

A Review and Analysis of the Clinical and Cost-Effectiveness Studies of Comprehensive Health Promotion and Disease Management Programs at the Worksite: Update VII 2004–2008

Kenneth R. Pelletier, PhD, MD(hc)

Objective: To conduct the seventh periodic review and analysis of the clinical and cost-effectiveness research conducted in worksite/corporate environments between 2004 and 2008. **Methods:** A literature search of US-based research was conducted using a multistage process including MEDLINE, ADI, EDGAR, CARL, Inform, Lexis-Nexis, as well as direct inquiries to key researchers in this area of expertise. **Results:** From 2004 to 2008, there were 16 new studies that met the Inclusion/Exclusion criteria. These studies are critiqued and entered into a data table consisting of 13 variables and citations of the 16 new studies. **Conclusions:** Clinical and cost-effectiveness research in the worksite/corporate environment continues to evolve although there was only one randomized clinical trial conducted during the most recent interval. There are innovations in pilot studies, quasi-experimental methodologies, and econometric modeling as indicative of future trends. (J Occup Environ Med. 2009;51:822–837)

This article is the seventh in a series of critical reviews of the clinical and cost-effectiveness studies of comprehensive, multifactorial, health promotion, and disease management programs conducted in corporate worksites. As with these previous reviews, the purpose of this article is to review and assess the experimental and quasi-experimental research trials that have focused on clinical and/or cost outcomes of worksite health promotion and disease management interventions. Comprehensive worksite programs are those that provide an ongoing, integrated, program of health promotion and disease management that integrates specific components into a coherent, ongoing program, which is consistent with corporate objectives and includes program evaluation of clinical and/or cost outcomes. This article focuses on peer review studies published during 2004 to 2008. In terms of identifying emerging trends, this commentary draws upon the previous six reviews as well as the new studies conducted during the last 4 years.

Inclusion and Exclusion Criteria

A comprehensive search was conducted using a multistage process that included a MEDLINE, ERIC, ADI, EDGAR, CARL, Inform, Lexis-Nexis databases, and direct inquiries to worksite researchers and corporate medical directors. This lit-

From the Department of Medicine, University of Arizona School of Medicine, Tucson, Ariz; and Department of Medicine, University of California School of Medicine (UCSF), San Francisco, Calif.

Address correspondence to: Kenneth R. Pelletier, PhD, MD(hc), American Health Association, 1990 North California Blvd., Suite 830, Walnut Creek, CA 94596; E-mail: drkrpelletier@aol.com.

Copyright © 2009 by American College of Occupational and Environmental Medicine

DOI: 10.1097/JOM.0b013e3181a7de5a

erature search, focused on 2004 to 2008, resulted in identifying 16 new studies to which the following inclusion criteria were applied to research conducted in the United States; results published in English; minimal methodological quality of a nonexperimental design with premeasures and postmeasures but no comparison group; quasi-experimental or premeasures and postmeasures with a nonrandomized control group; to a true experimental design with premeasures and postmeasures plus a randomized control group evaluated for clinical and/or cost outcomes. Exclusion criteria were studies research projects conducted outside of the United States and non-English publications. That resulted in the identification of 16 studies for this seventh, analytic review.

Findings Extraction Methods

Finding extraction and analysis of the 16 studies was undertaken by the author and medical student research assistants by extracting the relevant population, intervention design, clinical results, and cost outcomes from the published article. Findings are summarized in a table format as in previous reviews that extracts and describes each study by: 1) study author(s) and publication date; 2) corporate site; 3) purpose of the evaluation; 4) employee population; 5) number of percent of programs participants; 6) number of employees included in the evaluation; 7) brief description of the intervention; 8) evaluation design; 9) evaluation time period; 10) clinical and cost outcomes; 11) research rating; and, 12) most significant findings and conclusions. During the most recent review period, several studies have been conducted using econometric, statistical methodologies rather than formal research designs. To accommodate this innovation, the specific type of econometric modeling is included under the "Intervention Design" column of the Table. Another addition in response to the last 4 years is the inclusion of a new Web site or "url"

column for the studies cited in the table rather than just a hard copy citation. Based on these 16 studies, a brief methodological critique is conducted. Conclusions regarding study quality and new trends during the time period of 2004 to 2008 are discussed.

Major Conclusions

Results from randomized clinical trials and quasi-experimental designs suggest that providing individualized, risk reduction for all employees including high-risk employees within the context of comprehensive programming is the critical element of worksite interventions.¹ Despite the acknowledged limitations of the current methodologies of the 16 new studies during 2004 to 2008, the vast majority of more than 153, including the current 16 studies, research studies to date indicate positive clinical and cost outcomes. There is one important caveat in this and all research that studies, which do not demonstrate statistically significant results, tend not to be published and may result in a publication bias of positive outcomes. It is important to note that there has been a marked decline in both the quantity and quality of studies during 2004 to 2008. With an increasing demand for clinical and cost outcomes to justify corporate investments in health promotion and disease management, this is an ominous trend. Of the 16 studies published in 2004 to 2008, only one was a true experimental design.² This decline in both the number and quality of studies is the lowest than in the previous five reviews and is potentially a major, negative impact on the corporate health promotion and disease management field.

Background

Comprehensive health promotion and disease management programs have evolved significantly in both large and small worksites during the last three decades. Historically, the first published worksite disease management intervention was conducted

in 1974 at Gimbel's Department store in New York City. That early intervention focused on screening asymptomatic employees for hypertension. Based on that screening of 180 employees, there were 94 identified hypertensives who were retained in treatment for 1 year with 81% achieving satisfactory blood pressure reduction.³ An impressive prototype especially since hypertension still remains one of the most poorly controlled risk factors for cardiovascular disease. Large self-insured and self-administered corporate medical plans are placing more emphasis upon comprehensive health promotion and disease management programs.

Inherent to managed care is increasing emphasis on both clinical and cost effectiveness.⁴ With the current generation of worksite programs, there is a greater emphasis upon disease management with high-risk employees, combinations of public health and individualized behavioral risk management, and utilization of telemedicine delivery technologies and inclusion of performance and productivity measures in the economic analyses.^{3,5,6} Disease management programs may be more likely than general health promotion programs to generate return on investment (ROI) because they focus on high-risk individuals who typically impact medical or related costs, such as absenteeism and productivity, in the near term. However, that possibility has yet to be demonstrated by rigorous research. During the 2004 to 2008 interval, 7 of the 16 new studies^{2,7-12} reported positive ROI.

Increasingly, the research evidence supporting both the clinical and cost effectiveness of such programs is becoming more compelling. Previous literature reviews of the clinical and cost outcomes of comprehensive, health promotion and disease management programs in the worksite have been published by this author¹³⁻¹⁸ and other researchers.^{19,20} Based upon these reviews of overall, comprehensive health promotion and disease management pro-

grams in worksites, 137 studies have been cited in a previous series of six reviews.^{13–18} Collectively, these reviews clearly indicate that comprehensive interventions do evidence both clinical and cost effectiveness.^{19–23} Studies cited in this article and in previous reviews are providing corporations, health insurance providers, managed care organizations, consulting firms, and government with the preliminary data to guide program design, implementation, with clinical and cost-outcome evaluations.

Data Sources

For this review and commentary of multifactorial health promotion programs in worksites focused on risk factor and/or disease management, a literature search was conducted using a multistage process that included a MEDLINE, ERIC, ADI, EDGAR, CARL, Inform, and Lexis-Nexis bibliographic search of databases, a manual search of specific journals, a reference list search, and direct inquiries to worksite health promotion and disease management researchers. This search resulted in the identification of 16 new studies, which met the selected by inclusion/exclusion criteria of studies that examined the clinical and/or cost outcomes of such multifactorial programs. Analysis consists of an analytic literature review of the data findings of the new studies from 2004 to 2008 as well as relevant findings from earlier studies and previous reviews.

Inclusion and Exclusion Criteria

For purposes of this analytic review, comprehensive worksite-based health promotion and disease management programs refer to, “Those programs that provide an ongoing, integrated, program of health promotion and disease prevention that integrates the particular components (ie, smoking cessation, stress management, lipid reduction, etc) into a coherent, ongoing program that is consistent with corporate objectives and includes program evaluation.”

This review is limited to articles that meet these criteria. Single-risk factor interventions, even though they might be reported as clinical and cost effective, such as smoking cessation and hypertension screening, are not included. Studies or demonstration projects of a nonexperimental design were also excluded. Anecdotal, purely descriptive, and qualitative studies were excluded. All cited research has been published in peer review journals between 2004 and 2008. All articles were published in English and all research was conducted in worksites in the continental United States.

Findings Extraction and Analysis

Extraction and analysis of the 16 studies was undertaken by the author and medical student research assistants by citing the relevant population, intervention design, clinical results, and cost outcomes from the published article. Each article was read in its entirety, versus the abstract only, to ensure that the reported clinical and cost outcomes were both assessed by an appropriate research design and that the stated results were supported by the reported data. Because it is crucial to consider the methodological rigor of the research methodology included in each study, the resulting table only includes research that fulfills one of three categories: 1) nonexperimental design with preoutcomes and postoutcomes but no comparison group (**); 2) quasi-experimental conducted study with premeasure and postmeasure and a nonrandomized comparison or control group (****); or 3) study with premeasures and postmeasures plus a randomized comparison or control group with clinical and/or cost outcomes (*****). These studies are summarized in Table 1.

Emerging Trends in Worksite Health Promotion and Disease Management Interventions

For the 2000 to 2004 time period, there are 12 significant trends that are evident from this updated review.

Fewer Clinical Trials

An unfortunate, marked decrease in the number of formal randomized, control trials in worksites. Only one study² was conducted as a rigorous, true experimental design or randomized clinical trial (RCT). This may be due to the difficulty in obtaining either government or private foundation funding for such research.

Increase in Demonstration Projects

Based on this observation, there is a major trend toward companies conducting very focused, preexperimental or nonexperimental demonstration disease management programs on areas that are of specific importance to the employer.^{2,7–10,19–27} This trend was first noted in the previous reviews of 2001 and 2004¹⁸ and continues more strongly in the last 4 years. Although these are not at the usual level of randomized control trials sophistication, they do represent both the most significant trends from 2000 through 2004. Although lacking in experimental rigor, the nonexperimental and even preexperimental pilot studies do indicate new areas of innovation for future programs and evaluation using more rigorous methodologies. Such demonstration projects by corporations are commendable especially if they are precursors more formal research designs and analysis.

Observational Studies

Following from this trend is an additional one where companies conduct an observational study to track the preclinical and postclinical and cost outcomes of participants versus nonparticipants in comprehensive worksite programs. Most notable are the Citibank studies conducted by Ozminowski et al.²⁸

Long-Term Follow-Up Studies

Significant, long-term follow-up to existing programs indicating sustained risk, morbidity, and cost reductions at 4 years with Johnson & Johnson²⁹; an ROI analysis conducted by highmark of its employee wellness program dur-

TABLE 1
Summary of Comprehensive Worksite Health Promotion Programs

Study	Purpose of Evaluation	Employee Population	No. or Percent of Program Participants	No. of Employees Included in Evaluation	Intervention Design	Evaluation Design	Evaluation Period	Outcomes	Research Rating	Findings
Goetzel et al., 2005	Estimate the impact of corporate health management and risk-reduction programs for The Dow Chemical Company by using a prospective return-on-investment (ROI) model	All employees	100%	100%	An econometric modeling where the risk and expenditure estimates were derived from multiple regression analyses showing relationships among worker demographics, health risks, and medical expenditures	Multiple regression analyses demonstrating the relationships among worker demographics, risks, and medical expenditures	10 yrs	Findings from this study were incorporated into other components of a business case for health and productivity management, and these supported continued investments in health improvement programs designed to achieve risk reduction and cost savings	***	A "break-even" scenario would require Dow to reduce each of 10 population health risks by 0.17% points per year over the course of 10 yr. More successful efforts at reducing health risks in the population would produce a more significant ROI for the company
vanVonne et al., 2005	To estimate the financial return on investment in a pilot disease management program to manage congestive heart failure (CHF) among members, prior to a full program rollout	3,843	59%	A cohort of 457 participants from the state of Maryland was matched to a cohort of 803 nonparticipants from a neighboring state where the CHF program was not offered	The MULTIFIT program: a CHF disease management program to address risks related to diet, exercise, medication management, and smoking utilizing individualized assessment, education, counseling, and progress monitoring	Outcome measures were the differences over time in medical care expenditures paid by FEP and by all payers. Independent variables included indicators of program participation, type of heart disease, comorbidity measures, and demographics	2 yr	The value of a pilot initiative and evaluation is that lessons for larger-scale efforts can be learned prior to full-scale rollout	***	Estimated return on investment for the pilot CHF disease management program was a savings of \$1.08 in medical expenditure for every dollar spent on the program. Adding savings to other payers as well, the return on investment was a savings of \$1.15 in medical expenditures per dollar spent on the program. The amount of savings depended upon CHF risk levels

(continued)

TABLE 1
(Continued)

Study	Purpose of Evaluation	Employee Population	No. or Percent of Program Participants	No. of Employees Included in Evaluation	Intervention Design	Evaluation Design	Evaluation Period	Outcomes	Research Rating	Findings
Wild et al., 2005	Developed a model-based approach to evaluate the costs and benefits of isocyanate induced asthma surveillance from both an employer and a societal perspective	100,000 employees over 10 yr	100,000 employees over 10 yr	100,000 exposed workers, 18–65 yr old	Surveillance of 100,000 workers exposed to isocyanate resulting in 683 fewer cases of disability over 10 yr	A mathematical simulation to compare annual surveillance to passive case finding. Outcome measures included symptom free days (SFD), quality adjusted life year (QALY), direct costs, productivity losses, and incremental cost effectiveness ratio (CER), measured from the employer and the societal perspectives. Input data were obtained from a variety of published sources	10 yrs	For 100,000 exposed workers, surveillance resulted in 683 fewer cases of disability over 10 yr. Surveillance conferred benefits at an incremental cost of 24,000 dollars/QALY (employer perspective); 13.33 dollars/SFD) and was cost saving from the societal perspective. Results were sensitive to assumptions about sensitization rate, removal rates, and time to diagnosis, but not to assumptions about therapy costs and disability rates	***	Baseline results placed the CER for surveillance for isocyanate asthma within the acceptable range. Costs from the societal and employer perspective differed substantially with a more attractive CER from the societal perspective, suggesting opportunities for employer/societal cost sharing. The analysis demonstrates the value of a model-based approach to evaluate the cost effectiveness of surveillance programs for isocyanate asthma and to inform shared decision making among clinicians, patients, employers, and society
Chenoweth and Garrett, 2006	Assess the cost effectiveness of a worksite clinic	725	100%	725	In-house clinic operational costs were compared with off-site (i.e., community) health care costs	Community cost norms were extracted from statewide databases and adjusted to local costs. Lost productivity costs were based on survey feedback from current clinic users, which included their estimated time away from work if they had to seek health care off-site, average hourly wages, and the number of actual treatments rendered by the on-site staff	1 yr	Overall, it appears the organization's worksite clinic provides employee health care services 2 to 3 times more cost effectively than do off-site health care services	****	Combined off-site costs of dollars 224,461 (health care) and dollars 113,883 (lost productivity) were nearly twice as high as actual on-site operational costs (dollars 171,332)

(continued)

TABLE 1
(Continued)

Study	Purpose of Evaluation	Employee Population	No. or Percent of Program Participants	No. of Employees Included in Evaluation	Intervention Design	Evaluation Design	Evaluation Period	Outcomes	Research Rating	Findings
Herman et al., 2006	Test whether a financial incentive integrated with health benefits for an online physical activity program was associated with increased employee participation and improved health status among participants compared with nonparticipants	126,372	53.30%	67,324	Participation in the Virtual Fitness Center (VFC), an online physical activity program associated with a 150 dollars cash rebate, was assessed	Risk status for 2004 VFC participants and nonparticipants was compared using a health risk appraisal	10–12 wk	A total of 53.8% of total eligible employees were VFC participants and reduced their risk for physical inactivity (8.4% points), life dissatisfaction (2.1), low perception of health (1.9), high-risk status (1.3), smoking (0.4), and high body weight (0.2)	***	Providing a cash incentive is one strategy for encouraging VFC participation and eliciting improved health status in an employer-sponsored, web-based physical activity program
Koehoom et al., 2006	Investigate if work-related musculoskeletal disorders (WMSDs) are associated with increased health care use, over and above workers' compensation benefits, in the period prior to and following a workers' compensation claim indicating gradual progression and declining function associated with musculoskeletal morbidity [Canada]	5,029	549	Injured workers with a WMSD claim (n = 549) compared with a matched group of nonclaim workers	A retrospective follow-up study (1987–1997) whereby existing employee records, workers' compensation records and provincial health care billing records were linked together in order to investigate the patterns of health care use associated with WMSD claims among a study group of hospital workers and a comparison sample of hospital workers without claims	Secondary analysis of employment data, workers' compensation claim data, and provincial (universal) medical services data for a cohort of health care workers; and investigated rates of medical care contacts among injured workers with a WMSD claim (n = 549) compared with a matched group of nonclaim workers. Predictors of health care contacts were estimated using general linear regression	12 mo	The pattern of visits for WMSDs suggests that workers visit general practitioners as part of an ongoing pattern of symptoms, resulting in frequent utilization of health services prior to work disability that is also reflected in health care contacts after return-to-work	***	WMSD injured workers had significantly higher rates of health care contacts associated with a claim compared with noninjured workers, over and above workers' compensation health care benefits. In the final multivariable model, a WMSD claim among injured workers was associated with an estimated 69% (95% CI = 1.50, 1.91) increase in health care use for the 12-mo period immediately after the injury date compared with noninjured workers

(continued)

TABLE 1
(Continued)

Study	Purpose of Evaluation	Employee Population	No. or Percent of Program Participants	No. of Employees Included in Evaluation	Intervention Design	Evaluation Design	Evaluation Period	Outcomes	Research Rating	Findings
Lo Sasso et al., 2006	A cost-benefit analysis of depression treatment under different workplace assumptions better reflecting the nature of employment	Studies conducted at 12 community primary care practices across the United States using workers across the occupational spectrum from companies across the country	Patients presenting for routine visits at these practices between April 1996 and September 1997 were asked to complete a 2-stage screener that identified patients reporting 5 or more of the 9 Diagnostic and Statistical Manual-III-R criteria for major depression in the past 2 wk	National sample of 198 workers employed in a range of positions	Data from a randomized controlled trial in which employed primary care patients with depression were treated in practices randomly assigned to an enhanced treatment intervention or usual care were used to construct a cost-benefit model from an employer perspective under different assumptions regarding employment	Randomized controlled trial	2 yr	Enhanced depression treatment resulted in an average net benefit to the employer of \$30 per participating worker in Year 1 of the intervention and \$257 per participating worker in Year 2, for an estimated ROI during the 2-yr period of 302%	****	ROI increased in firms that rely on team production, hire more costly substitute labor, or realize penalties for output shortfalls. ROI decreased in firms that have a large fraction of employees with dependent coverage and experience high turnover rates. Results also are sensitive to how subjectively reported productivity is valued
Ozminkowski et al., 2006	Estimate savings to Medicare associated with participation in one or more health promotion programs offered to 59,324 retirees from a large employer and their aged dependents	59,324	59,324	59,324	Analyses to demonstrate the impact of membership in each of the four major study groups: HRA only; HRA plus one additional program; HRA plus two or more programs; Other programs but no HRA; and Nonparticipants on changes in medical expenditures over time	Propensity score and multiple regression techniques were used to estimate savings adjusted for demographic and health status differences retirees and dependents who used one or more health promotion services and between elderly nonparticipants	1 yr	Participants who completed a health-risk assessment saved from \$101 to \$648 per person per year. Savings were generally higher as more programs were used, but differences were not always statistically significant	***	Using the health-risk assessment as a guide for health promotion programs can yield substantial savings for the elderly and the Medicare program. The federal government should test health promotion programs in randomized trials and pay for such programs if the results suggest cost savings and better health for Medicare beneficiaries

(continued)

TABLE 1
(Continued)

Study	Purpose of Evaluation	Employee Population	No. or Percent of Program Participants	No. of Employees Included in Evaluation	Intervention Design	Evaluation Design	Evaluation Period	Outcomes	Research Rating	Findings
Franche et al., 2007	Using administrative and self-reported data, the relationship between early return-to-work (RTW) strategies and work absence duration	1,038 eligible and successfully contacted	61%	632 claimants	Cohort of 632 claimants with musculoskeletal injuries. Participants were asked to report the total number of full days of work they missed because of their original workplace injury, from the date of their injury to the date of their 6-mo follow-up interview	Pilot project of Return to Work (RTW) strategies evaluated at 1 mo and 6 mo postinjury. Cox proportional hazard analyses were performed with RTW strategies		Outcomes were 6-mo self-reported work absence duration and time receiving wage replacement benefits from an administrative database. Work accommodation offer and acceptance and advice from health care provider (HCP) to the workplace on reinjury prevention were significant predictors of shorter work absence duration indexed by both self-report and administrative data. Receiving an ergonomic visit was a significant predictor of shorter duration receiving benefits only	****	Analyses using administrative and self-reported indices of work absence generally converged. Work targeted HCP communication with the workplace are critical for effective early RTW interventions
McGrew et al., 2007	Comparing two models of funding services for persons with severe mental illness: fee-for-service and results-based funding (RBF)	Vocational rehabilitation (VR) supervisors and counselors (n= 35) as well as supported employment (SE) program managers and employment specialists (n= 26) were enrolled in a 12-mo evaluation	35	23 RBF and 12 FFS VR staff participants	Quantitative measures of job satisfaction and preference for funding method were obtained prospectively on a quarterly basis, and SE staff activity logs were collected monthly. Qualitative data were collected using a series of focus groups conducted at the conclusion of the study	Mixed randomized and quasi-experimental design		Vocational rehabilitation staff was consistently more satisfied with RBF, expressing particular satisfaction with perceived effectiveness and the payment authorization process. Both VR and SE staff expressed some reservations about RBF, primarily concerning possible pressures for adverse client selection	****	Techniques, such as tiered payments to minimize and prevent adverse client selection, and better training and attention to SE provider concerns, RBF can provide a win-win for all involved

(continued)

TABLE 1
(Continued)

Study	Purpose of Evaluation	Employee Population	No. or Percent of Program Participants	No. of Employees Included in Evaluation	Intervention Design	Evaluation Design	Evaluation Period	Outcomes	Research Rating	Findings
Miller et al., 2007	Estimates the effectiveness and benefit-cost ratio of a peer-based substance abuse prevention program at a US transportation company, implemented in phases from 1988 to 1990	The company's US operations employ 26,000 people spread across 47 states and the District of Columbia	More than 6,500 union and management employees have received Peer-Care training. In early 2000, the 152 active teams included 2,400 employees	?	The PeerCare program focuses on changing workplace attitudes toward on-the-job substance use in addition to training workers to recognize and intervene with coworkers who have a problem. The program was strengthened by federally mandated random drug and alcohol testing (implemented, respectively, in 1990 and 1994)	A retrospective ecological analysis evaluated the impact of Peer-Care using time-series analysis. Using Poisson and linear regression, respectively, to model the association of Peer-Care activity with injury counts and costs	January 1986 to August 1999	The combination of the peer-based program and testing was associated with an approximate one-third reduction in injury rate, avoiding an estimated \$48 million in employer costs in 1999. That year, the peer-based program cost the company \$35 and testing cost another \$35 per employee. The program avoided an estimated \$1,850 in employer injury costs per employee in 1999, corresponding to a benefit-cost ratio of 26:1	***	The findings suggest that peer-based programs buttressed by random testing can be cost-effective in the workplace
Long and Parry, 2007	Evaluating the financial impact of long-term lifestyle management interventions is difficult because of the variability across the program members' enrollment and participation levels. This variability is often referred to as "censored" health claims data. Survival analysis is designed to overcome censored data of various kinds (e.g., disenrollment, loss to follow-up, missing data)	521	Participants (N = 142) in smoking cessation or weight management programs in 1997 were retrospectively matched to non-participants (N = 142)	142	Program interventions included health-risk appraisals, screenings, and telephonic health coaching for weight management and smoking cessation	A quasi-experimental program vs matched reference group study design	1997-2004	Program participants experienced more health care claims but significantly lower cost than nonparticipants. Nonparticipants averaged \$40.77 more per claim than participants. Participants were less likely than nonparticipants to experience a high-cost or outlier claim event. For example, by month 72 nonparticipants had twice the probability of experiencing an outlier claim as participants	****	Effective lifestyle health management may increase low-cost health claims activity, because many patients improve at self-care. As demonstrated here, preventive initiatives result in lower cumulative costs and decrease the risk of high-cost or outlier claim events

(continued)

TABLE 1
(Continued)

Study	Purpose of Evaluation	Employee Population	No. or Percent of Program Participants	No. of Employees Included in Evaluation	Intervention Design	Evaluation Design	Evaluation Period	Outcomes	Research Rating	Findings
Mills et al., 2007	Evaluate the impact of a multicomponent workplace health promotion program on employee health risks and work productivity [At a multinational corporation headquartered in the United Kingdom.]	618 employees; 2,500 control population	43% employee; 49.7% control population	266; 1,242 control population	A multicomponent health promotion program incorporating a health-risk appraisal questionnaire, access to a tailored health improvement web portal, wellness literature, and seminars and workshops focused upon identified wellness issues	Quasi-experimental, before-after intervention-control study.	12 mo	Outcomes were (1) cumulative count of health risk factors and the World Health Organization health and work performance questionnaire measures of (2) workplace absenteeism and (3) work performance	****	After adjusting for baseline differences, improvements in all three outcomes were significantly greater in the intervention group compared with the control group. Mean excess reductions of 0.45 health-risk factors and 0.36 monthly absenteeism days and a mean increase of 0.79 on the work performance scale were observed in the intervention group compared with the control group. The intervention yielded a positive return on investment, even using conservative assumptions about effect size estimation
Pratt et al., 2007	Describes the design characteristics of the National Heart, Lung, and Blood Institute (NHLBI)-funded studies that are testing innovative environmental interventions for weight control and obesity prevention at worksites including hotels, hospitals, manufacturing facilities, businesses, schools, and bus garages located across the United States	Seven separate studies that have a total of 114 worksites (48,000 employees) across studies are being conducted	Across all seven studies about 48% (N = 23,000) of the population is randomly selected for measurements	23,000	Environmental- and individual-level approaches to improve physical activity and promote healthful eating practices. Environmental strategies include reducing portion sizes, modifying cafeteria recipes to lower their fat contents, and increasing the accessibility of fitness equipment at the workplace	Weight scales for body weight/BMI, the Godin survey for assessing physical activity, fast foods, and fruit and vegetable consumption questionnaire, the Work Limitations Questionnaire, short form, to measure worker productivity, and a health care use and absenteeism survey	?	The results of these studies could have important implications for the design and implementation of worksite overweight and obesity control programs	***	The primary outcome measure is change in BMI or body weight after 2 yr of intervention. Secondary measures include waist circumference, objective, and self-report measures of physical activity, dietary intake, changes in vending machines and cafeteria food offerings, work productivity, health care use, and return on investment

(continued)

TABLE 1
(Continued)

Study	Purpose of Evaluation	Employee Population	No. or Percent of Program Participants	No. of Employees Included in Evaluation	Intervention Design	Evaluation Design	Evaluation Period	Outcomes	Research Rating	Findings
Jordan et al., 2008	Using assessment data from the Substance Abuse Treatment Support System, we estimated the economic benefit of chemical dependency treatment to employers	N/A?	Cohort of individuals (N= 498) treated at Kaiser Permanente's Addiction Medicine programs in Southern California	498	A computerized questionnaire that includes demographic items and questions relating to treatment history, motivation, strengths, self-efficacy, and risk factors for dropout and relapse. Quantitative measures include the severity of alcohol, drug, psychiatric, family/social, and medical problems, using the scales of the Addiction Severity Index, and severity of employment problems, using a scale based upon the ASI model. The intake assessment provides a broad range of information relating to the patient's clinical condition, including risk factors for dropout and relapse, and severity data identifying the need for supplemental services based upon a 5-yr study of treatment-services matching	Outpatients at each of the four KPAM programs complete an Substance Abuse Treatment Support System (SATSS) intake assessment upon admission to treatment	Patients are asked to complete an update SATSS assessment after every 30 d of treatment	Compared with intake, subsequent assessments indicated substantial reduction in the number of patients who missed work, were late for work, were less productive than usual at work, and/or had conflict with coworkers or management. The net economic value of these improvements to their employers depended upon the utilization rate of the benefit and the salary level of the employees receiving treatment. For a utilization rate of 0.9% and a mean annual salary of US\$45,000, the net benefit of treatment was US\$1,538 for > or = 61 d of treatment	***	Based solely upon these employment-related measures, without factoring in the medical cost offset or indirect benefits of treatment that may help employees to maintain higher levels of productivity, employers break even on an investment of US\$30 per member per year for a chemical dependency treatment benefit if the mean annual salary of the employees participating in treatment is US\$36,565

(continued)

TABLE 1
(Continued)

Study	Purpose of Evaluation	Employee Population	No. or Percent of Program Participants	No. of Employees Included in Evaluation	Intervention Design	Evaluation Design	Evaluation Period	Outcomes	Research Rating	Findings
Naydeck et al., 2008	Determine the return on investment (ROI) of Highmark Inc.'s employee wellness programs	Employees ranged between 8,936 and 10,105 over the study period	82% of those participating in a wellness program also had biometric screenings done	Almost all (n = 9,666) participated in a wellness program sometime between the yr 2002 and 2005	The Highmark Wellness Program offers health-risk assessments (HRAs), on-line programs in nutrition, weight management and stress management, tobacco cessation programs, on-site nutrition and stress classes, individual nutrition and tobacco cessation coaching, biometric screenings and various 6- to 12-wk campaigns to increase fitness participation, and awareness of disease prevention strategies. Highmark employees are also able to use state-of-the-art fitness centers, located at corporate headquarters	Growth curve analyses compared medical claims for participants of wellness programs vs risk-matched nonparticipants for yr 2001 to 2005. The difference was used to define savings. ROI was determined by subtracting program costs from savings and alternative discount rates were applied in a sensitivity analysis	4 yr	Using sophisticated methodology, this study suggests that a comprehensive health promotion program can lower the rate of health care cost increases and produce a positive ROI	***	Multivariate models estimated health care expenses per person per year as \$176 lower for participants. Inpatient expenses were lower by \$182. Four-year savings of \$1,335,524 compared with program expenses of \$808,403 yielded an ROI of \$1.65 for every dollar spent on the program

***Nonexperimental design with preoutcomes and postoutcomes but no comparison group.

****Quasiexperimental conducted study with premeasure and postmeasure and a nonrandomized comparison or control group.

*****Study with premeasures and postmeasures plus a randomized comparison or control group with clinical and/or cost outcomes.

ing 4 years¹²; and, a prospective ROI projection of the Dow Chemical Company's risk-reduction programs during 10 years.³⁰

Statistical Modeling of Projected Risks and/or Return on Investment

Within the last 4 years, there has been an emergence of predictive statistical modeling to monetize the linkages between changes in risk factors and the subsequent impact on ROI. Among these published research studies are an estimate of the ROI from changes in employee risk factors at Dow³⁰; estimated savings gained from the participation of a Medicare population of 59,324 retirees who used a Health-Risk Assessment compared with those who did not¹¹; and most recently, development of a low cost, accurate ROI estimation model to evaluate outcomes from a worksite-based obesity management intervention.³¹

New Outcome Measures

Development of new measurements to link medical and productivity/performance costs such as the "Presenteeism" or "SPS6" scale³² as well as more sophisticated data integration systems continuing the pioneering research by Burton at BankOne³³ and predictive projections linking medical risks and costs during a 10-year interval.³¹ Also assessments of a positive impact on short-term disability (STD) and long-term disability (LTD)³⁴ and STD only.³⁵

Health and Productivity Management (HPM) Strategies

Very significantly is the extension of ROI analyses to include other outcomes resulting from health interventions such as performance and productivity. Very few newly approved pharmaceuticals actually save money, but they can improve health at a reasonable expense.³² In the pharmacy literature, net increases in spending that are up to \$50,000 may be deemed acceptable or cost effective.

tive, if these dollars will save at least one quality-adjusted year of life.³⁶ However, this widely accepted methodology has rarely been used when considering the value of health improvement programs.³² By contrast, the more demanding objective of realizing net savings has generally been required in evaluations of health and productivity management (HPM) programs. As employers and payers realize that investments in HPM are long term in nature and that there may be a significant lag between improvements in health and savings in medical expenditures or improvements in productivity, the significance of documenting ROI may become more sophisticated. This is more likely to occur if it can be demonstrated that investments that yield cost-effectiveness in the short run will subsequently lead to net cost savings in the intermediate and long run.

Participant Versus Nonparticipant Studies

Employer oriented studies that are purely observational of participants versus nonparticipants^{7,37-40} do demonstrate both clinical and cost outcomes but are confounded by the classical issue of self-selection and noncomparable companion groups.

Preexperimental Studies

Many of the preexperimental studies^{11,24,27,30,40-42} again seem to indicate both clinical and cost effectiveness but in lacking any comparison group, these findings may or may not prove to be substantiated by more rigorous future assessments.

More Sophisticated Economic Analyses

A recent economic analysis of 10 years of economic outcomes from these 12 current studies as well as those cited in previous reviews¹³⁻¹⁷ concluded that the evidence is "very strong for average reductions in sick leave, health plan costs, worker's compensation, and disability costs of slightly more than 25%."⁴³ Whether the clinical

and cost outcomes to date are this positive or not is clearly a matter of different interpretation of the research data to date. However, given the clear methodological flaws in the study designs and evaluations combined with the lack of standardization of the clinical and especially the cost outcomes, this issue remains to be resolved by the future and more rigorous, true experimental, RCTs conducted in worksites over multiple years with adequate follow-up times.

Utilizing New Information Technologies

Information technologies such as personal health records, electronic medical records, interconnectivity, web-based health improvement programs, and information portals will strongly influence the efficiency of health care delivery and health improvement efforts. These technologies will evolve into an interconnected system with appropriate tracking, reminders, oversight, reporting, and communication components. Standardized information systems will enable the sharing of the most basic health information (eg, medical history, diagnostic test results, and vital signs) to the most sophisticated (eg, nanotechnology-based remote biometric screening information).⁴⁴ Such innovations will generate the information infrastructure whereby health promotion services are provided to keep the healthy population well. Furthermore to provide disease, demand, and case management to individuals who are already at high risk, disabled, or with diagnosed chronic conditions to prevent exacerbation of their illness. Seamless health management is required for a sustainable health care system. A significant component of that system is integration of the multidimensional interventions that support the population, including disease management, utilization management, primary care delivery, and health improvement programs.⁴⁵ Additionally, nanotechnology will permit on-

going, noninvasive monitoring and telemetry of an array of vital signs, including heart rate and regularity, aerobic capacity, glucose/insulin levels, blood pressure, sleep patterns, stress levels at the neurophysiological and hormonal level, and other indicators of ongoing health status.⁴⁶ Thus, the process of biometric screening will evolve substantially in the coming years, to take advantage of this new technology. Ongoing, in vivo information for self-care and for remote monitoring of ongoing health and/or illness status may then serve as the basis for developing, maintaining, or enhancing personalized risk management interventions. Superordinate to individual imaging technologies, biomonitors, nanotechnology, and more effective behavioral change will be a "telemedicine" delivery model.¹⁸ Computers, e-mail, cell phones, and other evolving wireless devices will create a convenience of access and use that is known to be a major determinant of sustained healthy behavior. Such a telemedicine model may be more cost effective than our current infrastructure. Although this is yet to be determined, it has the potential for disseminating relevant, timely, and targeted health information to patients and their health care providers.

New Government Funded Studies

At the present time, there are several large studies underway to assess innovative HPM models. Among these studies are the Centers for Medicare and Medicaid Services' Senior Risk Reduction Demonstration,⁴⁷ the National Heart Lung and Blood Institute's Obesity Management in the Workplace studies,⁴⁸ and the Centers for Disease Control and Prevention's Health Protection Research Initiative.⁴⁹ It is likely that such programs will be favorably influenced by these ongoing and newly funded research studies. Further, these studies will increase our knowledge about the relative effec-

tiveness of behavioral change interventions and the manner in which these programs can be delivered most efficiently. Computer-based interactive programs, plus health coaching, specialized referrals, and financial incentives need to be further developed and evaluated. Clinical and cost-effectiveness studies behavior change in such areas as improving pharmacological compliance, weight loss, and smoking cessation are still evolving. Large-scale government research will likely inform future program design and implementation.⁵⁰ Armed with better and more practical data on what works, federal, state, and local governments can play a larger role in disseminating information about evidence-based programs, with the expectation that such dissemination will prompt more employers to adopt them. Through legislative or other initiatives, government agencies may also support financial incentives such as tax credits to encourage employers to implement effective programs.⁵¹ Collaborative research efforts between the public and private sector are an encouraging direction.

One question that frequently arises is what type or types of interventions are most successful either in terms of implementation and/or outcomes. There is no readily generalizable answer to that question. As a best approximation, it is useful to consider the area of “best practices” of such interventions. As a caveat, it is important to note that not all workplace health promotion programs are created equal. There is a great deal of variation in program design and execution. To address what constitutes the best and promising practice, a necessary first step is to examine the outcomes of the most effective programs.^{52–55} By analyzing a series of benchmarking studies, it is possible to identify common themes. One such review⁵⁶ identified six elements frequently found among best practices: 1) organizational commitment; 2) incentives for employees to participate; 3) effective screening and

triage; 4) state-of-the-art theory and evidence-based interventions; 5) effective implementation; and, 6) ongoing program evaluation. Similarly, another assessment of the best practices components⁵⁴ identified the following characteristics of sustainable programs: 1) linking of program to business objectives; 2) executive management support; 3) effective planning; 4) employee input when developing goals and objectives; 5) wide variety of program offerings; 6) effective targeting of high-risk individuals; 7) incentives to motivate employees to participate in the program, leading to high participation rates; 8) program accessibility; 9) effective communications; and, 10) evaluation of effectiveness. Many of the studies cited in this review as well as in the six prior publications, do have many but not all of these characteristics. Although not definitive, these checklists do provide a set of “best practices” that are more likely than not to insure a successful intervention in terms of both implementation and outcomes.

Methodological Critique

Methodological rigor of worksite health promotion evaluation and disease management studies has evolved considerably during the past three decades. Methodological challenges continue to be formidable, and further innovation and refinement are necessary. All of the currently reviewed studies indicate favorable clinical and/or cost outcomes. As in the previous six reviews, there are caveats and limitations to all of these studies in terms of the actual research design, participation rates, attrition from the sample, self-selection, duration of the intervention, time intervals on follow up, publication bias, cost outcomes and/or ROI documentation, as well as the inherent limitations of non-experimental demonstration and pilot projects.

Discussion and Future Recommendations

For the 16 studies cited during the 2004 to 2008 time period, there is an increase in a trend toward a decrease in the number of formal randomized, control trials or quasi-experimental designs in worksites. This may be due to the difficulty in obtaining either government or private foundation funding for such research. However, it may indicate an acknowledgment of the limitations of the randomized, control trial especially in worksite programs. According to the report of the WHO European Working Group on Health Promotion Evaluation (Health Promotion Evaluation: Recommendations to Policymakers, WHO, 1998), “The use of randomized control trials to evaluate health promotion initiatives is, in most cases, inappropriate, misleading and unnecessarily expensive.”⁵⁷ Based on this observation, there is a significant trend toward companies conducting very focused preexperimental, pilot projects in disease management areas that are of specific importance to the employer and evaluating such interventions as pre and post demonstration projects with clinical and/or cost outcomes.^{58–63} Such focused disease management interventions are clearly of more extensive use among employers in the last 4 years compared to formal, randomized, control trials.

Conclusion

In reviewing the studies here, the most promising future directions seem to be with disease management programs that combine comprehensive plus high-risk interventions that focus on a dose response model of increasing levels of intensity. Although it is difficult and costly to conduct, randomized trials, such studies would greatly contribute to our understanding of what constitutes an effective intervention in terms of both clinical and cost outcomes. Results of the comprehensive, multifactorial, health promotion, and disease management interventions in worksites

reviewed here provide guarded cautious optimism about the clinical and/or cost effectiveness of these worksite programs. Additionally, they provide initial insights regarding the critical components and characteristics of successful programs. It is significant to note that in May of 2004, the Centers for Disease Control issued the first major request for research proposals focused on clinical and cost outcome evaluations of worksite focused interventions. At this time, the most salient issue for managed care organizations and corporations to address is not whether worksite health promotion and disease management programs should be implemented to reduce risks and enhance productivity, but rather how such programs should be designed, implemented, and evaluated to achieve optimal clinical and cost effectiveness.

References

- Whitmer RW, Pelletier KR, Anderson DR, Basse CM, Frost GJ. A wake up call for corporate America. *J Occup Environ Med.* 2003;45:916–925.
- Lo Sasso AT, Rost K, Beck A. Modeling the impact of enhanced depression treatment on workplace functioning and costs: A cost-benefit approach. *Med Care.* 2006;44:352–358.
- Alderman MH, Schoenbaum EE. Detection and treatment of hypertension at the work site. *N Engl J Med.* 1975;2:65–68.
- Sherman B. Worksite health promotion—a critical investment. *Dis Manag Health Outcomes.* 2002;10:101–108.
- Heaney CA, Goetzel RZ. A review of health-related outcomes of multicomponent worksite health promotion programs. *Am J Health Promot.* 1997;11:290–307.
- Stokols D, Pelletier K, Fieldings J. Integration of medical care and worksite health promotion. *JAMA.* 1995;273:1136–1142.
- vanVonno CJ, Ozminkowski RJ, Smith MW, et al. What can a pilot congestive heart failure disease management program tell us about likely return on investment? A case study from a program offered to federal employees. *Dis Manag.* 2005;8:346–360.
- Chenoweth DH, Garrett J. Cost-effectiveness analysis of a worksite clinic: is it worth the cost? *AAOHN J.* 2006;54:84–89.
- Pratt, CA, Stevens J, Daniels S. Design characteristics of worksite environmental interventions for obesity prevention. *Obesity.* 2007;15:2171–2180.
- Jordan N, Grissom G, Alonzo G, Dietzen L, Sangsland S. Economic benefit of chemical dependency treatment to employers. *J Subst Abuse Treat.* 2008;34:311–319.
- Ozminkowski RJ, Goetzel RZ, Wang F, et al. The savings gained from participation in health promotion programs for Medicare beneficiaries. *J Occup Environ Med.* 2006;48:1125–1132.
- Naydeck BL, Pearson JA, Ozminkowski RJ, Day BT, Goetzel RZ. The impact of the highmark employee wellness programs on 4-year healthcare costs. *J Occup Environ Med.* 2008;50:146–156.
- Pelletier KR. A review and analysis of the health and cost-effective outcomes studies of comprehensive health promotion and disease prevention programs. *Am J Health Promot.* 1991;5:311–315.
- Pelletier KR. A review and analysis of the health and cost-effective outcome studies of comprehensive health promotion and disease prevention programs at the worksite: 1991–1993 update. *Am J Health Promot.* 1993;8:43–49.
- Pelletier KR. A review and analysis of the health and cost-effective outcome studies of comprehensive health promotion and disease prevention programs at the worksite: 1993–1995 update. *Am J Health Promot.* 1996;10:380–388.
- Pelletier KR. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: 1995–1995 update (IV). *Am J Health Promot.* 1999;13:333–345.
- Pelletier KR. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: 1998–2000 update. *Am J Health Promot.* 2001;16:107–116.
- Pelletier KR. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: update VI: 2000–2004. *J Occup Environ Med.* 2005;47:1051–1058.
- Leutzinger JA, Ozminkowski RJ, Dunn RL, et al. Projecting health care costs using the HERO database and prevalence rates of lifestyle risks at Union Pacific Railroad. *Am J Health Promot.* 2000;15:35–44.
- Wright DW, Beard MJ, Edington DW. Association of health risks with the cost of time away from work. *J Occup Environ Med.* 2002;44:1126–1134.
- Wasserman J, Whitmer RW, Bazarre RL, et al. Gender-specific effects of modifiable health risk factors on coronary heart disease and related expenditures. *J Occup Environ Med.* 2000;42:1060–1069.
- Musich S, Napier D, Edington DW. The association of health risks with workers' compensation costs. *J Occup Environ Med.* 2001;43:534–541.
- Ramsey S, Summers KH, Leong SA, et al. Productivity and medical costs of diabetes in a large employer population. *Diabetes Care.* 2002;25:23–29.
- Koehoorn M, Cole DC, Hertzman C, Lee H. Health care use associated with work-related musculoskeletal disorders among hospital workers. *J Occup Rehabil.* 2006;16:411–424.
- Franché RL, Severin CN, Hogg-Johnson S, Côté P, Vidmar M, Lee H. The impact of early workplace-based return-to-work strategies on work absence duration: a 6-month longitudinal study following an occupational musculoskeletal injury. *J Occup Environ Med.* 2007;49:960–974.
- McGrew JH, Johannesen JK, Griss ME, Born DL, Katuin CH. Performance-based funding of supported employment for persons with severe mental illness: vocational rehabilitation and employment staff perspectives. *J Behav Health Serv Res.* 2007;34:1–16.
- Miller TR, Zaloshnja E, Spicer RS. Effectiveness and benefit-cost of peer-based workplace substance abuse prevention coupled with random testing. *Accid Anal Prev.* 2007;39:565–573.
- Ozminkowski RJ, Goetzel RZ, Smith MW, Cantor RI, Shaughnessy A, Harrison M. The impact of the Citibank, NA, health management program on changes in employee health risks over time. *J Occup Environ Med.* 2000;42:502–511.
- Goetzel RZ, Ozminkowski RJ, Bruno JA, Rutter KR, Isaac F, Wang S. Long-term impact of Johnson & Johnson's Health & Wellness Program on employee health risks. *J Occup Environ Med.* 2002;44:417–424.
- Goetzel RZ, Ozminkowski RJ, Baase CM, Billotti GM. Estimating the return on investment from changes in employee health risks on the Dow Chemical Company's health care costs. *J Occup Environ Med.* 2005;47:759–764.
- Baker KM, Goetzel RZ, Pei X, et al. Using a return-on-investment estimation model to evaluate outcomes from an obesity management worksite health promotion program. *J Environ Occup Med.* 2008;50:981–986.
- Koopman C, Pelletier KR, Murray JF, et al. Stanford Presenteeism Scale: health

- status and employee productivity. *J Occup Environ Med.* 2002;44:14–20.
33. Burton WN, Conti DJ. Disability management: corporate medical department management of employee health and productivity. *J Occup Environ Med.* 2000; 42:1006–1012.
 34. Schultz AB, Lu CF, Barnett TE, et al. Influence of participation in a worksite health-promotion program on disability days. *J Occup Environ Med.* 2002;44:780.
 35. Serxner S, Gold D, Anderson D, Williams D. The impact of a worksite health promotion program on short-disability usage. *J Occup Environ Med.* 2001;43:25–29.
 36. Haynes G, Dunnagan T. Comparing changes in health risk factors and medical costs over time. *Am J Health Promot.* 2002;17:112–121.
 37. Stein A, Shakour S, Zuidema R. Financial incentives, participation in employer-sponsored health promotion, and changes in employee health and productivity: HealthPlus Health Quotient Program. *J Occup Environ Med.* 2000;42:1148–1155.
 38. Serxner S, Gold D, Grossmeier J, Anderson D. The relationship between health promotion program participation and medical costs: A dose response. *J Occup Environ Med.* 2003;45:1196–1200.
 39. Herman CW, Musich S, Lu C, Sill S, Young JM, Edington DW. Effectiveness of an incentive-based online physical activity intervention on employee health status. *J Occup Environ Med.* 2006;48: 889–895.
 40. Wild DM, Redlich CA, Paltiel AD. Surveillance for isocyanate asthma: a model based cost effectiveness analysis. *Occup Environ Med.* 2005;62:743–749.
 41. Stave G, Muchmore L, Gardner H. Quantifiable impact of the contract for health and wellness: health behaviors, health care costs, disability, and workers' compensation. *J Occup Environ Med.* 2003; 45:109–117.
 42. Aldana SG, Merrill RM, Price K, Hardy A, Hager R. Financial impact of a comprehensive multisite workplace health promotion program. *Prev Med.* 2005;40: 131–137.
 43. Chapman L. Meta-evaluation of worksite health promotion economic return studies. *American Journal of Health Promotion - Art of Health Promotion Newsletter.* January/February 2003:1–8.
 44. Disparity Reducing Advances (DRA) Project. *The Biomonitoring Futures Project: Final Report and Recommendations.* Available at: www.altfutures.com/bfp. Accessed March 30, 2007.
 45. Stone B. *Social Networking's Next Phase.* New York Times. March 3, 2007. Available at: http://www.nytimes.com/2007/03/03/technology/03social.html?ei=5090&en=f71af17a000673a4&ex=1330578000&adxnnl=0&partner=rssuserland&emc=rss&adxnnlx=1172938042-ykmcfkRFvjEqnR2pLPd9FA&page_wanted=all. Accessed March 30, 2007.
 46. Institute for Alternative Futures. *The 2029 Project—Achieving an Ethical Future for Biomedical R&D.* Available at: <http://www.altfutures.com/2029/The%202029%20Report.pdf>. Accessed March 30, 2007.
 47. Goetzel RZ. *Senior Risk Reduction Demonstration (SSRD).* Baltimore, MD: Centers for Medicare Medicaid Services. 2006. Available at: http://www.cms.hhs.gov/DemoProjectsEvalRpts/downloads/Senior_Risk_Reduction_Solicitation.pdf. Accessed May 19, 2009.
 48. Goetzel RZ, Stapleton D, DeJoy D, Wilson M, Ozminkowski RJ. *Environmental Approaches to Obesity Management at The Dow Chemical Company.* RFA-HL-04-006, Sponsor Agreement ID: 1 R01 HL079546 2004. Bethesda, MD: National Heart Lung and Blood Institute.
 49. Goetzel RZ, Ozminkowski RJ, Luisi D. *Worksite Health Promotion.* Public Private Partnerships RFA-CD-04-002, 1 R01 DP000096-01. Atlanta, GA: Centers for Disease Control and Prevention; 2004.
 50. O'Donnell MP. Health promotion advocates history and current focus. The art of health promotion. *Am J Health Promot Suppl.* 2005;1–12.
 51. O'Donnell MP. The rationale for federal policy to stimulate workplace health promotion programs. *N C Med J.* 2006;76: 455–457.
 52. Goetzel RZ, Ozminkowski RJ, Ascuitto AJ, Chouinard P, Barrett M. Survey of Koop Award winners: life-cycle insights. *Art Health Promot (Am J Health Promot Suppl).* 2001;5:2–8.
 53. Goetzel RZ, Ozminkowski RJ, Pelletier KR, Metz D, Chapman L. Emerging trends in health and productivity management. *Am J Health Promot.* 2007;22:1–10.
 54. O'Donnell M, Bishop C, Kaplan K. Benchmarking best practices in workplace health promotion. *Art Health Promot (Am J Health Promot Suppl).* 1997;1:1–8.
 55. WELCOA: Wellness Councils of America. 2007. *Seven Benchmarks of Success.* Available at: <http://www.welcoa.org/wellworkplace/index.php?category=2>. Accessed May 19, 2009.
 56. Goetzel RZ. Essential building blocks for successful worksite health promotion programs. *Manag Employ Health Bene.* 1997;6:1–6.
 57. Bauer RL, Heller RF, Challah S. United Kingdom Heart Disease Prevention Project: 12 year follow-up of risk factors. *Am J Health Promot.* 1985;121:563–569.
 58. Pescatello LS, Murphy D, Vollono J, Lynch E, Bernene J, Costanzo D. The cardiovascular health impact of an incentive worksite health promotion program. *Am J Health Promot.* 2001;16:16–20.
 59. Poole K, Kumpfer K, Pett M. The impact of an incentive-based worksite health promotion program on modifiable health risk factors. *Am J Health Promot.* 2001; 16:21–26.
 60. Tucker LA, Clegg AG. Differences in health care costs and utilization among adults with selected lifestyle-related risk factors. *Am J Health Promot.* 2002;211–213.
 61. Mills PR, Kessler RC, Cooper J, Sullivan S. Impact of a health promotion program on employee health risks and work productivity. *Am J Health Promot.* 2007;22: 45–53.
 62. Wang F, Schultz AB, Musich S, McDonald T, Hirschland D. The relationship between national heart, lung and blood institute weight guidelines and concurrent medical costs in a manufacturing population. *Am J of Health Promot.* 2003;17:183–189.
 63. Long DA, Parry TL. An application of survival analysis to population health management program evaluation. *Am J Health Promot.* 2007;21:529–533.