

An Experimental Evaluation of an Incentive Program to Reduce Serum Cholesterol Levels Among Health Fair Participants

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Objective: To evaluate the impact of a health fair and incentive program on the reduction of serum cholesterol levels among participants.

Design: Pretest-posttest control group design, with a 6-month delay between pretest and posttest screenings.

Setting: Health fair program for employees of a large midwestern school district.

Participants: Volunteer sample among persons with serum cholesterol levels above 5.17 mmol/L (200 mg/dL). Participants were randomly assigned to experimental (N=29) and comparison groups (N=34).

Intervention: The intervention consisted of four components: a health fair, health risk information, announcement of follow-up screening, and an incentive program. The incentive program consisted of five

\$100 cash prizes for reducing serum cholesterol levels by 20% or below 5.17 mmol/L (200 mg/dL). The comparison group received only the first three components.

Main Outcome Measure: Serum cholesterol levels were measured by a venipuncture, nonfasting, chemical analysis process.

Results: The experimental group showed a 13.2% reduction in serum cholesterol levels, and the comparison group exhibited an 11.3% reduction ($P<.05$).

Conclusions: A health fair, consisting of information on the level of risk and how to reduce risk, and announcement of follow-up screening and incentives can reduce the risk for cardiovascular disease.

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CARDIOVASCULAR disease is the primary cause of death in the United States, and has been since 1950.¹ Medical researchers have established a connection between high cholesterol levels and cardiovascular disease.^{2,3} Reducing intake of dietary fat and cholesterol is shown to reduce serum cholesterol levels and the corresponding incidence of cardiovascular disease.²⁻⁴ The expected reduction in total serum cholesterol levels is between 10% and 20% if intake of saturated fatty acids is reduced to less than 7% of calories and intake of dietary cholesterol is reduced to less than 5.17 mmol/L (200 mg/dL) per day.⁵ Additional reductions of 1% to 10% may occur with additional dietary modifications such as increasing intake of dietary fiber.⁵ The Lipid Research Clinics Pro-

gram³ found a 19% reduction in the incidence of cardiovascular disease for every 8% reduction in total serum cholesterol levels.

Health fairs are generally assumed to be an effective mechanism for informing the public about important features of health status, such as levels of serum cholesterol, and for educating the public about behavior changes designed to reduce risk, such as dietary modification and increased exercise. The population screening aspect of health fairs is widely accepted as a valid mechanism for detecting

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METHODS

SETTING

The health fair that provided the context for this evaluation was conducted in Wichita, Kan. Wichita is a medium-sized midwestern city (population, 300 000). Unified School District 259, the local school district, sponsored the health fair as part of an employee wellness program that has been in effect over the past 3 years. The director of the employee wellness program is a member of the Kansas Low-fat Eating for America Now (LEAN) Coalition, Wichita. The mission of the Kansas LEAN Coalition is to reduce total fat levels in the diet of Kansans. Sponsored by the Kansas Health Foundation, Wichita, and the Kansas Department of Health and Environment, Topeka, this coalition is composed of representatives from a variety of private and public agencies concerned about cardiovascular disease and cancer in Kansas. Partners include staff of local departments of health, physicians, school representatives, food professionals, and supermarket administrators.

PARTICIPANTS

Participants in the health fair with elevated serum cholesterol levels (greater than 5.17 mmol/L [200 mg/dL]) were invited to take part in this study. Of the 432 participants in the health fair, 98 agreed to participate. Of those who agreed, 63 participants completed the pretest and posttest screenings. Participants in both groups received \$5 for attending the posttest cholesterol screening.

Participants were randomly assigned to one of two groups and were homogeneous across several demographic characteristics. **Table 1** provides demographic characteristics and the results of the χ^2 analysis. There were no statistically significant differences between the groups.

OBSERVATION SYSTEM

Serum cholesterol levels were identified using a total cholesterol screening (nonfasting, venipuncture blood samples). Research suggests that the finger-prick method may require interpreting obtained values with a total margin for

error of $\pm 14.2\%$ ¹² and that these values are found to produce high false-negative (13.9% to 24.7%) and false-positive (1.8% to 5.6%) readings when compared with the venipuncture method.¹² Accordingly, the more accurate venipuncture method was used.

Blood samples were collected by professionals from a medical center with experience in conducting large-scale screenings at health fairs. Analysis was conducted by experienced medical technicians using a Kodak Ektachem Analyzer (model DT-60, Eastman Kodak Co, Rochester, NY). An evaluation¹³ of dry-chemical cholesterol analyzers indicated that this analyzer was superior to other analyzers currently in use. It was found that there was high test-retest reliability. A posttest venipuncture screening was conducted 6 months after the initial assessment. Participants were reminded of the screening by mail and by telephone to help maintain a high level of program participation. Many participants did not attend the first posttest health screening due to a severe tornado and thunderstorm that occurred in the area the night before the screening. A second posttest screening was conducted 2 weeks later. Thirty-two people attending the initial health fair did not attend either posttest health screening event.

INTERVENTION

The intervention consisted of four components: a health fair, risk information, announcement of a posttest cholesterol screening for participants at risk, and an incentive program. All participants received the first three components; the incentive program was used with only a randomly assigned subset of participants at risk. Each component is described briefly below.

Health Fair

Attendees of the health fair received a wide variety of general and specific information on the relationship between health behaviors (healthy lifestyles) and the reduction of health problems as well as risk factors for long-term illness. Information was provided specifically on how to make appropriate lifestyle changes, including diet and exercise levels, to reduce excess body fat, serum cholesterol levels, and high blood pressure. The health fair was set up to guide

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high serum cholesterol levels and informing participants about risks and alternatives.⁶ It is not clear whether information provided in health screening contributes to lifestyle changes and related risk reduction in participants, however. A search of the literature found few descriptions of health fairs and screening programs that use follow-up screening. In one notable study,⁷ at a 6-month follow-up, serum cholesterol levels were 3.6% lower for persons not following the advice of a counselor, 4.4% lower for persons following the advice of the counselor, and 8.8% lower for persons following the advice of the counselor and taking prescription medications.

One community screening program⁸ that provided information on risk and lifestyle changes reported statistically significant changes in serum cholesterol levels at a 1.5-year follow-up. Alternate explanations of the results cannot be ruled out, however, since a control group was not used. Another community screening program⁹ used a pretest-posttest control group design to examine the effect of knowing cholesterol levels and having information on lifestyle changes on the reduction of risk for cardiovascular disease. At the 6-month posttest, this program found a 10.2% reduction in serum cholesterol levels for persons over 60 years of age and a 5.3% reduction in se

attendees through or past interactive displays provided by local chapters of the American Heart Association and the American Cancer Society, Wichita, and of the Kansas LEAN Coalition, as well as other health-related groups. The local medical center staff provided professional health screening and specific advice based on results.

Risk Information

Participants were given information about their risk for cardiovascular disease in the form of a health risk appraisal that summarized risk based on family history of cardiovascular disease, lifestyle (eg, smoking and consumption of alcohol and dietary saturated fats), and biochemical indicators (eg, serum cholesterol levels and blood pressure). This information was summarized and mailed to all participants in the 2 weeks following the health fair.

Announcement of Posttest Screening

Participants were informed by mail of the posttest cholesterol screening 2 weeks after the initial screening. A second announcement was mailed to participants 2 weeks before the posttest screening. Participants were also notified by phone of the date, time, and place of the second screening.

Incentive Program

The incentive consisted of a lottery for which five cash prizes were awarded (\$100 each) for accomplishment of the goal (reduction of serum cholesterol levels by 20% or to a level below 5.17 mmol/L [200 mg/dL]). Participants in the experimental group were notified of the drawing. The drawing was held at the the Office of Employee Wellness at Unified School District 259, and notification of the winners took place within 3 weeks of the posttest screening.

EXPERIMENTAL DESIGN

A pretest-posttest control group design¹⁴ was used to evaluate the effects of the incentive component of the intervention on serum cholesterol levels and reported lifestyle changes. Health fair participants who agreed to participate

in the study were randomly assigned into experimental (N=29) and comparison (N=34) groups. The experimental group was offered an incentive for reducing serum cholesterol levels by 20% or below 5.17 mmol/L [200 mg/dL] in 6 months. The comparison group was not offered an incentive for reducing serum cholesterol levels.

Statistical Analysis

A repeated measures analysis of variance (ANOVA) was used to test the null hypotheses that there were no differences between pretest and posttest serum cholesterol levels collectively or in each group separately and to assess interaction effects. The *t* tests were also used to measure the difference between the groups at pretest and posttest screening. An α level of .05 was used as the cutoff for rejection of the null hypotheses.

Collateral Measures

In addition to the primary measures, we surveyed study participants to determine the importance of and satisfaction with study procedures and selected health professionals to determine the clinical significance of the effects. Study participants were asked to use a 7-point Likert-type scale to rate the importance of the health goal and satisfaction with the procedures used. Surveys were completed at the posttest screening. Participants in the experimental group were asked an additional question about the importance of the incentive program in reducing their serum cholesterol levels.

Health professionals included faculty members in a department of preventive medicine, a cardiologist, a public health epidemiologist, two public health dietitians, and a public health nurse. The survey of the health professionals provided information on dietary and exercise changes, family history of cardiovascular disease, and serum cholesterol levels (pretest and posttest values) of the study participants. They were asked to use a 7-point Likert-type scale (responses could range from highly satisfied to highly unsatisfied and from highly important to highly unimportant) to rate the social importance of the health goal and clinical significance of the effects. Surveys were mailed to the health professionals and returned to the investigators anonymously.

rum cholesterol levels for persons between the ages of 40 and 60 years among participants who attended the health fair and were given knowledge of personal risk status. Serum cholesterol levels among control group participants increased during the same 6-month period. These researchers found the greatest reduction among participants in the experimental group who discussed results from the initial screening with their physicians. There was no information provided in this research on the lifestyle changes made by the participants.

Some studies examined whether participation in health fairs affected the use of health professionals and

changes in health risk behaviors. One study⁶ found that approximately 4.5% of the attendees at a community-wide screening consulted a private physician following the screening. A different survey¹⁰ of attendees at a health fair and screening program found that there was a low rate of consultation with personal physicians following the health fair. Another study¹¹ attempted to examine changes in health risk behaviors based on pretest and posttest scores from a health risk appraisal, and they found a reduction in self-reported health risk behaviors, such as smoking, in both attendees and comparison groups. Most studies interpreted self-reported use of information pro-

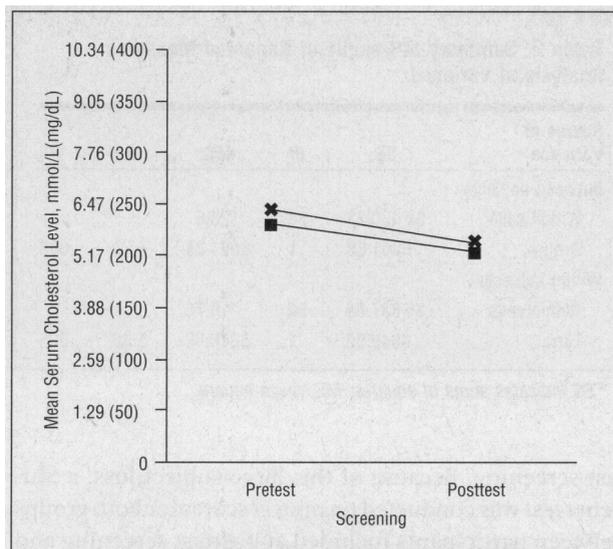
Table 1. Demographic Characteristics of Participants and Results of χ^2 Analysis*

Characteristic	Experimental Group	Comparison Group	χ^2	df
Age, y				
Mean	51	51	28.65	27
Range	27-66	34-68		
Sex				
M	13	17	0.17	1
F	16	17		
Race				
White	28	30	2.02	3
Asian	1	2		
Black	0	1		
American Indian	0	1		
Highest education level				
College diploma	18	16	2.51	5
Vocational/technical school	6	10		
High school diploma	5	2		
Less than high school diploma	0	1		
Income per year, \$				
<5000	0	1	2.55	4
5000-10 000	2	1		
10 000-15 000	4	2		
15 000-25 000	9	12		
>25 000	19	18		
Marital status				
Single	4	6	0.66	2
Divorced	2	1		
Married	23	27		

*Groups are described in the introductory and "Methods" sections of the text. Differences between groups for each characteristic were not significant.

vided at health fairs as evidence of behavior change. The lack of follow-up in most health fair and community-wide screening programs was noted by other researchers,¹¹ and evidence of change in lifestyle and related risk reduction remains sparse.

Our study used a pretest-posttest control group design to examine the effects of an incentive program combined with health risk information on serum cholesterol levels among participants in a health fair. We hypothesized that there would be reductions in serum cholesterol levels among participants in both groups because of information provided about the risk for cardiovascular disease (serum cholesterol level) and the opportunity for a follow-up health screening 6 months after the initial health fair screening. It was also expected that there would be a greater reduction in serum cholesterol levels among participants who were offered an incentive (the experimental group) when compared with participants who were not offered an incentive (the comparison group).



Average serum cholesterol levels for the experimental and comparison groups at pretest and posttest screenings. Crosses indicate the experimental group; squares, the comparison group. Groups are described in the introductory and "Methods" sections of the text.

RESULTS

The experimental group showed an average decrease in serum cholesterol levels of 13.2% from pretest to posttest screening. Serum cholesterol levels in the comparison group decreased an average of 11.3%. The **Figure** shows average serum cholesterol levels for each group at pretest and posttest screening. For the experimental group, the mean serum cholesterol level decreased from 6.31 mmol/L (244 mg/dL) at pretest screening to 5.48 mmol/L (211.8 mg/dL) at posttest screening. The scores ranged from 5.17 to 8.35 mmol/L (200 to 323 mg/dL) at pretest screening and from 4.45 to 7.09 mmol/L (172 to 274 mg/dL) at posttest screening. For the comparison group, the mean serum cholesterol level decreased from 5.97 mmol/L (230.71 mg/dL) at pretest screening to 5.29 mmol/L (204.56 mg/dL) at posttest screening. The scores ranged from 5.17 to 8.15 mmol/L (200 to 315 mg/dL) at pretest screening and from 3.85 to 6.57 mmol/L (149 to 254 mg/dL) at posttest screening. Statistically significant changes were noted within each group, with the experimental group showing a greater change from pretest to posttest screening ($t=7.81$; $P<.05$) than the comparison group.

A repeated measures ANOVA was conducted and statistically significant differences were noted between groups ($F[1,50]=4.70$; $P=.035$) and between results of first to second screenings within groups ($F[1,50]=5.36$; $P=.025$). **Table 2** summarizes the complete results of this analysis.

SUBJECT ATTRITION

Sixteen participants from each group who were present for the pretest screening did not participate in the post-

Table 2. Summary of Results of Repeated Measures Analysis of Variance*

Source of Variance	SS	df	MS	F	P
Between subjects					
Within cells	64 430.23	50	128.6
Group	6061.88	1	6061.88	4.70	.035
Within subjects					
Within cells	35 837.38	50	716.75
Time	3840.62	1	3840.62	5.36	.025

*SS indicates sums of squares; MS, mean square.

test screening. Because of this large subject loss, a Student *t* test was conducted on pretest scores for both groups between participants included at posttest screening and those not included at posttest screening. The null hypothesis stated that no systematic bias was present to account for subject attrition. An α value of .05 was used as the cutoff value. A comparison of the scores for participants in the experimental group included at posttest screening ($N=29$; $\chi^2=244.00$; $SD=31.47$) vs those excluded at posttest screening ($n=16$; $\chi^2=240.93$; $SD=45.94$) revealed no statistically significant differences ($t=-0.26$, which was not significant). A comparison of the scores between participants in the comparison group included at posttest screening ($N=34$; $\chi^2=230.71$; $SD=26.40$) and participants excluded at posttest screening ($n=16$; $\chi^2=230.31$; $SD=34.52$) revealed no statistically significant differences ($t=-0.05$, which was not significant).

COLLATERAL MEASURES

We found that three (4.8%) of the participants indicated that the health goal of reducing their risk for cardiovascular disease was not important, 10 (16.1%) were neutral about the topic, and 49 (79%) indicated that the health goal was important or very important. Satisfaction with the procedures was also rated by the participants, with two (3.9%) of the participants not satisfied that the study procedures helped them lower their serum cholesterol levels, 16 (25.4%) of the participants neutral, and 33 (64.7%) of the participants satisfied or very satisfied with the study methods. In the group having access to the cash prize, 17 (27.9%) of the participants indicated that the cash prize was not important to lowering their serum cholesterol levels, four (6.6%) of the participants were neutral, and six (9.8%) of the participants indicated that the cash prize was important or very important to their results.

Health experts were asked to rate the clinical significance of the risk for cardiovascular disease among the participants. The average responses changed from more than slightly significant risk for cardiovascular disease at pretest screening to a neutral risk among participants at posttest screening.

The primary finding is that incentives for the reduction of cholesterol levels combined with health fair participation, risk information, and announced posttest screening may produce a greater reduction in serum cholesterol levels than the health fair, risk information, and posttest screening without the incentive. Both groups significantly reduced their serum cholesterol levels, although the experimental group showed greater reductions.

These findings also have clinical significance. Based on the findings of the Lipid Research Clinics Program³ and the observed reduction in serum cholesterol levels, the average participant in the experimental group could expect a reduction of 31.35% in risk for cardiovascular disease due to serum cholesterol levels; the average participant in the comparison group, a reduction of 28.03%.

Effects of the health fair may be due to a combination of factors that included screening information on risk, health education information, and the informal setting of personal goals that may accompany announcements of a posttest screening. Participant ratings suggest that changing health-related behaviors was already important to most participants in this study. Since the participants had an average age of over 50 years, perhaps they saw the adverse effects of cardiovascular disease, as some of their friends and family may have suffered heart attacks and strokes, and were ready to make lifestyle changes. Health fair programs—consisting of free initial screening, information and advice based on the assessment, and follow-up screening—may enable many participants to reduce their serum cholesterol levels.

Although the experimental design nicely controlled for alternate explanations of effects, the generalizability of the findings may be limited. Selection bias—the idea that people who participate in health fairs and agree to follow-up assessments may be atypical—may contribute to the observed effects in both groups. Perhaps the effects would not hold, at least in the same magnitude, for the general population. Similarly, the reactive arrangements of an announced posttest screening may limit the generalizability of the findings to people who have such knowledge of future assessment. A comparison group from the same population, but without knowledge of a second screening, might help determine whether the opportunity for a second screening and setting the goal of reducing serum cholesterol levels below a predefined level are also contributors to the success demonstrated here.

The collateral measures provided useful information about the clinical and public health significance of this intervention. Changes in the health expert's ratings were small compared with the clinical literature describing a reduction of risk for cardiovascular disease of 19% for every 8% reduction in serum cholesterol level. When

this standard is applied to the experimental group in this study, one could expect a reduction in risk for cardiovascular disease of more than 31%. Perhaps additional information such as self-reported changes in lifestyle would enable health experts to make more sensitive assessments of reduction in risk for cardiovascular disease associated with empirical information about changes in serum cholesterol levels. Further, collecting information from the participants on satisfaction with procedures and the difference in procedures relative to the effects produced are likewise important. For risk reduction programs to be effective, the consumers they are designed to serve must be satisfied with the procedures. Participants and public health officials must also be satisfied with the effects.

Future research should examine the relative contributions of intervention components and whether the effects are maintained for longer durations. Would providing information on serum cholesterol levels alone be sufficient? Is it necessary to offer information on improving health risk status, usually provided in health fairs? What are the effects of other types of incentives, such as the reduction of health insurance premiums for demonstrated improvement in health risk status? It is also important to examine the maintenance of effects demonstrated here by conducting posttreatment probes at intervals beyond the 6-month posttest screening and including a 1-year follow-up.

This study enhances our understanding of the effects of a community health innovation on reducing a key risk factor associated with cardiovascular disease. Such an outcome evaluation of the effects of health fairs on health risk status are rare in the literature on health promotion. Our study is an improvement in the methods of some previous studies¹⁵ since high quality control procedures were used in the screening.

Perhaps similar community health innovations could be used to provide screening opportunities for people who do not have access to regular health care. Such persons, usually belonging to less empowered groups in our society, are often more at risk for long-term consequences of elevated serum cholesterol levels and other health risk factors. Mass screening and health-related education, with follow-up at regular intervals, might assist in reducing the costs of health-related services. Ultimately, such community health innovations might reduce the incidence of cardiovascular disease, the most prevalent cause of premature death in our society.

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