed to participate. Refusers were significantly more likely to be male and to be smokers and were on average 2 years younger. The participants were allocated into groups as follows: screening only (control), 259; self-help, 310; and nutrition course, 114. A baseline food frequency questionnaire was obtained from 79% of the participants. Of participants allocated to the nutrition course, 38 (33%) failed to attend any classes, 40 (35%) attended three or more classes, and 36 (31%) attended one or two classes.

Follow-up cholesterol samples were obtained from 61% and 63% of the participants at the 3- and 6-month follow-ups, respectively. Repeat measures of weight were obtained from 51% (at 3 months) and 49% (at 6 months) of the participants. Compared with those seen at follow-up, dropouts were significantly heavier and had higher blood pressure at screening, but the two groups were similar with respect to gender, age, mean baseline cholesterol level, exercise, and smoking. A repeat food frequency questionnaire was completed by 48% of the trial participants; paired baseline and follow-up food frequency questionnaires were available for 261 (38%) of the participants. Participants who failed to complete both food frequency questionnaires were younger (3 years on average) and were more likely to be male and to smoke.

Of the 261 paired questionnaires, 10 were excluded from analysis because of extreme values of reported energy intake (outside the 1st and 99th percentiles) or extremely large drops (greater than 10 MJ) in energy intake.

Compared with the other groups, the nutrition course significantly reduced reported total energy intake and increased fiber intake (Table 1). A reduction in total and saturated fat was reported in all

TABLE 1—Baseline Intakes of Energy, Total Fat, Saturated Fat, and Fiber and Change at 6-Month Follow-Up, by Intervention Group

Group	Energy, MJ		Total Fat, % of Total Energy		Saturated Fat, % of Total Energy		Fiber, g/MJ	
	Baseline	Change at 6 Months	Baseline	Change at 6 Months	Baseline	Change at 6 Months	Baseline	Change at 6 Months
Screening only	9.2	−1.1[a]	36.8	−2.0[a]	13.8	−1.0[a]	2.9	+0.1
Self-help package	8.7	−0.9[a]	37.3	−2.4[a]	14.2	−1.7[a]	2.7	+0.2[a]
Nutrition course	10.0	−2.1[a,b]	37.5	−2.5	13.9	−1.7	2.7	+0.6[a,c]

Note. Paired baseline and follow-up questionnaires were obtained for 261 participants (38% of the total n of 683). Ten questionnaires were excluded from analysis because of extreme values; therefore, the table presents data for 251 participants.
[a]95% confidence interval does not include zero.
[b]Change in nutrition course group is significantly different from change in self-help package group ($P = .04$) and change in screening-only group ($P = .05$).
[c]Change in nutrition course group is significantly different from change in screening-only group ($P = .04$).

groups, but the reduction was not significantly greater in either intervention group than in the control group. There were no changes in intake of polyunsaturated or monounsaturated fats.

There were no changes in mean cholesterol level in any group at the 3- or 6-month follow-up (Table 2). The maximum possible decrease in cholesterol (from the lower bound of the 95% confidence interval) was no more than approximately 4% for any group. There were no changes in high-density lipoprotein cholesterol. The maximum decrease in cholesterol predicted from the observed dietary changes was 0.12 mmol/L (2%) for those in the nutrition course.

A mean weight loss of 0.9 kg for the nutrition course group was observed at the 3-month follow-up, but this change was not significantly different from weight changes in the other groups. At 6 months participants in the nutrition course continued to show a 0.35-kg mean weight loss, a statistically significant loss compared with that of the screening-only group ($P = .04$).

TABLE 2—Baseline Cholesterol Levels (mmol/L) and Changes at 3 and 6 Months, by Intervention Group

Group	Baseline Level (n = 668)	Change at 3 Months (n = 417)		Change at 6 Months (n = 430)	
		Mean	95% CI	Mean	95% CI
Screening only	5.82	−0.07	−0.19, +0.05	−0.10	−0.22, +0.01
Self-help package—low	5.79	−0.05	−0.16, +0.05	−0.01	−0.10, +0.09
Self-help package	5.99	−0.05	−0.15, +0.04	−0.02	−0.10, +0.07
Nutrition course	6.16	+0.06	−0.14, +0.26	−0.05	−0.25, +0.15

Note. CI = confidence interval. The control group was compared with the subset of participants in the self-help package group whose screening cholesterol was below 7.0 mmol/L (self-help package—low); the whole of the self-help package group was compared with the whole of the nutrition course group (see Methods).

Discussion

An effective union between academic medicine and the work site is needed to exploit the full potential of work-site health promotion.[18] In the Staff Healthy Heart Project a major effort was made to achieve an effective collaboration among members of the steering committee. Broad agreement on the risk factors to be addressed and the interventions to be used was achieved among researchers, management, and unions. Management and union representatives were then able to negotiate agreements on provision of time off work and use and confidentiality of data. The head of each department was asked personally to support the project, to allocate a room for screening, and to allow staff time away from their duties to participate. This cooperation among researchers, management, and staff was probably responsible for the high participation in screening. The participation rate of about 80% compares favorably with those of other work-site trials, including the World Health Organization European trial in which participation rates ranged from 75% to 89%.[9]

The recruitment rate (67% of eligible staff) compares well with rates of 50% or less in other work-site trials of cholesterol intervention.[7,8] Women, older participants, and nonsmokers were more likely to be recruited. However, the relatively high recruitment rate in this population may have resulted in the inclusion of participants who were not sufficiently motivated to complete the trial. In contrast, Edye et al. recruited only 35% to 45% of participants initially, but retained almost 80% after 3 years.[8] These authors also noted that young women were more likely to drop out. Our study population was unusual in that it was predominantly young and female, and this characteristic may have increased the difficulty of achieving ongoing participation.

Organizational factors are also considered important determinants of participation.[19] Although screening was very convenient, follow-up was less convenient. Participants had to leave their work areas and walk to the staff clinic; follow-up took about 15 minutes at 3 months and about 45 minutes at 6 months (to complete the food frequency questionnaire in addition to the other measures). Participants also had to leave their work areas to attend the nutrition sessions, and many reported difficulty in leaving because of the pressure of work, even though time off work to attend had been arranged. However, in another work-site trial of nutritional classes, the proportion attending no classes (32%) was similar to that in our trial.[7] Follow-up rates were also reduced by the high staff turnover at

this work site; approximately one quarter of those who did not participate in follow-up had resigned or retired.

Finally, follow-up rates varied by outcome measure and were worst for the food frequency questionnaire. The baseline response rate was 79% (similar to that reported by other authors using food frequency questionnaires[20,21]), so the follow-up rate was limited to a proportion of these participants. The questionnaire was quite long and detailed and some participants were reluctant to spend the time needed to complete it, particularly for a second time. However, as no brief, valid, self-report measure of fat intake was available, we chose the food frequency questionnaire as the most appropriate and practical form of dietary assessment for this study.

Each intervention group reported appropriate dietary changes, including reductions in total and saturated fat intake. In addition, participants in the nutrition course increased their fiber intake and reduced their weight, compared with the control group. No benefit for intervention groups in terms of cholesterol reduction was demonstrated, although this result should be interpreted with caution in view of the low ongoing participation rates.

Conclusions

This project demonstrated that a large work-site screening program is feasible and high rates of initial participation can be achieved. The dietary interventions achieved some self-reported dietary change, but no reduction in blood cholesterol was demonstrated. However, this result is difficult to interpret because of the low rates of ongoing participation in the trial. Strategies to maintain high rates of participation beyond the initial stages of work-site projects are required. These strategies might include ways of making programs more accessible and convenient for staff. Such strategies would make a major contribution to the evaluation of dietary interventions used in cholesterol screening programs. □

Acknowledgments

Funding for this project was received from the Central Sydney Area Health Service, Royal Prince Alfred Hospital, the National Heart Foundation of Australia, and the National Health and Medical Research Council (through the Public Health Research and Development Committee). Additional sponsorship was received from the Australian Nutrition Foundation; Pfizer Pty Ltd; Becel Heart Care Information Service; Merck, Sharp & Dohme; SP Agencies; and Reebok Australia.

We would like to acknowledge the contribution made to this project by Dr Sue Morey, Chief Medical Officer, New South Wales Department of Health (formerly Director, Department of Community Medicine, Royal Prince Alfred Hospital) in establishing the project, and by the other members of the Steering Committee—Prof Douglas Baird, Chairman, Central Sydney Area Health Service; Ms Jo Rogers, Australian Nutrition Foundation; Dr Phil Harris; Dr Ian Caterson; Ms Kate Hogan; Ms Marilyn Wise; Ms Vanessa Child; Ms Katherine Maxwell; Mr Terry Conlon; and Ms Annabelle Harman of Royal Prince Alfred Hospital—who have provided much support and assistance.

References

1. Risk Factor Prevalence Study Management Committee. *Risk Factor Prevalence Study: Survey No. 3, 1989.* Canberra, ACT, Australia: National Heart Foundation of Australia and Australian Institute of Health; 1990.
2. Sempos CT, Cleeman JI, Carroll MD, et al. Prevalence of high blood cholesterol among US adults: an update based on guidelines from the second report of the National Cholesterol Education Program Adult Treatment Panel. *JAMA.* 1993;269:3009–3014.
3. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Summary of the Second Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel II). *JAMA.* 1993;269:3015–3023.
4. The management of hyperlipidaemia: a consensus statement. *Med J Aust.* 1992; 156(suppl):S1–S8.
5. Fielding JE. Frequency of health risk assessment activities at U.S. worksites. *Am J Prev Med.* 1989;5(2):73–81.
6. Sallis JF, Hill RD, Fortmann SP, Flora JA. Health behavior change at the worksite: cardiovascular risk reduction. In: Hersen M, Eisler EM, Miller PM, eds. *Progress in Behavior Modification.* New York, NY: Academic Press; 1986;20:161–197.
7. Bruno R, Arnold C, Jacobson L, Winick M, Wynder E. Randomized controlled trial of a nonpharmacologic cholesterol reduction program at the worksite. *Prev Med.* 1983;12: 523–532.
8. Edye BV, Mandryk JA, Frommer MS, Healey S, Ferguson D. Evaluation of a worksite programme for the modification of cardiovascular risk factors. *Med J Aust.* 1989;150:574–581.
9. World Health Organization European Collaborative Group. Multifactorial trial in the prevention of coronary heart disease, 1: recruitment and initial findings. *Eur Heart J.* 1980;1:73–80.
10. Lovibond SH, Birrell PC, Langeluddecke P. Changing coronary heart disease risk factor status: the effects of three behavioral programs. *J Behav Med.* 1986;9:415–436.
11. *Guidelines on Detection of High Blood Pressure and its Evaluation.* Canberra, ACT, Australia: National Heart Foundation of Australia; 1987.
12. Record S, Baghurst K. *Dietary Assessment by Computer.* Adelaide, SA, Australia: Commonwealth Scientific and Industrial Research Organisation; 1987.
13. The Health Targets and Implementation (Health for All) Committee. *Health for All Australians.* Canberra, ACT, Australia: Australian Government Publishing Service; 1988.
14. Keys A, Parlin RW. Serum cholesterol response to changes in dietary lipids. *Am J Clin Nutr.* 1966;19:175–181.
15. Keys A. Serum cholesterol response to dietary cholesterol. *Am J Clin Nutr.* 1984;40: 351–359.
16. Hegsted DM, McGandy RB, Myers ML, Stare FJ. Quantitative effects of dietary fat on serum cholesterol in man. *Am J Clin Nutr.* 1965;17:281–295.
17. Hegsted DM. Serum cholesterol response to dietary cholesterol: a re-evaluation. *Am J Clin Nutr.* 1986;44:299–305.
18. Alderman MH. Academic medicine and the workplace. *Am J Public Health.* 1993;83: 313–314.
19. Sloan RP, Gruman JC. Participation in workplace health promotion programs: the contribution of health and organizational factors. *Health Educ Q.* 1988;15:269–288.
20. Baghurst KI, Crawford DA, Worsley A, Record SJ. The Victorian Nutrition Survey—intakes and sources of dietary fats and cholesterol in the Victorian population. *Med J Aust.* 1988;149:12–20.
21. Hebert JR, Harris DR, Sorensen G, Stoddard AM, Hunt MK, Morris DH. A work-site nutrition intervention: its effects on the consumption of cancer-related nutrients. *Am J Public Health.* 1993;83:391–394.