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Workplace Interventions to Reduce Obesity and Cardiometabolic Risk

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Abstract

The worksite is ideal for implementing interventions to reduce obesity and cardiometabolic risk factors. Although worksite health promotion is not new, employer-sponsored wellness programs have become more widespread due to the rising prevalence and high cost of obesity. Over the past two decades, employers and researchers focused efforts on individual-based programs to change employees' nutrition and exercise behaviors, but more recently, the worksite environment has been targeted. Overall, there is good evidence that individual-based worksite programs can produce modest weight loss, but the evidence for effects on other risk factors and on long-term health outcomes and costs is inconsistent. There is less evidence for the benefit of environmental-based interventions, and more data will be needed to establish conclusions about the benefits of these types of interventions. A major challenge for employers and researchers in the future will be to find the balance between effectiveness and economic viability of worksite wellness programs.

Keywords

Obesity; Worksite intervention; Physical activity; Nutrition; Environmental intervention; Cardiovascular risk; Cost-effectiveness

Introduction

As the prevalence of obesity continues to rise, population-based interventions are needed to promote healthy weight and to prevent obesity-related diseases. Obesity is associated with increased risk of cardiovascular diseases, diabetes, and overall mortality [1] and was estimated to account for 10% of all medical spending or $147 billion per year in 2008 [2]. The worksite is an ideal setting to prevent and treat obesity because 60% of Americans get their health insurance through their employer [3], and a majority of adults spend substantial time at work [4]. Employers have an incentive to reduce and prevent obesity in their workforce because they pay more for obese workers as a result of higher medical claims expenses, increased disability expenses, and increased absenteeism [5•]. In an analysis of the National Health and Nutrition Surveys and the National Health Interview Survey, obese workers had the highest prevalence of hypertension, dyslipidemia, and diabetes compared to normal weight workers, and the rate of metabolic syndrome among obese workers was 53.6% compared to 5.7% among those with normal weight [6]. Angina pectoris, essential hypertension, diabetes, and acute myocardial infarction are among the top 10 most-costly physical health conditions to the employer [7].

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The concept of health promotion in the workplace is not new [8–11], but employers' interest in providing wellness programs has increased due to the rapidly rising cost of providing healthcare for employees and the recent provision for worksite health promotion in the Affordable Care Act [4, 12]. Worksites provide the opportunity to implement interventions through already established channels of communication and social support networks. Studies of individual-level behavioral interventions targeting nutrition and physical activity in the workplace have demonstrated moderate weight loss [13, 14••]. In 2004, the National, Heart, Lung and Blood Institute (NHLBI) funded seven research projects to test the effectiveness of environmental interventions either alone or in combination with individual-level interventions to prevent and treat obesity in the workplace [15, 16], and some of these projects have reported results over the past 2 years [5•, 17, 18•, 19•, 20•].

The epidemiologic triad (host, vector, environment) is a useful model for considering the role of the different types of worksite programs to reduce obesity and cardiometabolic risk factors [21]. Host-based strategies incorporate educational and individual-based interventions to change behaviors. Vector-based strategies target energy-dense food and drinks, portion sizes, and physical inactivity. Environmental strategies can be applied toward the physical, social, cultural, and organizational environments. All of these strategies can be applied alone or in combination at worksites.

This review examines the effectiveness of worksite interventions on employees' obesity and cardiometabolic risk factors. Although many different approaches to work-site wellness have been tested, most programs can be categorized into one of two categories: 1) individual-based interventions (targeting the host) or 2) environmental-based interventions (targeting the vectors and the environment). The first section summarizes evidence for the effectiveness of individual-level behavioral interventions. These types of interventions typically focus on physical activity and nutrition behaviors, but some target specific risk factors. The second section focuses on recently published results from trials of environmental-level interventions to address obesity in the worksite.

Individual-Level Behavioral Interventions

Although early worksite programs focused on individual cardiovascular risk factors [11], the increasing weight and sedentary lifestyle of workers has led employers and researchers to target obesity and physical activity for work-site interventions in the past decade. Up until the past 5 years, most worksite wellness programs reported in the literature were interventions that targeted individual behavior and did not address aspects of the worksite environment.

Types of Individual-Based Interventions

Worksite programs targeting obesity or risk factors represent a broad range of interventions that focus on nutrition and physical activity behaviors and may also utilize a health risk assessment to estimate an individual's risk of disease or death. These types of interventions include behavior modification, cognitive-behavior modification (self-monitoring, self-reinforcement, acquisition of coping skills), health education, exercise prescription, health risk appraisal, or some combination of these interventions [14••, 22]. Some programs are structured with scheduled individual or group sessions whereas other programs are unstructured with more self-directed approaches [14••]. The Internet has also been tested as a means of delivering worksite behavioral weight management programs [23, 24].

Health risk assessments (HRAs) are a popular tool for worksite wellness programs because they are easy to administer to large populations of workers, are relatively low cost, and convey a lot of information quickly [11, 25••]. Although HRAs vary in their content and

application, Soler et al. [25•] recently defined the basic elements of HRAs as being 1) the assessment of personal health habits and risk factors, with or without physiologic measurements; 2) a quantitative estimation or qualitative assessment of future risk of death or disease; and 3) provision of feedback in the form of education or counseling to reduce future risk of disease.

Effectiveness

Several review articles and meta-analyses have summarized the literature examining the effectiveness of worksite-based behavioral interventions [11, 13, 14••, 25••, 26–28]. A major difficulty in assessing the overall effectiveness is that there is much variation and inconsistency in reporting of the types of interventions, the characteristics of the populations assessed, and the outcomes measured. Many authors have concluded that the overall scientific quality of studies of worksite interventions is poor [14••, 22, 26–28]. Pelletier [27] warns that worksite interventions that do not produce significant results tend not to be published, and this may be responsible for a bias in the literature toward positive outcomes. In 2005, the Center for Disease Control's Task Force on Community Preventive Services published a systematic review of the evidence for the effectiveness of worksite programs to reduce overweight and obesity [13]. The Task force concluded that there was insufficient evidence to determine the effectiveness of a single component worksite intervention that focused on nutrition, physical activity, or other behavioral intervention, but there was sufficient evidence to recommend interventions that combine both physical activity and nutrition components.

The Task Force's systematic review of worksite nutrition and physical activity interventions for controlling employees' weight demonstrated modest improvements in employees' weight at 6 to 12 months with a pooled effect estimate of –2.8 pounds (95% CI, –4.6 to –1.0) and a decrease in body mass index (BMI) of –0.5 (95% CI, –0.8 to –0.2) [14••]. The focus of a program (eg, cardiovascular disease risk reduction, weight loss, diet, or physical fitness) did not influence a program's effectiveness, but this analysis was limited by a small number of studies for each category. Other subgroup analyses showed that programs with multiple components and structured programs for behavior skills development or physical activity were more effective than programs with single components or unstructured (self-directed) approaches. Behavioral counseling was more effective than education or information sessions offered alone [14••]. Another systematic review of worksite weight loss studies conducted between 1995 and 2006 concluded that these programs resulted in modest weight loss (–0.2 to –6.4 kg), but most lacked data on long-term health outcomes [26].

Two separate critical reviews of the literature on worksite physical activity interventions produced conflicting results [22, 28]. Proper et al. [28] concluded that there was strong evidence to support a positive effect of worksite physical activity programs on physical activity, whereas Dishman et al [22] reported that there was no evidence for an effect on physical activity and that the scientific quality of the literature was poor. Few physical activity studies have looked at health outcomes such as blood cholesterol or blood pressure, and the data from the few studies that do evaluate these outcomes is inconclusive for a positive effect [28].

A recent controlled trial of a multi-component work-site nutrition intervention recruited 113 workers with a BMI≥25 kg/m^2 or with a diagnosis of type 2 diabetes [29]. Workers at the intervention site were instructed to follow a low-fat vegan diet and also received group education sessions. At the end of the 22 weeks, the intervention group lost 5.1 kg (vs a gain of 0.1 kg in the control group; $P<0.0001$) but did not have statistically significant differences in total and low-density lipoprotein (LDL) cholesterol, blood pressure, or glycemic outcomes.

Soler et al. [25••] performed a systematic review of worksite interventions that utilized HRAs with feedback alone or HRAs with feedback as part of a broader worksite health promotion program. This analysis found insufficient evidence to support use of HRAs alone, but there was strong evidence of effectiveness of HRAs implemented as part of a broader intervention program on reduction of dietary fat intake, blood pressure, cholesterol, and summary health risk estimates. There was insufficient evidence for body composition and physical fitness. The authors concluded that "the assessment of health risk with feedback has utility as a gateway intervention to a broader worksite health promotion program that includes health education lasting at least 1 h or being repeated multiple times during 1 year and that may include an array of health promotion activities" [25••].

Racette et al. [30] reported on a cohort-randomized trial of 151 employees completing health assessments at baseline at two worksites. One worksite was randomized to the assessment only and the other worksite was randomized to receive the multi-component intervention that included nutrition components, physical activity components, and incentives to promote healthy lifestyle and reduce risk for cardiovascular disease. All study participants received individualized personal health reports based on the assessment. At 1 year, there were significant improvements for both worksites in fitness, blood pressure, and in total, high-density lipoprotein (HDL), and LDL cholesterol. The only changes that were significantly better for the site with the multi-component intervention were BMI and fat mass, leading the authors to conclude that "many of the improvements were achieved with worksite health assessments and personalized health reports in the absence of an intervention."

Results of Internet-based weight management programs conducted at worksites are mixed. Tate et al. [23] conducted a randomized controlled trial of 91 healthy, overweight hospital employees to either an Internet education program or a 24-week Internet behavior therapy program with feedback. All participants had one face-to-face counseling session about weight loss. Attrition was 22% and did not differ between groups. The behavior therapy group lost more weight than the education group at 3 months (4.0 kg vs 1.7 kg; P=0.005) and 6 months (4.1 kg vs 1.6 kg; P= 0.005). Another randomized trial tested the efficacy of a 16-week lifestyle modification program delivered by e-mail to 787 employees of a large healthcare organization [31•]. Participants who were assigned to the intervention chose one of three paths (increasing physical activity, increasing fruits and vegetable intake, or decreasing fat and sugar intake) and received tailored e-mail messages. All outcomes were self-reported and analyzed by intention-to-treat. The intervention group had significant improvements in both the physical activity and dietary outcomes.

A much larger but non-randomized Internet-based weight management program using a comprehensive, interactive online weight management tool was implemented at International Business Machines (IBM) [24]. Employee participants in the program were compared to non-participants using HRA and administrative data. A total of 7,743 employees (5.7% of the total work force) enrolled in the program, and 21% of these participants completed both the baseline and 6-month survey assessing eating habits, stage of change, and weight. The authors reported a small weight loss at 6 months for those who completed both surveys, but in an analysis of a subset of program participants and matched non-participants, there were no significant changes in the average weight change over a 12 month period. The low participation rate, high rate of attrition, and lack of significant differences in weight outcomes are limitations to this study. Although the results from the two randomized trials are promising, the IBM experience highlights some of the difficulties of utilizing an Internet program without any personal interaction.

Summary

Individual-based behavioral worksite interventions appear to have a modest effect on employees' weight, but the evidence for effect on other cardiometabolic risk factors, such as blood pressure, lipids, and glycemia, is inconclusive. Quality randomized trials are often difficult to conduct in the worksite environment due to the high cost of conducting a trial, and therefore much of the available data are based on controlled trials and pre/post-intervention evaluations. Most studies do not evaluate long-term weight and health outcomes, and it is unknown if interventions produce any lasting benefit for workers.

Environmental-Based Interventions to Reduce Obesity

Recently, environmental interventions in the workplace have emerged as promising opportunities to reduce obesity at a population-based level [15, 16]. Environmental interventions can take advantage of both the physical and the social environment of the worksite to change workers' behaviors [16]. In 2004, the National Heart, Lung, and Blood Institute funded seven separate research studies to examine the effects of worksite environmental interventions to reduce obesity [15]. Results of workplace environmental studies to reduce obesity have started to emerge over the past couple of years.

Types of Interventions

The types of environmental interventions tested in the worksite setting differ depending on the size of the worksite, the number of employees, the types of jobs, and the food and physical activity venues available. Many programs combine environmental with individually targeted interventions [16]. Several common themes exist among the programs [16]. Some programs incorporate organizational leadership, interpersonal relationships, and social norms to promote healthier eating habits and physical activity among workers. Other interventions directly target energy-dense foods and physical inactivity by changing vending machine offerings, improving healthy options in the cafeteria, or improving access to gyms or walking paths.

Effectiveness

Goetzel et al. [5•, 17] conducted a 1-year and 2-year evaluation of an environmental weight management intervention at the Dow Chemical Company. In this study, there were nine treatment and three control sites. The treatment aimed to improve employees' physical activity habits, eating habits, and weight management. Employees at all sites were eligible to participate in the HRA and biometric screening programs that provided individual feedback about health risks. The intervention sites utilized environmental prompts and point-of-choice messages that encouraged healthy food choices and physical activity. Half of the intervention sites utilized the organizational culture and leadership to reinforce and encourage health promotion. Overall, 24% of all eligible employees (n=2431) participated in both the baseline and 2-year follow-up HRAs, and 63% of the HRA cohort (n=1521) completed biometric measurements at both time points [5•]. At 2-year follow up, the average weight and BMI was unchanged at the intervention sites but had increased significantly at the control sites. Employees at the intervention sites also had significant improvements in blood pressure and cholesterol. Strengths of this study are the 2-year follow up and the measurement of biometric outcomes, but the high rate of attrition, the quasi-experimental design, and the voluntary nature of participating in outcomes measurements are significant limitations to interpreting the results.

Step Ahead was a pair-matched, randomized controlled trial of an ecologic intervention to prevent weight gain of hospital employees by targeting organizational and social norms related to healthy eating and physical activity at the worksite [18•]. The study was

conducted at six hospitals in central Massachusetts, with three hospitals randomized to the intervention. The 2-year intervention was developed by hospital employee and leadership advisory committees and included a social marketing campaign (ie, newsletters, website), environmental strategies to promote physical activity (ie, stairway signs, outdoor walking routes) and healthy eating (cafeteria signs, farmers' markets), and campaigns and challenges for physical activity, healthy eating, and weight loss goals. A random sample of employees was invited to participate in the outcomes evaluation to determine the effectiveness of the intervention. A total of 806 (56% of eligible) participants enrolled in the study and 648 (80% of enrolled) completed 2-year follow-up. The results of this study demonstrated that intervention and control hospital employees had no significant differences in BMI at 1-year and 2-year follow-up [18•]. Although the baseline response rate for participation in the study was relatively low, the study sample was representative of the entire employee population and the retention rate was high.

Dishman et al. [32•] reported on the efficacy of a 12-week intervention to increase physical activity of employees at Home Depot by targeting features of the workplace environment and employees' motivation by utilizing personal and team goal setting. The intervention encouraged cooperation between senior management and employees by creating joint steering committees and created environmental prompts in the form of signage promoting physical activity. This was a group-randomized trial of 1,442 employees at 16 sites, and the primary outcome was amount of weekly physical activity. At the end of 12 weeks, the intervention group had significant increases in moderate and vigorous physical activity. This study did not measure physical activity outcomes after 12 weeks or any biometric outcomes, and therefore the effect of the program on long-term behavior, weight, or cardiometabolic risk factors is unknown.

Siegel et al. [33•] conducted a randomized controlled trial of 16 school worksites to determine the effectiveness of an obesity intervention utilizing worksite wellness committees of 3 to 10 teachers and administrators to formulate health promotion activities for the school employees. Each intervention school was given $3,500 per year for 3 years to subsidize wellness activities, and each control school was given an unrestricted stipend of $1,000 at baseline and follow up. Most health promotion activities included improving diet (ie, healthy snacks at meetings) or increasing physical activity (ie, walking clubs), and in the second year, the research study sponsored an interschool competition for wellness activities and offered cash prizes. From the 16 schools, data were collected on 413 volunteers at baseline and 340 volunteers at post-intervention, but only 125 employees provided both baseline and post-intervention data. Outcomes were evaluated at the school level rather than the individual level. At the end of 2 years, there was a significant difference in BMI, with a decrease of 0.14 kg/m^2 at the intervention schools and an increase of 0.42 kg/m^2 at the control schools (P=0.047). The intervention did not have a significant effect on waist-hip ratio or weekly minutes of physical activity. A limitation of this study is that anthropometric outcomes at baseline and follow up were based on school sites rather than individuals and, therefore, the amount of exposure to the intervention for each individual is unclear.

As part of a multi-component worksite obesity prevention program for metropolitan transit workers, French et al. [19•] implemented an 18-month intervention to increase the availability and lower the prices of healthier food and beverages in vending machines. Four bus garages were paired on location and number of employees and then two garages were randomized to the intervention. At the intervention sites, the sales of healthy food and beverage items in vending machines increased compared to the control sites. These results are promising but are limited by the fact that the data were collected in aggregate and there is no information about whether individuals made different choices or if new patrons were attracted to the healthy choices.

Summary

Early results of environmental worksite studies are mixed, and the difficulty in obtaining follow-up data from employees limits the interpretation of several of the published studies. It is likely that more data will be forthcoming over the next couple of years and will help clarify whether environmental interventions are effective in reducing obesity among workers.

Cost-Effectiveness of Worksite Programs to Reduce Obesity

From the employer perspective, a major goal of worksite wellness programs is to save money by reducing health care costs, disability, and absenteeism [4]. Most studies that report cost outcomes focus on short-term effects over 1 to 2 years rather than longer-term health outcomes [11]. There is also wide variation in what researchers consider to be the costs and benefits of a program. Pelletier [11] recommends that a longer time period of 3 to 5 years of follow up is needed to estimate the true cost-effectiveness of worksite programs.

Nonetheless, some authors have tried to estimate cost savings of workplace wellness programs. Based on a literature review and case study findings, Koffman et al. [34] concluded that employers can yield $3 to $6 return on investment for each dollar invested over a 2- to 5-year period and improve employee cardiovascular health by investing in worksite health promotion. A separate meta-analysis of the literature on cost-savings resulting from workplace wellness programs estimated that medical costs fell $3.27 for every $1 spent on a wellness program [4]. A return on investment simulation model of workplace obesity interventions estimated that across all overweight and obese employees, a 5% weight loss would result in a reduction of total annual costs of $90 per person [35].

Few studies have looked at the economics of implementing environmental obesity interventions in the workplace. Meenan et al. [20•] recently reported a business case analysis of the 3 W trial, a group-randomized trial of a multi-component worksite weight loss and obesity prevention program conducted over 2 years at 31 hotels in Hawaii. Hotels were randomized to either a minimal (Level 1) or intensive (Level 2) intervention. The Level 1 program (control) included a measure of BMI and a questionnaire with brief feedback on weight and lifestyle choices. The Level 2 program (intervention) included this assessment with feedback plus environmental interventions (ie, newsletters, cafeteria food, contests), weekly onsite groups for all employees, weekly offsite groups for obese employees, and dissemination of training and materials for intervention maintenance at the end of the study. After 2 years, employees from hotels receiving the Level 2 intervention reduced both BMI and waist/hip ratio compared to employees receiving Level 1. The Level 1 (control) program cost $61 per participant and the Level 2 intervention program cost $334 per participant. The business analysis was done from the employer perspective and demonstrated that over 24 months, both the Level 1 and Level 2 programs generated large financial losses ($342,000 for Level 1 and $1.17 million for Level 2) resulting from lack of demonstrable benefits in medical care costs or improvements in absenteeism or presenteeism. Based on these findings, the authors speculated that targeting high-risk subgroups in worksite programs might result in better economic returns.

Conclusions

As worksite interventions to reduce obesity and cardiometabolic risk are becoming more widespread, it is important to evaluate the effectiveness of different types of programs. Although the quality of published studies is somewhat variable, systematic reviews of individual-based behavioral interventions have demonstrated a consistent finding of moderate weight loss, but the data to support reduction of other cardiometabolic risk factors

is inconsistent. Although studies of environmental interventions have several limitations, early results suggest that these interventions may have a small effect on weight and nutrition and physical activity behaviors.

The effect size of worksite interventions is small when considered on an individual basis, but when these results are applied across large populations of workers, the potential impact is much larger. Programs that intervene at multiple levels (host, vector, and environment) are most likely to produce lasting impact on workers' health. A major challenge for employers will be finding the balance between effectiveness and economic viability of worksite programs. Future research of worksite interventions must evaluate both short-term and long-term health and cost-effectiveness outcomes.

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