Impact of Worksite Wellness Intervention on Cardiac Risk Factors and One-Year Health Care Costs

Richard V. Milani, MD*, and Carl J. Lavie, MD

Cardiac rehabilitation and exercise training (CRET) provides health risk intervention in cardiac patients over a relatively short time frame. Worksite health programs offer a unique opportunity for health intervention, but these programs remain underused due to concerns over recouping the costs. We evaluated the clinical efficacy and cost-effectiveness of a 6-month worksite health intervention using staff from CRET. Employees (n = 308) and spouses (n = 31) of a single employer were randomized to active intervention (n = 185) consisting of worksite health education, nutritional counseling, smoking cessation counseling, physical activity promotion, selected physician referral, and other health counseling versus usual care (n = 154). Health risk status was assessed at baseline and after the 6-month intervention program, and total medical claim costs were obtained in all participants during the year before and the year after intervention. Significant improvements were demonstrated in quality-of-life scores (+10%, p = 0.001), behavioral symptoms (depression −33%, anxiety −32%, somatization −33%, and hostility −47%, all p values <0.001), body fat (−9%, p = 0.001), high-density lipoprotein cholesterol (+13%, p = 0.0001), diastolic blood pressure (−2%, p = 0.01), health habits (−60%, p = 0.0001), and total health risk (−25%, p = 0.0001). Of employees categorized as high risk at baseline, 57% were converted to low-risk status. Average employee annual claim costs decreased 48% (p = 0.002) for the 12 months after the intervention, whereas control employees' costs remained unchanged (−16%, p = NS), thus creating a sixfold return on investment. In conclusion, worksite health intervention using CRET staff decreased total health risk and markedly decreased medical claim costs within 12 months. **(Am J Cardiol 2009;104:1389–1392)**

The cost of health care in the United States continues to increase, with chronic disease comprising the majority of health care expenditures, accounting for 75% of the nation's annual health care costs and affecting >1/3 of working-age Americans.[1,2] The increasing cost of health care has had a major impact on employers, with nearly 60% of after-tax profit being spent on corporate health benefits.[3,4] Moreover, as much as 80% of this cost is currently being spent on only 10% of employees.[3,5] Employers also have collateral consequences of poor health including higher rates of absenteeism, presenteeism, disability, and injury leading to decreased productivity,[6] producing a clear incentive for employers to partner with health care providers in implementing worksite health promotion activities that may decrease subsequent diseases and their costs. Cardiac rehabilitation and exercise training (CRET) are typically hospital-based programs structured to provide a broad range of risk-modification therapies within a concentrated period, most often over a 3-month intervention[7]; these programs employ health educators, dietitians, nurses, and exercise physiologists who are skilled in health education and behavior modification, but are rarely used in the primary prevention setting. The purpose of this investigation was to evaluate the impact of a comprehensive worksite intervention program, using predominantly staff and program components from CRET, on health risk factors and 1-year cost of care.

Methods

We recruited participants from a single employer with 2 geographically disparate work locations, 1 serving as the site of active intervention, the other site serving as the control. The physical plant at each site was significantly different; however, the 2 sites offered the opportunity to exercise during lunch. Participants included employees and spouses who maintained health insurance through a single employer-sponsored health insurance provider. Risk evaluation was obtained at baseline in all participants by health educators and nurses and after 6 months of intervention in the active intervention group. Three subjects dropped out of the intervention group shortly after initiation of the program; there were no dropouts from the control group. Data obtained included weight, height, percent body fat, blood pressure, lipids, glucose, smoking status, physical activity level, general health and safety practices, behavioral assessment, addictive potential, quality of life, and evaluation of other known existing disease.

Behavioral assessment was measured by the Kellner Symptom Questionnaire, a 92-question survey validated to assess behavioral characteristics including symptoms of depression, anxiety, somatization, and hostility, with a lower score being more favorable for each behavioral symptom.[8]

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*Corresponding author: Tel: 504-842-5874; fax: 504-842-5875.

E-mail address: rmilani@ochsner.org (R.V. Milani).

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Table 1
Baseline characteristics in intervention and control subjects

Variable	Intervention (n = 185)	Control (n = 154)
Age (years)	40 ± 8	43 ± 10
Body mass index (kg/m^2)	28.6 ± 5.7	28.2 ± 6.1
Fat (%)	27.0 ± 7.5	26.7 ± 7.2
Men (%)	52%	53%
Smokers (%)	18%	20%
CAGE (U)	0.17 ± 1.1	0.19 ± 1.3
Sedentary (%)	79%	78%
Anxiety (U)	3.7 ± 4.2	3.4 ± 4.0
Depression (U)	2.4 ± 3.7	2.5 ± 4.0
Somatization (U)	5.2 ± 4.1	5.9 ± 4.4
Hostility (U)	3.6 ± 4.0	3.5 ± 3.9
Quality of life (U)	117 ± 12	119 ± 12
Systolic blood pressure (mm Hg)	124 ± 14	126 ± 16
Diastolic blood pressure (mm Hg)	81 ± 10	82 ± 10
Total cholesterol (mg/dl)	190 ± 27	196 ± 30
HDL cholesterol (mg/dl)	47 ± 10	44 ± 10
TC/HDL (U)	4.2	4.4
Health habits (U)	2.8 ± 1.7	2.6 ± 1.7
Total health risk score (U)	7.2 ± 5.1	7.0 ± 5.0

CAGE = Cutting down, Annoyance by criticism, Guilty feeling, and Eye-openers; TC = total cholesterol.

Table 2
Change in health parameters in active participants after worksite health intervention (n = 185)

Variable	Baseline	After Intervention	Change	p Value
Anxiety (U)	3.7 ± 4.2	2.5 ± 3.6	−32%	0.0001
Depression (U)	2.4 ± 3.7	1.6 ± 3.1	−33%	0.0002
Somatization (U)	5.2 ± 4.1	3.5 ± 3.3	−33%	0.0001
Hostility (U)	3.6 ± 4.0	1.9 ± 2.8	−47%	0.0001
Quality of life (U)	117 ± 12	128 ± 14	10%	0.001
CAGE (U)	0.17 ± 1.1	0.09 ± 0.08	−47%	NS
Body mass index (kg/m^2)	28.5 ± 5.7	28.3	−1%	0.08
Fat (%)	26.7	24.4	−9%	0.001
Smoker (%)	17%	15%	−12%	NS
Sedentary (%)	79%	72%	−9%	0.14
Total cholesterol (mg/dl)	190	184	−3%	NS
HDL cholesterol (mg/dl)	47	53	13%	0.0001
TC/HDL (U)	4.2	3.6	−14%	0.0001
Systolic blood pressure (mm Hg)	124	122	−2%	0.08
Diastolic blood pressure (mm Hg)	81	79	−2%	0.01
Health habits (U)	2.0	0.8	−60%	0.0001
Total health risk score (U)	7.2 ± 5.1	5.4 ± 4.0	−25%	0.0001

Abbreviations as in Table 1.

Addictive potential was obtained by the CAGE (Cutting down, Annoyance by criticism, Guilty feeling, and Eye-openers) questionnaire.[9] The Medical Outcomes Short-Form 36 survey was used to assess quality of life, with a high score indicating a more favorable quality of life trait.[10] Scores were generated for each category of health risk and a total health risk score was created that summed scores relating to behavioral traits, health habits, cardiac risk factors, and physical activity, with a lower score indicating a more favorable health risk status. Based on total health risk score, participants were divided into high-risk (total health score ≥10) and low-risk (total health score <10) groups.

Health intervention over a 6-month period was provided by the Risk Assessment and Modification Program (RAMP) through Ochsner Health System (New Orleans, Louisiana). The RAMP program used nurses, dietitians, health educators, and exercise physiologists and psychologists from CRET to create a worksite-based program consisting of onsite health education, referrals to group smoking cessation programs, stress management, lipid clinic, physician referral for hypertension and diabetes management, treatment for drug and alcohol addiction, and membership in a consortium of health and fitness centers located throughout the greater New Orleans area. Onsite classes were given weekly and included nutritional education, fitness counseling, weight control, worksite and home safety, and general health measures. One month before intervention, newsletters went to all employees describing the program and focus groups and team leaders were selected. Awards were created for milestones in behavior change. Group competition was held with awards for best outcomes (including vacation days and other job-related perks). Monthly newsletters were generated to all employees, and monthly themes were created stressing the importance of a unique health risk behavior. Free health-related premiums were dispensed at worksite lunch-and-learn programs to encourage attendance. Health care costs were obtained from the health insurer the year before intervention in each of the participants and the 12 months after the intervention.

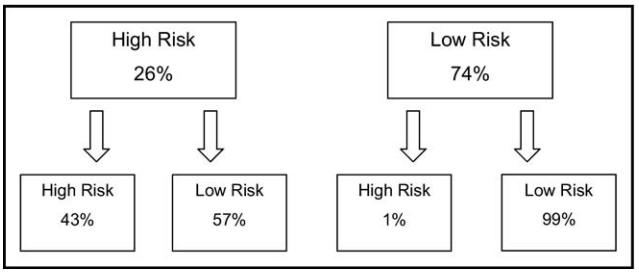

Figure 1. Categorical change in health risk status after worksite health intervention.

Results

Three hundred thirty-nine participants (308 employees and 31 spouses), were randomized by family units into active intervention (n = 185) and usual care (n = 154). The active intervention group consisted of 96 men (52%) at a mean age of 40 ± 8 years (range 23 to 65). Twenty-seven percent of participants were identified as hypertensive (19% stage 1, 7% stage 2, and 1% stage 3). These subjects (active and control groups) were referred to their primary care physicians or to a dedicated hypertension clinic. There were no significant baseline differences between the active and usual-care groups (Table 1).

After the intervention, there were significant improvements in scores of quality of life, depression, anxiety, hostility, and somatization (all p values <0.001; Table 2). Significant improvements were demonstrated in body fat,

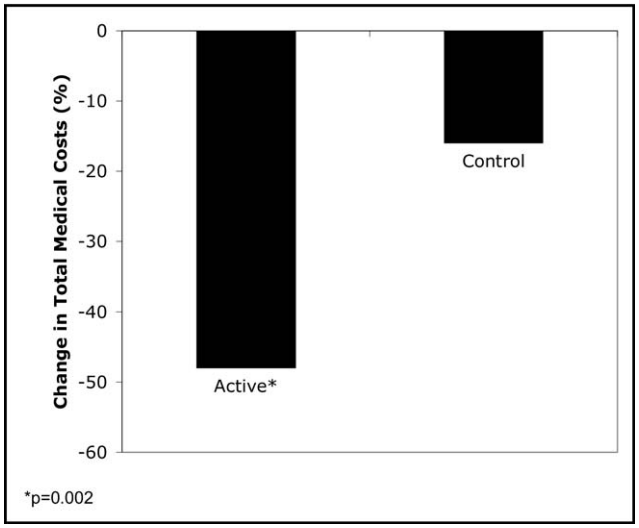

Figure 2. One-year change in total medical costs in active participants versus control subjects after worksite health intervention (*p = 0.002).

diastolic blood pressure, and general health habits. There was a significant improvement in HDL cholesterol (+13%, p = 0.0001), total cholesterol/HDL cholesterol ratio (−14%, p = 0.0001), and total health score (−25%, p = 0.0001). Twenty-six percent (n = 48) of the active arm was classified as high risk at baseline. After the intervention, 42% of this group (n = 20) remained at high risk, whereas 58% converted to the low-risk category (Figure 1). Of the 74% (n = 137) who were low risk at baseline, 99% (n = 136) remained at low risk after the intervention.

Total medical claim costs for the entire cohort averaged $2,981 per subject for the 12 months before intervention and were not significantly different between the active and control arms ($2,960 vs $3,002 respectively). For the 12 months after the intervention, medical claim costs decreased to an average of $1,539 per subject in the active group (p = 0.002) and $2,522 per subject in the control group (p = NS). The difference in annual cost change (Figure 2) was statistically significant between groups (p = 0.01). For every dollar invested in worksite intervention, $6 was realized in health care savings.

Discussion

There are several implications from this study. First, worksite health intervention, using staffing from existing CRET services, leads to significant improvements in multiple aspects of general health. Second, >1/2 of subjects categorized as having a high-risk health status can be converted to a low-risk health status in a relatively short period of time. Third, the financial benefits of a comprehensive worksite health intervention can be realized within 1 year of intervention, generating a sixfold return on investment.

Lifestyle behaviors including physical activities, nutrition, smoking, and substance abuse have a significant impact on long-term health, including contributing to chronic diseases such as hypertension, obesity, heart disease, type 2 diabetes, stroke, and some forms of cancer. According to the Centers for Disease Control and Prevention, each year ≥300,000 patients die from obesity-related illness, 440,000 die from illness attributed to cigarette smoking, and 40% of all deaths are caused by heart disease or stroke.[11] In addition, behavioral disorders, including depression and hostility, are major health problems and have been shown to contribute significantly to the risk of heart disease, accounting for 33% of the population's attributable risk for development of myocardial infarction.[12] That these and other risk factors are modifiable over the short term, and lead to long-term health benefits, has been demonstrated in numerous secondary prevention studies using CRET.[13–20]

The worksite provides a unique opportunity for primary health intervention because most American adults spend considerable time at work, and that amount of time has increased over the previous 2 decades.[4,21,22] Costs of care for employees are distributed unevenly, with as much as 80% of expenses incurred in only 10% to 20% of employees.[3,5,23–25] With health care costs increasing at a rate well ahead of inflation, and nearly 60% of after-tax profit being spent on corporate health benefits, employers are incented to partner with health care providers in creating successful worksite health intervention.[3]

Our program used health educators, dietitians, exercise physiologists, psychologists, and nurses from CRET services provided at our institution to create activities and educational events that targeted high-risk behaviors in employees at the worksite. Physicians were used in a minority of cases in which a significant chronic disease was diagnosed, thus creating an overall relatively low-cost intervention, such that each dollar invested realized a $6 savings in medical claims. The worksite intervention was successful in decreasing multiple individual aspects of health risk, and as a result led to >1/2 of high-risk subjects being converted to a low-risk (and lower-cost) status. These changes led to a marked decrease in total claim costs for the year after the intervention, suggesting that this type of primary intervention can be cost-effective for employer groups.

Importantly, however, although the positive effects on overall risk profiles and total medical claims were recognized after only a 1-year follow-up period, it seems likely that the changes noted in this study would result in even more substantial long-term cardiovascular benefits. For example, our study demonstrated an average 13% increase in levels of HDL cholesterol in the intervention group. Studies have demonstrated that for every 1% increase in HDL cholesterol, decreases in overall cardiovascular risk of 3% to 5% occur over a 3- to 5-year follow-up period.[26,27] Likewise, although our CRET data have demonstrated that improvements in psychological factors, including depression and overall psychological stress, result in some decreases in cardiovascular risk during the first year of follow-up, progressive benefits have been noted during 3- to 5-year follow-up periods.[17] Although the marked improvements in health habits may result in some decrease in risk even during the first year of follow-up, it is likely that additional benefits would be noted during a longer follow-up period.[28]

There are several limitations of this study worth describing. First, although this investigation was prospective and randomized, there was some spillover in the intervention, because subjects diagnosed with significant disease at screening in the 2 groups were referred to their physicians

for treatment. In addition, there were interactions of employees in the 2 groups and behavior changes likely carried over to the control arm. Second, we choose an employer that was highly motivated and with a very stable workforce without significant employee turnover and our results may not be exportable to other employee groups. Third, we did not measure health risk over time in our control group, because cost was our principal end point. Despite these limitations, however, we believe our conclusions to be noteworthy.

1. Heffler S, Smith S, Keehan S, Clemens MK, Won G, Zezza M. Health spending projections for 2002–2012. *Health Aff Millwood* 2003;Suppl Web Exclusives:W3-54-65.
2. Villaire M, Mayer G. Low health literacy: the impact on chronic illness management. *Prof Case Manag* 2007;12:213–218.
3. Center for Prevention and Health Services. National Business Group on Health. An Employer's Guide to Behavioral Health Services. A Roadmap and Recommendations for Evaluating, Designing and Implementing Behavioral Health Services. Washington, D.C., 2005:1–100.
4. Position Statement on Effective Worksite Wellness Programs. American Heart Association, 2008:1–5. Available at: *http://www.americanheart.org/presenter.jhtml?identifier=305748*.
5. Goetzel RZ, Anderson DR, Whitmer RW, Ozminkowski RJ, Dunn RL, Wasserman J. The relationship between modifiable health risks and health care expenditures. An analysis of the multi-employer HERO health risk and cost database. *J Occup Environ Med* 1998;40:843–854.
6. Goetzel RZ, Long SR, Ozminkowski RJ, Hawkins K, Wang S, Lynch W. Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers. *J Occup Environ Med* 2004;46:398–412.
7. Leon AS, Franklin BA, Costa F, Balady GJ, Berra KA, Stewart KJ, Thompson PD, Williams MA, Lauer MS. Cardiac rehabilitation and secondary prevention of coronary heart disease: an American Heart Association scientific statement from the Council on Clinical Cardiology (subcommittee on exercise, cardiac rehabilitation, and prevention) and the Council on Nutrition, Physical Activity and Metabolism (subcommittee on physical activity), in collaboration with the American Association of Cardiovascular and Pulmonary Rehabilitation. *Circulation* 2005;111:369–376.
8. Kellner R. A symptom questionnaire. *J Clin Psychiatry* 1987;48:268–274.
9. Ewing JA. Detecting alcoholism. The CAGE questionnaire. *JAMA* 1984;252:1905–1907.
10. Stewart AL, Greenfield S, Hays RD, Wells K, Rogers WH, Berry SD, McGlynn EA, Ware JE Jr. Functional status and well-being of patients with chronic conditions. Results from the Medical Outcomes Study. *JAMA* 1989;262:907–913.
11. The Burden of Chronic Diseases and Their Risk Factors. National and State Perspectives. CDC Chronic Disease Prevention. Baltimore: US Department of Health and Human Services, 2004.
12. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, McQueen M, Budaj A, Pais P, Varigos J, Lisheng L. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet* 2004;364:937–952.
13. O'Connor GT, Buring JE, Yusuf S, Goldhaber SZ, Olmstead EM, Paffenbarger RS Jr, Hennekens CH. An overview of randomized trials of rehabilitation with exercise after myocardial infarction. *Circulation* 1989;80:234–244.
14. Milani RV, Lavie CJ. Prevalence and profile of metabolic syndrome in patients following acute coronary events and effects of therapeutic lifestyle change with cardiac rehabilitation. *Am J Cardiol* 2003;92:50–54.
15. Milani RV, Lavie CJ, Mehra MR. Reduction in C-reactive protein through cardiac rehabilitation and exercise training. *J Am Coll Cardiol* 2004;43:1056–1061.
16. Lavie CJ, Milani RV. Adverse psychological and coronary risk profiles in young patients with coronary artery disease and benefits of formal cardiac rehabilitation. *Arch Intern Med* 2006;166:1878–1883.
17. Milani RV, Lavie CJ. Impact of cardiac rehabilitation on depression and its associated mortality. *Am J Med* 2007;120:799–806.
18. Lavie CJ, Milani RV. Prevalence of anxiety in coronary patients with improvement following cardiac rehabilitation and exercise training. *Am J Cardiol* 2004;93:336–339.
19. Lavie CJ, Milani RV. Effects of cardiac rehabilitation and exercise training programs on coronary patients with high levels of hostility. *Mayo Clin Proc* 1999;74:959–966.
20. Lavie CJ, Milani RV. Prevalence of hostility in young coronary artery disease patients and effects of cardiac rehabilitation and exercise training. *Mayo Clin Proc* 2005;80:335–342.
21. Leaf A. Preventive medicine for our ailing health care system. *JAMA* 1993;269:616–618.
22. Linnan L, Bowling M, Childress J, Lindsay G, Blakey C, Pronk S, Wieker S, Royall P. Results of the 2004 National Worksite Health Promotion Survey. *Am J Public Health* 2008;98:1503–1509.
23. Yen LT, Edington DW, Witting P. Corporate medical claim cost distributions and factors associated with high-cost status. *J Occup Med* 1994;36:505–515.
24. Yen L, McDonald T, Hirschland D, Edington DW. Association between wellness score from a health risk appraisal and prospective medical claims costs. *J Occup Environ Med* 2003;45:1049–1057.
25. Yen L, Schultz A, Schnueringer E, Edington DW. Financial costs due to excess health risks among active employees of a utility company. *J Occup Environ Med* 2006;48:896–905.
26. Lavie CJ, Milani RV. Shedding light on high-density lipoprotein cholesterol: the post-ILLUMINATE era. *J Am Coll Cardiol* 2008;51:56–58.
27. Cardenas GA, Lavie CJ, Cardenas V, Milani RV, McCullough PA. The importance of recognizing and treating low levels of high-density lipoprotein cholesterol: a new era in atherosclerosis management. *Rev Cardiovasc Med* 2008;9:239–258.
28. O'Keefe JH, Bybee KA, Lavie CJ. Alcohol and cardiovascular health: the razor-sharp double-edged sword. *J Am Coll Cardiol* 2007;50:1009–1014.