CardioVision 2020

Program Acceptance and Progress After 4 Years

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Objective: To report program acceptance and progress after 4 years of a heart disease prevention program.

Subjects: All Olmsted County, Minnesota residents aged ≥20 years.

Methods: The analysis is based on independent population-based interview samples from 1999, 2000, 2001, and 2003; a dietary questionnaire mailed to interviewees; and blood pressure and cholesterol data from medical records of consenting Olmsted County residents. National, Minnesota, and Olmsted County Behavioral Risk Factor Surveillance System trends for fruit and vegetable consumption, body mass index, participation in physical activity, and smoking are compared. The data were analyzed in 2005.

Results: More than 90% of the population considers CardioVision 2020 to be a good, very good, or excellent idea. The program is associated with a 25% reduction in the number of people exposed to environmental tobacco smoke and small but significant increases in consumption of fruits and daily physical activity. The population meeting the serum cholesterol goal increased from 52.0% in 1999 to 57.5% in 2003, and the population meeting the blood pressure goal increased from 53.7% in 1999 to 59.9% in 2003. However, attempts to quit smoking and the amount of time spent in physical activity did not increase. By 2003, nearly 9% of the population reported making a behavior change because of CardioVision 2020. Compared to Minnesota and national trends, fruit and vegetable consumption increased significantly in Olmsted County.

Conclusions: The population of Olmsted County views CardioVision 2020 in a positive light. Positive changes in several personal behaviors and risk factor levels have occurred.
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Introduction

Organized in the 1940s,[1] the Framingham Study documented that cardiovascular disease is caused by a limited number of behavioral and biological risk factors and is not a degenerative disease of aging. By 1970, the Seven Countries Study documented that levels of these risk factors place entire populations at high or low risk of cardiovascular disease.[2] In response to these observations, the North Karelia Project was organized in Finland in 1972.[3] Associated with comprehensive community-based interventions, age-standardized coronary heart disease mortality decreased by 73% in North Karelia and by 65% nationwide by 1995.[4] Changes of similar magnitude occurred among women. Deaths from coronary heart disease, cardiovascular disease, cancer, and all causes also declined sharply. In the United States, three community-level interventions—the Stanford Five-City Project, the Minnesota Heart Health Project, and the Pawtucket Heart Health Program—while associated with only marginal effects on disease rates, made major contributions to the knowledge base of community intervention strategies.[5–7]

McGinnis and Foege[8] have calculated that just a few factors of lifestyle—nutrition, physical activity levels, and use of and exposure to tobacco—are now responsible for about 40% of the burden of premature death in the U.S., and the emerging epidemic of obesity threatens the prosperity of the entire population.[9] In order to improve the health status of Olmsted County Minnesota residents (N=87,685 adults aged ≥20 in 2000), a group of individuals who live and work in Olmsted County began organizing CardioVision 2020 in 1996. The program was introduced to the public in

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June 1999.[10] Social modeling[11] and diffusion of innovations[12] are the primary theoretical models of the project, and the North Karelia Project is the primary model of practical application.

The overall goal of CardioVision 2020 is to stimulate community-wide intervention to make Olmsted County the healthiest county in the United States by the year 2020. This goal will be achieved by changes in four broad areas: elimination of tobacco and tobacco smoke, improved nutrition, increased physical activity, and improved health services for the primary and secondary prevention of cardiovascular disease. The vision for Olmsted County in the year 2020 includes a public environment that is free of tobacco smoke, promotion of tobacco products, and the sale of tobacco products to youth; nutritious foods that are clearly labeled, readily available, and widely promoted; widespread and widely promoted opportunities for physical activity; and clinical care systems for the secondary prevention and treatment of elevated risk factors. In addition to these goals for the community environment, individuals are encouraged to adopt five personal goals: (1) to be free from exposure to tobacco smoke and the use of tobacco; (2) to consume a total of five servings of fruits and vegetables per day, only lean or extra-lean meats, and 1% fat or fat-free dairy products; (3) to have a total cholesterol level <200 mg/dL if no coronary heart disease exists or a low-density lipoprotein level <100 mg/dL if coronary heart disease is present; (4) to have a systolic blood pressure <130 mm Hg and a diastolic blood pressure <85 mm Hg; and (5) to perform 30 minutes of physical activity on most, if not all, days of the week.[13]

CardioVision 2020 is organized around the supposition that sustained behavior change requires both the stimulation of individuals to attempt behavior change and a change in the physical and social environment to support the individuals who are trying to change.[10] To raise public awareness that Olmsted County residents are adopting the CardioVision 2020 personal goals, CardioVision 2020 produces television programs, radio interviews, and newspaper feature articles in the model of "behavioral journalism,"[14] an intervention technique that publicizes the healthy behavior of real people who live in the community. Because contests and competitions have been shown to help people change their diets, increase physical activity, and lose weight,[15–17] CardioVision 2020 sponsors short-term contests for smoking cessation, physical activity, and weight control. These contests stimulate the people who live or work in Olmsted County to sample lifestyle change. To help people sustain their new lifestyles, CardioVision 2020 promotes and produces environmental improvement programs. These include a smoke-free restaurant ordinance and a menu-labeling program for restaurants, cafeterias, and other suppliers of ready-to-eat food. The menu-labeling program identifies entrees that contain <1000 mg of sodium and ≤500 calories of which fewer than 7% come from saturated fat. CardioVision 2020 also advocates the construction of multi-use trails as a way to increase public opportunities for daily physical activity. Behavior change competitions in a particular area (e.g., the Quit-and-Win competition for smoking cessation) are conducted simultaneously with environmental change campaigns (e.g., the campaign for smoke-free restaurants and bars) because they support and reinforce each other. The CardioVision 2020 intervention strategy is described in greater detail in a previous publication.[18]

The baseline community report card was published in 2000.[13] Data regarding the weight distributions and weight goals of Olmsted County residents have also been reported.[19] This paper reports name recognition and program acceptance, self-reported behavior change, and changes in the proportion of Olmsted County residents who meet the CardioVision 2020 personal goals after 4 years of intervention. When state and national data are available, it also compares trends in Olmsted County with trends in Minnesota and the country as a whole.

Methods

Data Collection

The Mayo Clinic Institutional Review Board reviewed and approved the CardioVision 2020 survey and data collection protocol. Identical data collection methods were used for the baseline survey and the three follow-up surveys.[13] When constructing the survey instrument, the Behavioral Risk Factor Surveillance System (BRFSS) survey modules were used whenever relevant.[20] An independent survey organization was contracted to collect self-report data using random-digit-dial survey and interview techniques. The survey research firm selected and interviewed independent age–gender stratified random samples of approximately 1200 Olmsted County adult residents on four occasions—1999, 2000, 2001, and 2003 (Table 1). They completed data collection for each of the four surveys between March 1 and June 5 of the respective years. Somewhat more telephone numbers were used in the later years to identify 1200 eligible interviewees, but refusal rates by eligible individuals remained stable over the four surveys. The telephone interviews were supplemented with a mailed paper-and-pencil dietary calorie and fat assessment tool. This questionnaire had been validated in previous studies.[21] The completion rate for the supplemental dietary questionnaire declined significantly over the four surveys.

Blood pressure and serum lipid data for the period from January 1, 1999 to August 31, 2003 were extracted from the Mayo Clinic records of Olmsted County residents who gave permission to use their data for research. The blood pressure data include 705,091 observations and the lipid data include 128,360 observations. To avoid over-representing the data of individuals with multiple observations, only one randomly selected data point was used for each individual in the analysis.

Table 1. Participation and refusal rates for the four CardioVision 2020 random-digit-dial community surveys

Variable/year	1999	2000	2001	2003
Date of survey	March 1–April 21	February 28–May 5	March 13–June 5	March 3–May 13
Telephone numbers used	5668	5336	5958	6481
Completed interviews	1232	1224	1210	1229
Refused to participate after identified as eligible	808	790	849	798
Competed self-administered dietary questionnaire	732	688	590	436

Comparison to State and National Data

Variables from BRFSS surveys that had been conducted in Minnesota and throughout the United States provided the opportunity to compare trends in Olmsted County with trends in Minnesota and national trends.[22] For nutrition, these variables include the goal of eating five servings of fruits and vegetables per day, number of servings of fruits eaten each day, and number of servings of vegetables eaten each day. The assessment of physical activity was limited to a single variable, whether the respondent participated in any physical activities or exercises such as running, calisthenics, golf, gardening, walking for exercise or any other exercise during the past month. Current body mass index (BMI), and whether the respondent was not currently smoking cigarettes were also available in the BRFSS data sets.

To avoid confounding from seasonal effects on behavior, only Minnesota and national data that were collected in the months of March, April, and May were used. National data included the District of Columbia, Puerto Rico, and all 50 states except for Illinois. Illinois was excluded because a more complicated sampling scheme was used for some questions. Not all data were collected in all years. Sample sizes for national BRFSS data ranged from 41,957 to 60,838, and sample sizes for Minnesota BRFSS data ranged from 454 to 1308.

Data Analysis

The survey data were weighted to reflect U.S. Census estimates[23] of the 2000 Olmsted County population aged ≥20 years. SUDAAN (Research Triangle Institute, Research Triangle Park NC, 2004) was used to test for statistically significant trends across the four surveys. Minnesota and national BRFSS data were also weighted to the age–gender population of Olmsted County for analysis. Mean values were computed for each year using **PROC DESCRIPT**. The comparisons of Olmsted County trends with those of Minnesota and the nation were performed using logistic regression (**PROC RLOGIST**) for dichotomous variables (five servings of fruits and vegetables per day, physical activity, and smoking) and regression (**PROC REGRESS**) for continuous variables. The regression models included terms for year, BRFSS (yes=Minnesota or national, no=Olmsted), and year*BRFSS. The year*BRFSS term was used to test for a difference in trend. Only years with both BRFSS and Olmsted county data were included in the regressions to avoid bias from missing years. The Minnesota and national comparisons were run separately and in all cases the survey design was included in the analysis.

Results

Program Awareness, Acceptance, and Participation

Whether measured by reported awareness of any heart disease and stroke prevention program, the naming of CardioVision 2020 without prompting, or the recollection of seeing or hearing about CardioVision 2020 after prompting, program recognition increased significantly over the 4 years of the program (Table 2).

Table 2. Recognition and acceptance of CardioVision 2020 by population

Variable	% in 1999	% in 2000	% in 2001	% in 2003	*p* for trend
Respondent is aware of any programs in community that are designed to help individuals reduce risk of heart disease and stroke (missing=no)	28.6	41.9	47.7	42.0	**<0.0001**
Unprompted, respondent names CardioVision 2020 as a community program designed to help reduce risk of heart disease and stroke (%)	0.1	15.4	23.1	20.0	**<0.0001**
After hearing description of CardioVision 2020, respondent recalls seeing or hearing anything about CardioVision 2020 before telephone call (no response coded as "no")	Not asked	60.0	66.5	70.5	**<0.0001**
After hearing description of CardioVision 2020, respondent thinks that CardioVision 2020 is excellent, very good, or good idea (vs fair or poor)	Not asked	94.9	93.4	92.0	**0.007**

Table 3. Self-reported behavioral changes during CardioVision 2020 program

Variable	% in 1999	% in 2000	% in 2001	% in 2003	*p* (for trend)
Respondent reports behavior change as a result of the CardioVision 2020 program	Not asked	4.7	6.8	8.9	**<0.0001**
Respondent reports doing something to quit smoking (if smokes)	21.7	15.6	14.2	25.9	0.20
Respondent reports doing something to try to lower cholesterol	55.3	49.4	48.6	48.5	**0.0034**
If doing anything to lower cholesterol, respondent reports reducing fat in diet/ watching diet/eating balanced diet/eating better to lower cholesterol	87.3	83.8	85.2	79.0	**0.0001**
Number of servings respondent reports eating per day					
Fruit	1.74	1.80	1.82	1.84	0.08
Vegetables	2.29	2.30	2.32	2.34	0.38
Fruits and/or vegetables	4.03	4.09	4.15	4.18	0.12
Respondent reports trying to increase the amount of exercise that they get	64.7	67.7	67.5	68.7	0.07
Average **minutes** of physical activity per week reported by respondent	96.6	97.2	91.9	100.0	0.68

Enthusiasm for the program remained high across the four surveys, with >90% of the population considering CardioVision 2020 to be an excellent, very good, or good idea.

Unprompted, the leading ways in which respondents reported that they learned about program activities were newspaper articles (21.8%), newspaper advertisements (18.2%), television (17.2%), and banners/posters (14.2%). The Internet/web was named by only 2.7% of respondents, and only 2.4% of respondents said that they learned about CardioVision 2020 because of presentations by staff. The sources identified most frequently from a list presented to the respondents were the CardioVision 2020 pledge thermometer that was located at a central intersection in downtown Rochester (30.2%), banners/posters (28.4%), radio (23.1%), word of mouth (24.5%), and newspaper advertisements (20.1%).

Awareness of contests that CardioVision 2020 sponsored ranged from 18% for Weigh-and-Win to 34% for Walk-and-Win. Quit-and-Win was recognized by 27.4% of the population and about 1.1% of the population (5% of all smokers) participated in Quit-and-Win. Over 5% of the population participated in Walk-and-Win and 0.6% of the population participated in Weigh-and-Win.

Behavior Change

By 2003, 8.9% of the population—about 7800 people—made a behavior change as a result of the CardioVision 2020 program (Table 3). While taking action to quit smoking did not increase and there was a significant decline in the proportion of the population reporting that they were doing something to lower their cholesterol, there was a marginally significant increase in fruit consumption and the proportion of the population trying to increase their physical activity. The increase in the average minutes of physical activity per week was not statistically significant.

Population Meeting CardioVision 2020 Goals

Although there was no change in the proportion of the population reporting that they did not use tobacco, the proportion of the population reporting zero exposure to tobacco smoke increased markedly (Table 4). Most of the increase was seen on the fourth survey. The proportion meeting the five-a-day goal for fruits and vegetables increased significantly by five percentage points. The population meeting the blood pressure goal and the serum cholesterol goal increased signifi-

Table 4. Percent of population meeting CardioVision 2020 personal goals

	% in 1999	% in 2000	% in 2001	% in 2003	*p*
Zero tobacco use	80.0	79.6	80.2	79.3	0.79
Zero exposure to environmental tobacco smoke	41.5	43.0	39.7	54.3	**<0.0001**
Eats 5 servings of fruits and/or vegetables per day	27.0	30.0	30.9	31.7	**0.017**
Cholesterol <200 mg/dL (LDL <100 mg/dL if diagnosed with coronary heart disease)	52.0	53.6	56.2	57.5	**<0.0001**
Systolic blood pressure <130 mm Hg and diastolic BP <85 mm Hg	53.7	54.9	58.0	59.9	**<0.0001**
Physical activity every day	54.3	52.7	57.3	58.6	**0.009**

Table 5. Comparison of CardioVision 2020 population to Minnesota[a] and nation[b]

Variable description	Population	Mean 1999	Mean 2000	Mean 2001	Mean 2002	Mean 2003	Difference in linear trend vs Olmsted County, two-sided *p*-value
Eats 5 servings of fruits and vegetables per day	Olmsted	0.27	0.30	0.31		0.32	
	National		0.25		0.24	0.23	0.078
	Minnesota		0.34		0.23	0.27	**0.012**
Number of fruit and vegetable servings eaten per day	Olmsted	4.03	4.09	4.15		4.18	
	National		3.93		3.84	3.76	**0.011**
	Minnesota		4.23		3.70	3.97	**0.027**
Number of fruit servings eaten per day	Olmsted	1.74	1.80	1.82		1.84	
	National		1.55		1.52	1.47	**0.033**
	Minnesota		1.85		1.51	1.63	**0.008**
Number of vegetable servings eaten per day	Olmsted	2.29	2.30	2.32		2.34	
	National		2.37		2.32	2.28	**0.038**
	Minnesota		2.38		2.19	2.34	0.397
Current body mass index	Olmsted	26.43	26.25	26.19		27.04	
	National	26.36	26.53	26.74	26.79	26.87	0.516
	Minnesota	26.01	26.20	26.80	26.80	26.72	0.762
During the past month, subject participated in any physical activities or exercises such as running, calisthenics, golf, gardening, walking for exercise, or any others	Olmsted	0.82	0.86	0.85		0.84	
	National		0.73	0.74	0.75	0.75	**0.028**
	Minnesota		0.73	0.80	0.83	0.85	**<0.001**
Not currently a smoker	Olmsted	0.84	0.83	0.84		0.84	
	National	0.77	0.77	0.77	0.77	0.77	0.772
	Minnesota	0.80	0.83	0.79	0.79	0.78	0.187

[a]Sample sizes for Minnesota BRFSS data range from 454 to 1308.
[b]Sample sizes for national BRFSS data range from 41,957 to 60,838.
BRFSS, Behavioral Risk Factor Surveillance System.

cantly, as did the proportion of the population who reported daily physical activity.

Comparisons to Minnesota and National Data

Over the 4 years of observation, the trend in Olmsted County was for an increasing proportion of the population to meet the five-a-day goal for fruit and vegetable consumption while the trend was in the opposite direction nationally ($p=0.078$) and in the state of Minnesota ($p=0.012$) (Table 5). The trends for number of fruit and vegetable servings eaten per day were significantly different for Olmsted County compared to both national data ($p=0.011$) and Minnesota data ($p=0.027$). The same was true for the number of servings of fruit eaten each day. While the trend in the number of vegetable servings eaten each day was significantly different for Olmsted County compared to national data ($p=0.038$), the difference in trends was not significantly different for Olmsted County compared to Minnesota data ($p=0.397$). In all three populations BMI rose, and trends in smoking did not differ for Olmsted County compared to the other two populations. The proportion of the population who reported participation in physical activity remained at a high level over the period of observation, but did not increase to the same extent as it did in the national data ($p=0.028$) or in the Minnesota data ($p<0.001$)

Discussion

After 4 years, CardioVision 2020 is widely recognized as a positive force in Olmsted County, Minnesota. A significant portion of the population report that they have changed their behavior in response to CardioVision 2020, and between 1999 and 2003 the proportion of the population meeting the CardioVision 2020 blood pressure and serum cholesterol goals increased significantly. Based on comparisons with national trends and trends in the state of Minnesota, CardioVision 2020 appears to have generated increased fruit and vegetable consumption in Olmsted County. CardioVision 2020 also helped to significantly decrease risk from environmental tobacco smoke.

The ability to evaluate CardioVision 2020 is limited by the amount and types of data collected. Self-reported data have obvious biases, and the blood pressure and serum cholesterol data do not possess the same documentation of reliability as data collected in the context of high-quality research protocols. Because CardioVision 2020 was evaluated with repeated independent samples of the

population, it is impossible to determine whether any association between respondents hearing about CardioVision 2020 and adopting the advocated behaviors is causal.

The evaluation can also be faulted for not surveying a county similar to Olmsted County as a control group. These shortcomings are the result of a conscious decision at the beginning of the project to allocate as many resources as possible to intervention rather than evaluation. This decision is consistent with Hornik's[24] observation that there is little reason to conduct an elegant evaluation of an intervention that is obviously not intense enough to create an intervention effect. Comparison of a single pair of counties lacks the power to make statistical inferences.[25] In addition to being less expensive, comparison with state and national data using standard questions allows comparisons among communities. Despite all of the shortcomings in the evaluation design, any positive trends in the data are certainly not due to an effect of repeated questioning or differential attrition in a cohort. Calculations of random sampling indicate that only 144 individuals (3% of the total sample) would be expected to be selected to respond to any two surveys, and that there is only a 1% chance that even one individual was asked to respond to all four surveys.

It must be emphasized that the positive changes reported here were not due solely to the efforts of CardioVision 2020 to promote healthy lifestyles, healthy environments, and risk factor control. Although CardioVision 2020 led the way in collecting and publishing the data demonstrating that smoke-free restaurants and bars are preferred by all but a few people and that both are good for health and business,[26] the adoption of a county ordinance that assured smoke-free air in restaurants was the result of many, many individuals and organizations rising to the task. The largest share of the credit for population-level increases in meeting blood pressure and cholesterol goals goes to community physicians who organized their practices to achieve these goals.[27]

The decline in relative numbers of people who are trying to lower their cholesterol by reducing their consumption of dietary saturated fat is disappointing. While the population was not surveyed about their use of proprietary diet plans, this trend is contemporaneous with the aggressive marketing of low-carbohydrate diets. Unfortunately, low carbohydrate frequently translates as high saturated fat. In addition to being a risk factor for heart disease and cerebral infarction, a diet high in saturated fat is a risk factor for type 2 diabetes.[28,29]

These and other findings underscore the conflicts and frustrations that the population is experiencing. For example, the decline in the proportion of respondents who report trying to lower their serum cholesterol levels by restricting dietary fat contrasts with the observed decline in serum cholesterol levels. A decline in mean serum cholesterol levels alongside a decline in the proportion of people practicing dietary restraint may be due to an increasing use of cholesterol-lowering drugs. Data are not available to support or refute this supposition.

The proportion of individuals who report trying to increase daily physical activity increased significantly, but the total time spent in physical activity each week did not change. This pair of observations probably reflects the frustration that Americans have in translating intention into action in the context of a society that offers a huge menu of options on how to spend one's time.

The goal of CardioVision 2020 is to help people translate knowledge and intention into action. CardioVision 2020 is based on the premise that lifestyle is personal choice shaped by opportunity. Given the opportunity to choose, individuals must ultimately decide whether they will avoid tobacco smoke; eat a diet that emphasizes vegetables, fruits, and whole grains rather than saturated fats and simple sugars; get adequate physical activity; and control their blood pressure and cholesterol. However, people can choose this lifestyle only if they live in a physical and social environment that permits it, and most people can maintain the lifestyle only if they live in a physical and social environment that reinforces it. Therefore, the mission of CardioVision 2020 is "to partner with clinicians and community organizations to develop information systems, environment, skills, and encouragement needed to help individuals make informed choices that can lead to primary and secondary prevention of cardiovascular disease."

While the risk factor changes in the population—a 25% reduction in the number of individuals exposed to environmental tobacco smoke, a 2-mm Hg reduction in mean systolic blood pressure, and a 7-mg/dL reduction in mean serum cholesterol levels—would be small for an individual, they translate into important changes in risk for the Olmsted County population. Applied to the United States, the reduction in exposure to tobacco smoke would be expected to save nearly 14,000 lives a year.[30] Based on Framingham risk functions,[31] the reductions in blood pressure and improvements in serum cholesterol would be expected to reduce the incidence of cardiovascular disease in Olmsted county by nearly 50 cases per year. Recurrent events among the group of individuals who already have cardiovascular disease would also be reduced.

Conclusions

Within a period of <4 years, CardioVision 2020 has been able to achieve widespread recognition as a positive force to improve the health of Olmsted County residents. Nearly 10% of the population has reported that CardioVision 2020 stimulated them to adopt a healthier lifestyle. Differences in disease rates among populations, temporal trends in disease rates in the

What This Study Adds . . .

More than half of all deaths in the United States are the result of tobacco use and exposure, unhealthy diet, and physical inactivity.

CardioVision 2020 was organized to use the lifestyle modification technologies developed in academic centers to help residents of a Midwestern county lower their risk factor levels and reduce their burden of cardiovascular disease.

Positive behavior changes associated with the program indicate that population-based interventions can be successful in nonacademic settings.

U.S., and the success of similar projects around the world suggest that continuing the intervention, and optimally increasing its intensity, has the potential to maintain or improve the health of the population.

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