Research Compendium

The NIOSH Total Worker Health™ Program: Seminal Research Papers

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DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

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Foreword

In October 2004, NIOSH and our partners sponsored the Steps to a Healthier U.S. Workforce symposium. The symposium marked the launch of a new initiative, based on a comprehensive view of worker safety and health, that explored all avenues that affect the health of workers. The "Steps" symposium brought together leaders from the occupational safety and health community with leaders from the health promotion community to explore ways in which an integrated approach could help improve the protection and promotion of worker health. The symposium was developed around the themes of research, practice, and policy related to the integration of health protection and health promotion. In planning the symposium, NIOSH commissioned three white papers to examine the state of the science, stimulate discussion, and improve communication between researchers and practitioners in the fields of worksite health promotion and occupational safety and health.

These formative papers established the rationale for expanding research on the benefits of integrated programs to improve the health of workers and workplaces. They are widely cited and are considered seminal writings on the science and practice of integrating health protection and health promotion. In the 7 years that have elapsed, interest in integrated approaches to worker health and safety has mushroomed. Because of these developments, we asked the authors to update their papers and, as a service to NIOSH stakeholders, we have assembled them together into a single compendium to facilitate their dissemination and accessibility.

In the past 7 years, NIOSH has remained steadfast in its commitment to advancing efforts to improve workplace health and safety through multi-faceted approaches. Following the "Steps" symposium, NIOSH implemented a WorkLife Initiative under which we funded three extramural Centers of Excellence to further explore and research these concepts. In 2011, we renewed funding for those three Centers and added a fourth. As we set our sights on future directions for 2012 and beyond, NIOSH has also begun building a comprehensive intramural and extramural research program for Total Worker Health™ that builds on the progress under the "Steps" symposium and WorkLife Initiative.

As we work together to confront the challenges facing the American workforce, NIOSH believes that integrating the protection of worker health and safety with evidence-based health promotion will be a key strategy for building a strong economy on the foundation of safe jobs and healthy workers. All of us at NIOSH working in Total Worker Health™ hope that you find this document informative and that it inspires you to be creative in your efforts to pursue new research, implement new prevention practices and policies, and celebrate success stories illustrating the benefits of integrated approaches to total worker health.

John Howard, M.D.

Director, National Institute for Occupational Safety and Health

Abstract

Prior to the 2004 Steps to a Healthier U.S. Workforce symposium, sponsored by NIOSH and partners, NIOSH commissioned three white papers to examine the state of the science, stimulate discussion, and improve communication between researchers and practitioners in the fields of worksite health promotion and occupational safety and health. These papers, which were presented at the symposium, continue to be widely referenced in the scientific literature and reports. In preparation for this research compendium, the authors have updated their original papers to reflect recent developments in the field and to reinforce the need for programs with integrative approaches to worker health and safety.

"Steps to a Healthier U.S. Workforce: Integrating Occupational Health and Safety and Worksite Health Promotion: State of the Science" by Drs. Glorian Sorensen and Elizabeth Barbeau provides an overview of the scientific evidence for enhancing worker and worksite health by integrating worksite health promotion and occupational health and safety. The paper also introduces a framework for future research in this arena that emphasizes trans-disciplinary research teams in order to develop concepts and models that incorporate diverse perspectives.

"Examining the Value of Integrating Occupational Health and Safety and Health Promotion Programs in the Workplace" by Dr. Ron Goetzel focuses on building a business case for the integration of health protection and health promotion based on the fact that poor worker health not only affects direct medical expenditures but also productive work output. The paper describes the business strategy of Health, Safety, and Productivity Management centered on a four-phase model for integration with a rationale to remove the "silos" of accountability to achieve greater health and cost efficiencies.

"The Economics of Integrating Injury and Illness Prevention and Health Promotion Programs" by Drs. Seth Seabury, Darius Lakdawalla and Robert Reville describes an economic analysis of the gains of an integrated approach to health and safety by recognizing that many adverse health conditions have both occupational and non-occupational factors. The authors also discuss the policy implications of these findings in light of the escalating cost of health care in the US and a growing need to determine which combinations of health conditions represent the best targets for an integrated approach.

Together, these three papers establish a scientific rationale for integrating health promotion and health protection programs to prevent worker injury and illness and to advance health and well-being.

Contents

Steps to a Healthier U.S. Workforce

Integrating Occupational Health and Safety and Worksite Health Promotion: State of the Science

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Preface

The health and well-being of working people and their families are greatly influenced by the quality of their work environments, whether resulting directly from exposures to physical hazards on the job and risks associated with the organizational context, or indirectly through the impact of work on health behaviors. In recognition of these shared influences, this paper was written for Steps to a Healthier U.S. Workforce symposium, sponsored by the National Institute for Occupational Safety and Health (NIOSH) in 2004. The paper provided an overview of the scientific evidence available at that time for enhancing worker and worksite health by integrating worksite health promotion and occupational health and safety, and it introduced a framework for future research in this arena. Since then, significant progress has been made in support of integrated approaches to worker health. Notably, NIOSH has expanded its commitment to this approach to worker health. It successfully initiated the Total Worker Health™ program (formerly the WorkLife Initiative), and as part of this initiative, NIOSH funded three Centers for Excellence, including at the University of Iowa, the University of Massachusetts/Lowell, and the Harvard School of Public Health. The three centers collaborated on a *Statement on National WorkLife Priorities*,[1] and findings from their research are becoming available. With input from experts in the field, NIOSH also developed a set of "essential elements" of effective workplace programs and policies for improving worker health and wellbeing, as described on their Web link.[2]

Attention to an integrated approach to worker health has extended well beyond NIOSH. The Institute of Medicine released a pivotal report articulating both the rationale for an integrated approach to worker health, and providing a structure for the implementation of such an approach.[3] The American Heart Association endorsed efforts to integrate worksite health protection and worksite health promotion for cardiovascular health promotion.[4] In addition, the National Institutes of Health established the Work, Family, and Health Network, which is developing and evaluating the effects of worksite work-family policies and practices that impact health of workers and their families.[5] In addition, in recent healthcare reform policies, an emphasis on workplace health has placed increased attention on the implementation of evidence-based workplace wellness programs in an effort to expand utilization of such programs.

In 2009, the National Heart, Lung, and Blood Institute; NIOSH; the Centers for Disease Control and Prevention; the National Institute for Child Health and Human Development; and the National Cancer Institute, together convened a workshop to set priorities for research to support chronic disease prevention in the workplace. The discussions focused on promoting healthy and safe individual behaviors; reducing physical, psychosocial, and organizational risks at the worksite; and promoting work-life balance. The resulting recommendations[6] articulate a research agenda addressing cross-cutting research themes across these three targets. The six broad priorities for future research identified by the workshop reinforce the research directions outlined in our original "Steps" paper:

Assessment of intervention efficacy and characteristics associated with efficacy: Much research on worker health conducted to date has continued to focus separately on one of the three targets—worker health behavior outcomes, the work environment, or the work-family interface. The workshop participants placed a high priority on future research to test the effects of integration across these three intervention targets, with a particular focus on identifying opportunities for synergy.

Attending to population, job, and worksite characteristics: Disparities in worker health outcomes, exposures on the job, and access to interventions underscore the need for research to identify strategies to reduce

these inequalities. The recommendations included the need for attention to disparities by occupation, gender, age, socio-economic position, race/ethnicity, or other characteristics.

Use of appropriate study designs and methods: There remains a need for studies across phases of research, from hypothesis testing and methods development, to efficacy and effectiveness studies, to knowledge transfer and implementation science. Going beyond sole reliance on randomized controlled trials, it is important that our collective research portfolio also include natural experiments; in-depth, mixed methods, or comparative case studies; multi-level designs; and the application of participatory research methods.

Application of appropriate and expanded measures and metrics: With increasing research being conducted by researchers from diverse disciplines, it is important that common, standardized measures be used where possible to allow for comparisons across studies. The workshop participants stressed the need for improved occupational exposure assessments for integrated work environment and health promotion interventions, and for the development of standard measures of costs and evaluations of returns on investment.

Studying sustainability and knowledge transfer: In order to accelerate the adoption of tested interventions, there is a persistent need for worksite research on the processes of dissemination and implementation. Research directions include identifying effective ways to engage worksites and organizational leaders, examining the impact of financial and other incentives on motivating worksite participation in chronic disease prevention, and assessing barriers to effective intervention delivery.

Addressing global concerns: The increasing relevance of the global economy underscores the need for research on the use of effective worker health promotion and health protection efforts beyond the U.S. borders.

To advance this research agenda, the need for promoting trans-disciplinary research teams and improved collaboration remains. Collaborative efforts spanning disciplinary boundaries remain a core strategy in engaging the necessary diverse perspectives. Trans-disciplinary research additionally pushes toward the development of new common conceptual frameworks that synthesize models used in any one discipline.[7–9] The broadening base of institutional commitment and support for research on worker health and the work environment can serve as increased incentives for expanding beyond our disciplinary boundaries, and it holds promise for improving worker health outcomes.

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Abstract

This paper presents the rationale and scientific evidence for coordinating and integrating worksite health promotion and occupational health and safety as a means of enhancing the effectiveness of efforts to promote and protect worker health. Commissioned by NIOSH for its 2004 Steps to a Healthier U.S. Workforce symposium, this paper is intended to stimulate discussion and improve communication between the fields of worksite health promotion and occupational safety and health. We describe the parameters of each approach and suggest common goals and areas to increase coordination, with special attention to the implications of a rapidly changing labor market on future research priorities. We present recommendations for future research, barriers to be overcome to advance knowledge in this area, and suggestions for creating additional opportunities for scientists from a broad range of disciplines to engage in integrated occupational health and safety/worksite health promotion research aimed at improving worker health.

Introduction

In this paper, we review the scientific evidence for coordinating and integrating worksite health promotion and occupational health and safety as a means of enhancing the effectiveness of efforts to promote and protect worker health. The overall aim of this paper is to introduce the parameters for a research agenda aimed at improving worker health through such integrated and coordinated efforts.

Specifically, we summarize here the rationale for integrating occupational safety and health (OSH) and worksite health promotion (WHP). As a basis for considering integration of these fields, we briefly examine the types of research conducted to date examining the efficacy of occupational health and safety interventions and of worksite health promotion interventions, although we note that a full review of these literatures is beyond the scope of this paper. We review the emerging evidence on the efficacy of integrated interventions targeting occupational health and safety and worksite health promotion together. We hope that this paper might serve as a bridge to improve communication between the fields of worksite health promotion and occupational health and safety. With that in mind, we have sought to clarify the parameters of each approach and suggest common goals and areas to increase coordination. We use this review as the foundation for recommended research priorities and future directions.

As we described in an earlier paper,[1] NIOSH concluded in 1984 that simultaneously addressing worksite occupational safety and health and worksite health promotion would "make possible a 'synergism of prevention' to improve the health of workers through comprehensive risk reduction."[2] As illustrated in Figure 1, in this paper we define occupational safety and health and worksite health promotion as the content being addressed by intervention efforts potentially aimed across multiple levels of influence.[3,4] At the individual/interpersonal level, interventions aim to educate individual workers and build social norms supportive of worker health, for example through educational classes or one-on-one training programs. Interventions at the environmental/organizational level of influence aim to modify the work environment or organization in support of worker health outcome. By the term "environmental/organizational," we mean to encompass both the work environment or organization, including for example work climate and organizational policies; and the physical environment, including for example the potential for exposures to dusts, fumes, vapors, noise, ambient temperature, and other potential hazards. Increasingly, interventions are coordinating efforts across the individual/interpersonal and environmental/organizational levels in recognition of the mutually reinforcing capabilities of comprehensive approaches to worker health, which we term here multi-level interventions.[5,6]

OSH interventions are designed to minimize workers' exposures to job-related risks, including exposures to physical, biological, chemical, ergonomic, and psychosocial hazards.[7] These interventions may include changes in the organization and environment, such as the use of product substitution, engineering controls, and job redesign, as well as through individual efforts, including use of personal

Figure 1. Matrix of interventions supporting worker health

Content	Level of Influence		
	Individual/Interpersonal	Organization/Environment	Multi-Level
Occupational health and safety (OSH)			
Health promotion (WHP)			
Integrated OSH/WHP			

protective equipment, generally seen as a supplemental measure. These interventions are predominantly within the domain of management decisions, rather than of individual worker actions,[8,9] and may also be the subject of joint decision-making by labor and management through collective bargaining or less formal means.

Individual health-related behaviors are the prime target of WHP, which aims to promote healthy behaviors such as not using tobacco, weight control, a healthy diet, physical activity, seat belt use, influenza vaccinations, adherence to screening guidelines (e.g., mammography screening, blood pressure, cholesterol), substance abuse prevention, case management (e.g., diabetes), and sun exposure prevention, as key examples.[10–12] In a classic article, Walsh and her colleagues termed behavioral or personal exposures "life risks," to be differentiated from occupational exposures they termed "job risks."[13] Worksites provide an important setting for influencing life risks through educational efforts designed to reach large numbers of workers not accessible through other channels. Worksites offer the potential for support of long-term behavior changes, mobilization of peer support, use of environmental supports, and the possibility of offering comprehensive multi-level interventions repeatedly over time as a means of building and sustaining interest in behavior changes.[9,14–17] In general, corporate interest in and support for worksite health promotion has been considerable.[4,18]

Despite addressing differing subject matter and aims, occupational health and safety and worksite health promotion clearly share the common goal of promoting worker health, with complementary functions in protecting and enhancing the health of workers, and they thereby provide an important opportunity for coordinated and integrated efforts.[1,5,19,20] Coordination between occupational health and safety and health promotion in the workplace has not been the norm in the United States, however. The two fields approach their objectives with differing assumptions, set differing priorities, and utilize different methods. Understanding the distinct underpinnings of these two fields may shed light on historic and present-day tensions associated with the integration of occupational health and safety and worksite health promotion, and this can set the stage for productive dialogue toward a shared goal of improving worker health.

Flourishing worksite health promotion efforts over the past two decades have often spawned concerns and suspicions within the field of occupational safety and health that employers are shifting the burden for worker health away from management to individual workers.[8,13,21–23] This trend may reflect a shift in public health practice away from environmental/organizational determinants of disease to a focus on individual risk-taking behaviors, indicative of a broader political movement toward reducing corporate social and environmental responsibility.[23] In this vein, resources for workplace public health

practice have been increasingly directed toward improving workers' personal health behaviors, such as smoking, diet, and exercise, while de-emphasizing traditional occupational health and safety issues such as physical exposures and stressful working conditions. Even within the field of occupational safety and health, behavior-based safety programs have become prominent, directing attention toward "accident-prone" workers rather than redesigning hazardous processes.[23] Thus, for example, while many unions and working people recognize that smoking is a health threat, they may be mistrustful of worksite health promotion programs that provide smoking cessation services but ignore workplace safety concerns. It is therefore not surprising that relationships between health promotion professionals and those in occupational health and safety may be strained, particularly in situations where there might be competition for scarce resources devoted to worker health.[8,13,22,24] The result has all too often been a fragmented approach to worker health.[16,20]

Despite these tensions, there have been increasing calls for a comprehensive approach to worker health, based on multidisciplinary, integrated methods aimed at creating health-promoting workplaces.[5,9,13,15–17,19,20] Integrating worksite health promotion and occupational health and safety is a core principle of numerous international efforts and declarations in support of worker health.[25–29] Evidence is beginning to accumulate that documents the potential benefits of interventions to integrate efforts to reduce behavioral risks through the use of OSH initiatives, particularly for worker health behaviors.[5,30–32]

Rationale for Integrating Occupational Health and Safety and Worksite Health Promotion

Worksite health promotion and occupational health and safety provide two parallel pathways for promoting worker health within healthy workplaces. The argument we make in this paper is that these parallel efforts will be strengthened when they are coordinated and integrated, rather than separate and independent. We outline here four overarching reasons for integrating these two parallel approaches. These reasons provide a balance between the "business case" for integrated programs—focusing on potential cost savings and productivity gains for employers—with the "worker case" for integrated programs—focusing on clear benefits for workers as a result of a holistic approach to worker health. As we recognize the potential benefits, we are cognizant, too, that there are potential risks associated with integrated approaches. For workers, creating opportunities for management to gather personal information about health behaviors may present concerns that managers could misuse this information. For example, ill-intentioned managers could allow information about workers' health habits to unfairly influence decisions about raises and promotions, or this information could be used as evidence to argue against work-relatedness of illnesses in workers' compensation disputes. It is essential, therefore, as we contemplate the integration of health promotion and health protection, that we recognize the vast potential value as well as the risks to be guarded against.

1. Workers' risk of disease is increased by exposures to both occupational hazards and risk-related behaviors. Occupational disease and injury continue to account for a considerable proportion of the burden of disease in the United States. Current occupational health and safety surveillance data indicate that 6.1 million illnesses and injuries occurred in 1997 in private-sector employment settings; 6,238 workers died of occupational diseases in that same year. From 1973 through 1997, the number of lost workdays attributable to occupational illnesses and injuries rose from 1.9 million to 2.9 million per year.[33] Health behaviors also play a significant role in a range of health outcomes; for example, according to a recent assessment of contributors to overall mortality in the United States, tobacco accounts for 18% of total mortality, and diet and physical activity account for 17%.[34]

The effects of these life risks and job risks are not independent of one another.[35] Take, as an example, exposure to tobacco.[5] Some of the same toxic agents present in tobacco smoke are also hazards in the worksite (e.g., benzene), and thus workers who smoke may be doubly exposed through their exposures on the job. In addition, tobacco smoke and toxic agents found in the worksite may interact synergistically, increasing the profound effect beyond the simple addition of the two exposures alone (e.g., asbestos). Workplace chemicals may also be transformed into more harmful agents by smoking. For

example, the heat generated by burning tobacco may increase the toxicity of other chemicals inhaled as a cigarette is smoked. Similarly, tobacco use has been associated with stressful work organization, which is another type of occupational risk. Specifically, tobacco use can be associated with low job control.[36,37]

2. The workers at highest risk for exposure to hazardous working conditions are also those most likely to engage in risk-related health behaviors. Exposure to both job and life risks are concentrated among those employed in working-class occupations, meaning those employed in blue-collar or service occupations as typically defined in U.S. studies[38,39] or in lower supervisory, technical, semi-routine, or routine occupations, as defined by the United Kingdom's new National Statistics Socio-Economic Classification System.[40] Workers in these occupations are more likely to be injured or become ill because of workplace hazards than are professional employees. For example, 1997 data indicate that truck drivers and laborers were the occupations with the most injuries and illnesses involving days away from work, followed by nursing aides and orderlies.[33] Life risks also are concentrated in working class occupations and workers with lower levels of education. The smoking prevalence among blue-collar workers (including craftspersons and kindred workers, operatives, transportation operatives, and laborers) is 37% for men and 33% for women,[38] compared with 23% for the population overall.[41] National Health Interview Survey data for 2000 indicates that smoking prevalence is highest for persons employed in working class jobs, with less education, and with low incomes, and that while there is no socioeconomic gradient in quit attempts, those with the most socioeconomic resources are most successful with quitting. Similarly, overweight status is inversely associated with education level[42–45] and occupation.[42,43] According to the 2001 Behavioral Risk Factor Surveillance System, prevalence of obesity among adults ranges from 16% for persons with greater than a college education to 23% for those with high school education and 27% for those with less than high school education.[45]

There is also evidence that exposures to job hazards and health behaviors are correlated. For example, we found that blue-collar workers exposed to hazards on the job were more likely to smoke than their unexposed counterparts.[46] Similarly, others have linked increased exposure to hazards on the job with unhealthy dietary habits among blue-collar workers[47,48] and with binge drinking.[49]

These dual exposures are associated with a range of short-term adverse outcomes. Walsh and her colleagues[13] surveyed workers and managers from a large manufacturing firm about their occupational risks and health behaviors. Workers with high levels of job risks and life risks missed an average of three additional absence days per year, and they reported five times as much psychological distress, including depression, anxiety, and sleep disturbances, as workers in the low-risk group. In addition, they reported more symptoms of physical pain, poorer general health, and lower job satisfaction than the sample overall.

3. Integrating worksite health promotion and occupational health and safety may increase program participation and effectiveness for high-risk workers. Workers at highest risk for job exposures may be more likely to participate in integrated OSH/WHP than in worksite health promotion programs alone. There is evidence from the risk communication field that people place highest priority on those risks that are involuntary, outside personal control, undetectable, and that seem unfair,[50–52] features that often characterize occupational hazards. Accordingly, workers may perceive management actions to reduce workers' exposures to occupational hazards as of greater importance than personal health behavior changes, and they may feel that the benefits of individual health behavior changes are insignificant in the face of exposures to workplace hazards.[5] Skepticism about management's commitment to improve worker health may reduce workers' interest in participating in health promotion programs at work.[20,53,54] Conversely, employer efforts to create a safe and healthy work environment may foster a climate of trust and thereby enhance workers' receptivity to messages from their employer regarding health behavior change. In a study of blue-collar

workers, we found that workers who reported that their employers had made changes to reduce hazardous exposures on the job were significantly more likely to have participated in smoking cessation and nutrition programs than workers not reporting management changes.[55] Reduction of job risks may be required to gain credibility with this audience and to increase its receptivity to health education messages about individual health behaviors.[22,31]

In addition, programs integrating messages about job risks and risk-related behaviors may increase workers' motivations to make health-behavior changes. For example, one study found that blue-collar smokers exposed to chemical hazards on the job were more than three times more likely than those unexposed to be thinking of quitting smoking or taking action to quit.[46] Wellness programs that fail to address the hazards of work miss significant sources of health-related problems and costs, both to individual workers and employers. At the same time, occupational health and safety programs that ignore life risks may be underestimating workers' understanding of the complexities of health and well-being.[13]

We describe findings of the efficacy of interventions integrating worksite health promotion and occupational health and safety for high-risk workers in Section E.

4. Integrated occupational health and safety/worksite health promotion efforts additionally may benefit the broader work organization and environment. A growing literature demonstrates the benefits of worksite health promotion programs in terms of both direct costs (e.g., reduction in health-care costs)[56–58] and indirect costs (e.g., reductions in costs resulting from lost production as a result of reductions in productivity or increases in work absence).[57,59–65] In addition, research is also indicating the cost effectiveness of OSH interventions to prevent occupational diseases.[66–69] As an indicator of the mounting interest in this area of research, a recent supplement to the *Journal of Occupational and Environmental Medicine*[1‡] devoted an entire issue to effects of disease on workplace productivity. Within this growing literature, comprehensive programs integrating employee wellness, disability management, employee assistance, and occupational medicine have been shown to result in long-term savings in medical care utilization and expenditures[56] and reductions in sickness absence.[30] These findings are underscored by other papers prepared for this NIOSH symposium.[70,71] In addition, some experts have posited that the overall success of the organization is enhanced through coordination of, rather than competition, for resources.[6,9,15,27] For example, the World Health Organization's Regional Guidelines for the Development of Healthy Workplaces defines a healthy workplace as one that aims to create a healthy and safe work environment, ensure that worksite health promotion and occupational health and safety are an integral part of management practices, foster work styles and lifestyles conducive to health, ensure total organizational participation, and extend the positive impacts to the surrounding community and environment.[27] This document further underscores the benefits of such coordinated efforts, including their contributions to a positive and caring image for the company, improvements in staff morale, reduced turnover and absenteeism, and improved productivity.[27] It is imperative that future research document ways in which integrated OSH/WHP programs may further the mission of the organization through support for a healthy and productive workers within a healthy work organization.

1 ‡ *Journal of Occupational and Environmental Medicine*, June 2004 46(6).

Occupational Safety and Health Programs

OSH programs have traditionally been concerned with reducing hazardous exposures at work that can lead to work-related injury, illness, and disability, and they also may include emergency response programs.[72] The U.S. Department of Health and Human Services has defined national health goals to be reached by the year 2010 in its *Healthy People 2010 Report*,[10] including several objectives related to OSH. Two broadly stated goals are to reduce deaths from work-related injuries from 4.5 to 3.2 deaths per 100,000 workers aged 16 and older per year across all industries, and to reduce work-related injuries resulting in medical treatment, lost time from work, or restricted work activity 6.2 to 4.3 injuries per 100 full-time workers per year aged 16 and older. Additional OSH objectives relate to reducing injury and illness associated with overexertion or repetitive strain, deaths from pneumoconiosis, work-related homicides, elevated blood lead levels from work exposures, occupational skin diseases and disorders, work-related stress, occupational needle-stick injuries among health-care workers, and work-related noise-induced hearing loss.[10]

Prevalence of occupational safety and health activities

To our knowledge, there have been no national surveys of employers to determine the prevalence of OSH initiatives, though measuring such initiatives may prove infeasible given the varied nature of hazards across industries, occupations, and worksites. Furthermore, unlike health promotion activities, which employers choose to offer on a voluntary basis, OSH activities may either be initiated because employers are required to do so to comply with specific Occupational Safety and Health Administration (OSHA) standards that apply to their industry (e.g., cotton dust standard), or because they choose to go beyond regulatory requirements to provide additional health and safety measures. Even attempts to determine the prevalence of health and safety practices based on OSHA compliance or violations would yield incomplete and inaccurate data, because worksites are not routinely inspected. In 1996, 1,200 OSHA inspectors were assigned protection of 105.8 million workers at 6.4 million workplaces.[73] One crude and incomplete estimate of the prevalence of OSH activity is the number of worksites that have achieved Voluntary Protection Program (VPP) status. This program provides regulatory relief for companies meeting OSH performance criteria.[74] In 2002, OSHA reported 864 VPP sites in the United States,[75] a very small proportion of the total number of U.S. worksites and a reflection only of the number of worksites that apply for and receive this status.

Selected frameworks for occupational safety and health interventions

Occupational health and safety initiatives can take many different forms in different types of worksites, depending not only on the hazards present, but also on management practices. In unionized worksites, unions may also play a role in determining how hazards are addressed. Interventions to protect workers' health can operate at multiple levels of influence (individual, organizational, or both), as depicted in Figure 1. Many occupational health practitioners would argue for an approach that targets

organizational-level change over individual worker behavior, following a well-recognized "hierarchy of controls" model. This model calls for adherence to a recommended sequence for control of hazards beginning with control as close to the source as possible.[76] The ideal choice is the substitution of safer substances for those that are hazardous, thereby removing the potential hazard. Engineering controls provide a second line of defense for the control of hazards, followed by administrative controls, such as job redesign or job rotation. Personal protective equipment used by workers is recommended only as a last line of defense when substitution or engineering controls are not possible. By itself, it is not an acceptable method of control because its effectiveness is highly variable and not reliable. In a manufacturing setting, for example, a hierarchy of controls model would call first for elimination of substitution of a chemical that gives off toxic fumes, followed by engineering efforts to provide ventilation to reduce workers' exposure to fumes, and then by administrative controls such as rotating workers on and off jobs that involve the chemical so as to reduce total exposure to any one worker, and finally by personal protective equipment such as respirators. Another example might be addressing medical errors in a health-care setting by focusing at the organizational level to assess whether the staffing plan is adequate to avoid excessive worker overload, rather than at the individual level to educate workers how to cope with stress and overwork.

Useful as it is, the model was not intended to address other important aspects of OSH, including the role of managers and workers in creating "programmatic" or "systematic" approaches to occupational safety and health. Such approaches are rapidly emerging internationally as the preeminent strategy for employers to reduce occupational illness and injury.[77] Several countries have developed OSH program regulations or guidelines,[78] including the United States. OSHA has promoted a set of voluntary guidelines for OSH programs since 1989[79] and released a draft OSH program rule to the public in 1998.[80,81] Despite the rising prominence of the OSH program approach as a strategy for reducing occupational illnesses and injuries, there are few peer-reviewed empirical research reports about OSH programs or methods for assessing them,[77,82,83] yet these programs provide a useful framework for discussing such initiatives.

OSHA defines four program elements:

1. *Management commitment to and employee participation in OSH activities* (e.g., management sets health and safety goals for company on regular basis; company allocates money specifically for health and safety, managers are directly accountable for health and safety in their areas; employees participate in health and safety committees; means are available for employees to report health and safety hazards, problems, concerns).

2. *Workplace analysis* (e.g., new processes, machinery, methods, materials reviewed for health and safety before being introduced in work environment; health and safety audits; investigations of injuries, property damage, near misses).

3. *Hazard prevention and control* (e.g., specific time deadlines set for correction of identified hazards; follow-up inspections made to determine whether corrective action taken; engineering controls designed to eliminate or substitute hazards are considered before adopting personal protective equipment or administrative controls.

4. *Education and training* (e.g., health and safety training provided to all employees; additional training provided to employees that might encounter new hazards when changing jobs in company; training provided to contract or part-time employees).

The description of these two OSH intervention frameworks is presented here in the hope of providing a structure for readers outside the discipline of occupational safety and health, in order to provide a basis for conceptualizing OSH interventions beyond addressing a particular hazard.

Intervention effectiveness research in occupational safety and health

Before reviewing intervention research in OSH, we describe the political and economic context in which such interventions are undertaken in the United States, primarily intended for readers less familiar with the field. The patterns of worker morbidity and mortality flow directly from the choices of technology made by employers.[84] Employer choices, at least in the United States, are structurally driven by market forces that aim to maximize profit and minimize costs, the latter of which can include the costs of materials, technology, and systems to protect workers' health.[85] Intense competition may force firms to cut the costs of production and increase productivity as much as possible, which in many cases, may pit resources for health and safety against corporate profits, and may additionally increase worker stress. These are structural factors that shape decisions made by employers, regardless of their individual dispositions toward the health of their workers. This phenomenon explains, in part, why businesses and worker organizations, such as labor unions, battle intensely with one another over regulatory standards proposed by the OSHA, in addition to their ideological clashes about the appropriate role of the state in governing private employers.[84,85] This is to say that interventions to improve worker health and safety—whether undertaken voluntarily by employers or imposed upon them by regulatory standards—are situated in a political and economic context that must be considered when planning for interventions in worksites, be they OSH-specific or integrated OSH/WHP.

The aim of intervention effectiveness research in OSH is to evaluate the impact of interventions to prevent work-related injuries and illnesses. This type of research is relatively new to the OSH field compared with the worksite WHP field. The historical roots of occupational safety and health practice and research in the United States can be found in factory inspections performed at the start of the 20th century by politically and socially progressive occupational physicians such as Alice Hamilton, who called attention to lead dust and other hazards.[86] For the next several decades, occupational health researchers engaged mainly in surveillance-oriented research, using epidemiologic and exposure assessment methods. This research attempted to determine associations between working conditions and worker illness and injury, which in turn provided a scientific basis for addressing hazardous exposures through regulation or other means, on the assumption that removing or reducing certain hazards would result in fewer injuries and illnesses. More recently, the field has begun to embrace research aimed at determining the efficacy and effectiveness of interventions to prevent or ameliorate hazards.[87]

The peer-reviewed literature contains only a limited number of intervention effectiveness studies conducted in the 1980s and early 1990s, which have been reviewed by others.[88–94][2‡] Most reviews to date have concluded that OSH intervention studies were more likely to focus on improving workers' knowledge and behavior of hazards than on engineering or administrative improvements in the work environment—priorities that are at odds with the hierarchy of controls model described above. Inherent in any such review is identification of methodological limitations, which for some studies included small sample sizes of workers within a single worksite, quasi-experimental or nonexperimental study designs, lack of a theoretical framework to guide intervention and evaluation, and outcome measures based solely on worker self-reports rather than additional and perhaps more objective outcomes, such as reductions in hazardous exposures. Similar such concerns have been raised in reviews of worksite health promotion intervention studies. (See Section D.) As is also the case in worksite health promotion research, most OSH studies have been conducted in large businesses. With a few exceptions, small businesses have been largely understudied,[83,95] despite their centrality in the U.S. economy: 99% of employers employ fewer than 500 workers and approximately 50% of all workers.[96]

In 1996, NIOSH and its partners announced the National Occupational Research Agenda (NORA), as a guide for OSH research into the future, not only for NIOSH but for the entire occupational safety and health community.[97,98] NIOSH sought the input of

2 ‡ For further reading: *American Journal of Preventive Medicine* May 2000 Supplement, 18(4, Suppl 1).

approximately 500 organizations and individuals from the OSH community at large to develop the agenda, which was the first such research guide in the field.[99] The NORA process resulted in identification of 21 research priorities, including intervention effectiveness research. The NORA intervention effectiveness Web site[100] lists some 40 current intramural and extramural projects designed to assess the effectiveness of a wide range of interventions. These interventions include the following: a machine guarding intervention to reduce injuries in metal stamping and machine shops; ergonomic and work organizational interventions to reduce arm and hand pain, reduce lost time, and improve hand function in computer-based customer service work; crime prevention strategies to protect cab drivers; and training interventions targeting injuries occurring among small business workers.

Worksite Health Promotion Programs

Historically, WHP has focused on promoting worker health through reduction of individual risk-related behaviors such as tobacco use, substance use, a sedentary lifestyle, poor nutrition, stressors and reactions to them, reproductive risks, and other preventable health behaviors.[6,101] WHP may incorporate or be coordinated with employee assistance programs, clinical prevention services, disease management programs, and other health benefits.[101] Worksites may plan programs with worker input, and they may set priorities based on their own assessment of needs, and/or emphasizing those behaviors associated with the largest decrements in mortality and morbidity, increases in disability, decreases in work productivity, or potential for cost savings relative to health impact.[102–104]

Healthy People 2010 defines two specific goals for worksite health promotion: (1) to increase the proportion of worksites offering a comprehensive employee health promotion program to their employees, targeting 75% participation by the year 2010; and (2) to increase the proportion of employees who participate in employer-sponsored health promotion programs, again, targeting 75% participation rates by the year 2010.10 These recommendations include five elements in defining a comprehensive worksite health promotion program: (1) health education, including a focus on skill development for health behavior change, and information dissemination and awareness building, preferably tailored to employees' interests and needs; (2) supportive social and physical environments, including implementation of policies that promote health and reduce the risk of disease; (3) integration of the worksite program into the worksite's organizational structure; (4) linkage to related programs, such as employee assistance programs and programs to help employees balance work and family; and (5) worksite screening programs, ideally linked to medical care to ensure follow-up and appropriate treatment as necessary.[105]

Prevalence of and participation in worksite health promotion programs

The 1999 National Worksite Health Promotion Survey found that a third (34%) of employers with 50 or more employees offered comprehensive health promotion programs that met Healthy People 2010 criteria, and that these programs were offered by half of the nation's largest employers (those with 750+ employees).[10] This survey also found that more than 90% of surveyed worksites offered at least one health promotion activity, providing a solid foundation for future efforts.

As noted above, the Healthy People 2010 goals also aim to increase the proportion of workers participating in health promotion programs. According to the National Health Interview Survey, in 1994, 61% of U.S. employees age 18 years and older in 1994 took part in employer sponsored health promotion activities, defined to include one or more elements of a comprehensive worksite health promotion program.[106]

Worksite health promotion programs are not equally available to all workers. Using results from the 1994 National Health Interview Survey, Grosch et al.

found that nonprofessionals, blacks, and individuals with lower education levels were less likely to work in worksites that offered some type of health promotion programming.[107] Even when programs are available, participation rates are not equivalent across workers. Participants are likely to be salaried, white-collar employees whose general health is better than average.[108] Blue-collar workers are less likely to participate in worksite health promotion programs than are white-collar workers.[10,54,55,109–112] Low participation is also associated with lack of access to and the extent of health insurance coverage.[10,113] Low participation may be in part a consequence of ineffective "marketing" of programs to these workers,[10,113] as well as structural barriers to participation. For example, supervisors often function as gatekeepers controlling worker access to worksite health promotion activities, and they may be reluctant, in order to keep production lines moving, to allow workers to attend programs on work time. This can present the greatest barrier for those workers with the least amount of discretion over their time.[54,114] Further barriers may include working overtime, shift work, having a second job, car-pooling to work, long distances between the plant and the employee's home, and responsibilities at home.[115]

Frameworks for worksite health promotion interventions: Programs across multiple levels of influence

WHP programs are delivered at multiple levels of influence, as illustrated in Figure 1. At the individual and interpersonal levels of influence, worksite health promotion programs aim to help individual workers make health behavior changes. These interventions include intensive programs for high-risk individual workers, as well as worksite-wide programs designed to reach a breadth of the workforce. Intensive programs are likely to attract workers most interested in health behavior change and thus most motivated to change behavior. Worksite-wide programs instead generally aim to influence health behaviors among workers at varying stages of readiness for health behavior change. Not surprisingly, these two types of programs differ in their ability to change behaviors. For example, smoking cessation studies have found that more intensive programs, with multiple sessions and multiple components, yield higher quit rates than shorter-term, less-intensive interventions.[18,116,117] It is important to keep in mind, however, that because these programs are designed for highly motivated volunteers who are ready to commit to a behavior change program, they may miss important segments of the working population who are not interested in participating in intensive programs. From a public health perspective, the *impact* of an intervention is a product of both its *efficacy* in changing behavior and its *reach,* meaning the proportion of the population reached either through their direct participation, or indirectly through diffusion of intervention messages throughout the community, worksite or school.[118,119]

One promising avenue for individually-focused interventions is the growing area of tailored interventions. Moving away from the one-size-fits-all approach to interventions, "tailoring" is one strategy for increasing the intensity of interventions delivered to at-risk populations. Tailored interventions typically use print communication[120–122] or telephone counseling[123] to enhance the relevance of interventions to the daily lives of the target population, thereby increasing the likelihood of achieving short-term or sustained intervention effects.[118,124] Individually tailored interventions are typically algorithm-based and utilize expert systems or computer-based programs to match a large library of messages to individuals' varying information needs and levels of motivation to change, combining specific statements and graphics into personalized interventions for specific individuals.[121,123,124]

WHP programs also target the worksite environment, for example through tobacco control policies aimed both at protecting nonsmokers from the hazardous effects of environmental tobacco smoke and promoting an environment supportive on nonsmoking; by increasing the availability of healthy foods in worksite cafeterias; or by modifying the built environment to promote physical activity. For example, worksite policies on tobacco have been shown to decrease worker exposure to environmental tobacco smoke[125–127] and contribute to worker reductions in smoking, including quitting.[116,128–133] Employer efforts to promote compliance with smoking policies

can contribute to an overall climate supportive of nonsmoking.[134] Similarly, studies have examined the effects of cafeteria-based programs, for example through point-of-choice food labeling, as a location for media-based nutrition education, and through increasing the variety of foods and reducing prices. Although these programs hold promise for changing food purchasing patterns at work, it is less clear whether changes extend to dietary patterns outside work.[135,136]

Increasingly, WHP programs are focusing on multiple levels of influence, and growing attention is being placed on comprehensive programming, as illustrated in the Healthy People 2010 described above. The definition for "comprehensive" programs has not been consistent across reviews; for example, Pelletier defined comprehensive programs as "those programs that provide an ongoing, integrated program of health promotion and disease prevention that integrates the particular components (i.e., smoking cessation, stress management, lipid reduction, etc.) into a coherent, ongoing program that is consistent with corporate objectives and includes program evaluation."[137]

As noted in the previous section on OSH, laws and regulatory standards, such as those issued by federal or state OSHA agencies, can have an important impact on health and safety conditions at work. These are, by definition, policy interventions to protect workers' health and that fall outside of the discretion of individual employers and worksites. Likewise, in the health promotion field, laws and regulations, such as the smoke-free worksites bills passed in several states, serve as environmental cues for workers to quit smoking as well as protect workers from exposure to second-hand smoke on the job.

Efficacy of worksite health promotion interventions

WHP research has documented the efficacy of these programs across a wide array of outcomes, including changes in anthropometric measures, health behaviors, life satisfaction indicators, and measures of morbidity and mortality. In general, results from randomized studies of worksite health promotion have found modest yet promising effect sizes.[4,108,138–140] Figure 2 summarizes the results of meta-analyses of programs targeting physical activity, nutrition/cholesterol, smoking cessation and tobacco control policy, alcohol use, stress, and cancer risk factors, as well as multi-component programs. The studies included in these meta-analyses represent a range of study designs; although authors of these meta-analyses place the most weight on the results on randomized controlled studies, other study designs were included. Methodological limitations to the studies included in these meta-analyses are not dissimilar to those described in Section C for studies of OSH interventions, including inadequate sample sizes; the use of nonrandomized designs; differential attrition across study groups; analysis at the individual level failing to take into account of group randomization; and the use of inadequate measures, including sole reliance on worker self-reports rather than additional objective measures, such as biochemical assessments.

Figure 2. Health risk reduction through various WHP by significant findings

		Physical Activity			Nutrition/ Cholesterol	Weight control	Smoking cessation/ polcy		Alcohol	Stress		Cancer risk factors	Multi-component programs			
	Significant Findings ↓	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
Anthropometrics	Weight loss												■		■	
	BMI reduction	■			■	■						■				
	% body fat reduction	■										■				
	Blood pressure reduction	■									■		■	■		
	Cholesterol reduction	■			■								■	■	■	
	Improved glycemic control															■
	Physical activity increase	■	■	■								■	■	■	■	
Health promotion behaviors	Reduced smoking incidence	■						■				■	■		■	
	Improved endurance/ fitness		■										■			
	Nutrition choices				■							■	■			
	Reduced alcohol								■	■			■			
	Increased seatbelt use												■		■	
Life satisfaction/ attitudinal	Increased life satisfaction/ well-being	■								■						
	Increased job satisfaction/ well-being	■		■						■	■			■		
	Reduced stress/ anxiety/ somatic complaints										■					■
	Nutrition attitude				■							■	■			
	Alcohol attitude								■							
Morbidity/ Mortality	Reduced mortality												■			
	Fewer visits to doctors/ hospitalizations										■			■		■
	Reduced flu and complications													■		■
	Earlier cancer diagnosis (breast)														■	
	Reduced back pains													■		
	Decrease in overall disease risk														■	■

		Physical Activity			Nutrition/ Cholesterol	Weight control	Smoking cessation/ polcy		Alcohol	Stress		Cancer risk factors	Multi-component programs			
Organizational outcomes	Fewer accidents															
	Reduced absenteeism/ sick days															
	Increased productivity															
	Sickness costs															
	Positive return on investment															

Meta-analysis study, number of studies (years)

a. Shephard 1996, 52 (1972–1994)

b. Dishman et al. 1998, 26 (1979–1995)

c. Proper et al. 2002, 8 (1981–1999)

d. Glanz et al. 1996, Nutr = 10, Chol = 16 (1980–1995)

e. Hennrikus et al. 1996, 43 (1968–1994)

f. Cochrane

g. Erikson et al. 1998, 81 (1968–1994)

h. Roman et al. 1995, 24 (1970–1995)

i. Bamberg et al. 1996, 27 (1983–1992)

j. Murphy 1996, 64 (1974–1994)

k. Janer et al. 2002, 45 (1984–2000)

l. Heaney et al. 1997, 47 (1978–1996)

m. Pelletier 1996, 26 (1992–1995)

n. Pelleter 1999, 11 (1994–1998)

o. Pelletier 2001, 12 (1998–2000)

One concern sometimes raised in the interpretation of the results of these studies has been the magnitude of effect sizes, even when statistically significant changes in behavior are found. Some observers continue to apply the standard of clinical significance in assessing the value of the magnitude of the results of these trials. Yet as Rose noted,[141,142] small changes in behavior observed across entire populations are likely to have large effects on disease risk. For example, Tosteson and colleagues[143] estimated the cost-effectiveness of population-wide strategies to reduce serum cholesterol, and they found that community-based interventions to reduce serum cholesterol are cost-effective if serum cholesterol is reduced by only 2 percent or more.[143] It is important that the standards used for interpretation of the results of worksite intervention studies be based on the public health significance of the effects.

A key challenge: Identifying interventions to reduce class-based disparities in health behaviors

This research provides an important foundation for future worksite health promotion endeavors. A key priority for future research in this arena is attending to the persistent, and in some cases growing, class-based disparities in health behaviors. These disparities point to an important gap in current worksite health promotion efforts and suggest a critical need for new approaches to behavioral interventions for working-class populations. These disparities may be due, in part, to less access to worksite health promotion programs for blue-collar and service workers,[107,144,145] less participation by these workers in programs when they are available,[108] lower efficacy of interventions among blue-collar and service workers compared with white-collar workers, and/or increasing stress among blue-collar and service workers.[146] Integrated OSH/WHP approaches, as we describe in the following section, are designed to attend to workers' dual concerns about life risks and job risks. Promising results suggest that in comparison with tradition worksite health promotion approaches, these interventions can lead to greater worker participation and improved health outcomes than among blue-collar manufacturing workers.

Integrated Occupational Safety and Health/Worksite Health Promotion (OSH/WHP) Programs

Despite a clear rationale for integrating and coordinating worksite occupational health and safety and worksite health promotion and increasing discussions of the benefits of integrated OSH/WHP interventions,[6,9,15–17,147–151] as described in Section B, empirical evidence supporting the promise of this approach is only beginning to emerge. Early research in this area focused on worker surveys simultaneously assessing job risks and life risks,[152,153] and small scale studies[154–157]

There are a growing number of reports of best practice within single worksites. For example, Johnson and Johnson "Live for Life" program encompasses health promotion, occupational health and safety, employee assistance, disability management, and other benefits.[158] Administrative systems were established to promote cross-utilization of resources rather than "silos of service." A financial impact study found that this effort resulted in a cost savings on employee health care and administrative costs of about $8.6 million per year. Other companies have similarly reported the benefits of worker health programs that integrated health promotion, occupational health and safety and other benefits supporting worker health, among them UAW-GM,[159] Chevron,[160] 3M,[161] Glaxo Wellcome,[162] and Citibank.[163,164] These initiatives by vanguard companies have begun to change the dialogue about approaches to employee health.

In addition, there is a growing literature reporting results of studies that have systematically assessed the efficacy and effectiveness of integrated OSH/WHP interventions. The strongest evidence available, summarized below, supports the efficacy of this intervention model in promoting smoking cessation, particularly among blue-collar workers; some evidence additionally indicates significant effects for other health behaviors. Little evidence is available to date documenting the impact of these programs on occupational health and safety outcomes.

Defining integrated OSH/WHP programs

As illustrated in Figure 1, integrated OSH/WHP studies may be conducted across multiple levels of influence—targeting individual workers, the worksite organization and environment, or across multiple levels. Because reductions in job risks rest heavily on employers, while individual workers must be included in any efforts to reduce life risks, integrated interventions are most likely to be aimed at multiple levels of influence. There are circumstances, nonetheless, where interventions may separately target individual or organizational/environmental levels of influence, as we illustrate below.

Ideally, integration of OSH and WHP requires a change from the traditional organizational structure, in which OSH and WHP are situated in different locations within the organization, with little communication between these functions. In some cases, it may be possible for worksites to unify these functions within the organization, with a single budget and reporting structure, thereby integrating roles and responsibilities related to worker health.

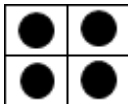
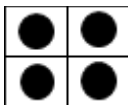
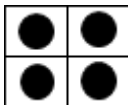
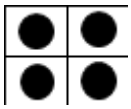
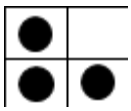
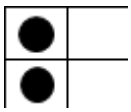
In other cases, it may be more likely for worksites to increase coordination across these functions, allowing for joint decisions about such key issues as priority-setting and resource allocation. This coordination across previously-disconnected functions provides a foundation for bringing various groups together within the organization, including those representing benefits/employee relations, employee assistance, health promotion, medical services, and occupational safety and health.[9]

Following standards for rigorous testing interventions, optimal assessment of the efficacy of integrated OSH/WHP programs generally relies on random assignment of worksites to the intervention, in order to control for secular trends in worksite initiatives and in worker health behaviors. Yet there are some research questions that cannot be effectively addressed in randomized trials, such as the impact of interventions that change the structure of OSH and WHP within the worksite organization, given the need for management initiative and commitment to such structure changes. Research to date has tested the efficacy of integrated OSH/WHP programs delivered by researchers; there remains a significant need for observational research to estimate the effects of structural changes in the operations and functioning of OSH and WHP.

Research assessing integrated OSH/ WHP programs

Table 1 summarizes key studies assessing the effectiveness of integrated OSH/WHP interventions. Included in this table are summaries of a series of studies we have conducted to examine the efficacy of interventions integrating worksite health promotion and occupational health and safety across multiple levels of influence. The first of these studies, WellWorks-1, was conducted as part of the Working Well Trial, in which four research intervention sites tested the effects of a comprehensive worksite cancer prevention model aimed at nutrition and smoking; this study found statistically significant effects for smoking cessation and smoking cessation.[165]

Table 1. Studies Integrating OSH and Health Promotion

Study	Design	Intervention Outcomes	Intervention‡	Results	Setting
WellWorks-1 (Sorensen et al., 1998)	RCT* worksites	Smoking cessation Dietary habits		▪ Significant improvements in smoking cessation and fruit and vegetable consumption for all workers ▪ Significant improvements in fiber consumption for laborers	Mid-to-large manufacturing worksites (n = 24 sites)
WellWorks-2 (Sorensen et al., 1998)	RCT* worksites	Smoking cessation Fruit and vegetable consumption OSH exposures		▪ Significant improvements in smoking cessation among hourly workers ▪ Significant improvements in OSH programs	Mid-to-large manufacturing worksites (n = 15 sites)
The Brabantia Project (Maes et al., 1998)	Quasi-experimental pre/post design	Lifestyle score (smoking, physical activity, hours sleep, BMI alcohol use, fat intake) Health risk General stress reactions Working conditions Absenteeism		▪ Improved cardiovascular health (due to improved serum cholesterol in men) ▪ Improved working conditions (due to improved perceived psychological demand and improved ergonomic conditions) ▪ Reduced absenteeism (8.1% reduction in experimental group, 4.8% reduction in the control group)	Three Dutch Brabantia worksites (n = 3 sites)
Healthy Directions/ Small Business (Sorensen et al. in press)	RCT* worksites	Fruit and vegetable consumption Red meat consumption Multi-vitamins Physical activity		▪ Significant improvements in physical activity and multi-vitamin use for all workers ▪ Larger effects for workers than managers for fruits and vegetables and physical activity	Small manufacturing worksites (n = 24 sites)
MassBuilt (Barbeau et al.)	Methods development	Smoking cessation		Not yet available	Construction apprentices in union program
United for a Healthy Future (Sorensen et al.)	RCT* worksites	Smoking cessation Fruit and vegetable consumption		Not yet available	Unionized construction laborers

* Random controlled trial with levels of randomization
‡ Intervention: Individual Organization

OSH
WHP


Our second study, WellWorks-2, asked the question: Does the addition of worksite occupational health and safety increase the effectiveness of worksite health promotion only?[165] Using a randomized, controlled design, 15 mid- to large-size manufacturing worksites were randomly assigned to receive either worksite health promotion only (WHP Group, eight worksites); or worksite health promotion plus occupational safety and health (WHP/OSH Group, seven worksites). The intervention components are summarized in Table 2. This comparison tested the integrated intervention, which aimed to reduce occupational hazards.

Table 2. Intervention Activities in the WellWorks-2 Study

Intervention Components	Health Promotion	WHP + OSH
Joint worker-management participation	Representation: ▪ Workers ▪ Management ▪ Various departments ▪ Variety of racial/ethnic groups represented in the workplace	Representation: ▪ Workers ▪ Management ▪ Various departments ▪ Variety of racial/ethnic groups represented in the workplace ▪ Occupational Health and Safety Manager ▪ Coordination with occupational health and safety committees
Interventions targeting workplace organizational and environmental change	Consultation to management regarding: ▪ Tobacco control policies ▪ Food catering policies* ▪ Cafeteria and vending machine signage of healthful food choices	Consultation to management regarding: ▪ Tobacco control policies ▪ Food catering policies* ▪ Cafeteria and vending machine signage of healthful food choices ▪ Recommended changes to reduce occupational hazards based on walk-through assessment
Interventions targeting change in individual health behaviors	Traditional interventions addressing tobacco and nutrition: ▪ Group discussions ▪ Worksite-wide events	Traditional plus integrated‡ interventions addressing tobacco, nutrition and occupational health: ▪ Group discussions ▪ Worksite-wide events

* Catering policies specify offering healthful food options when food is served at company activities

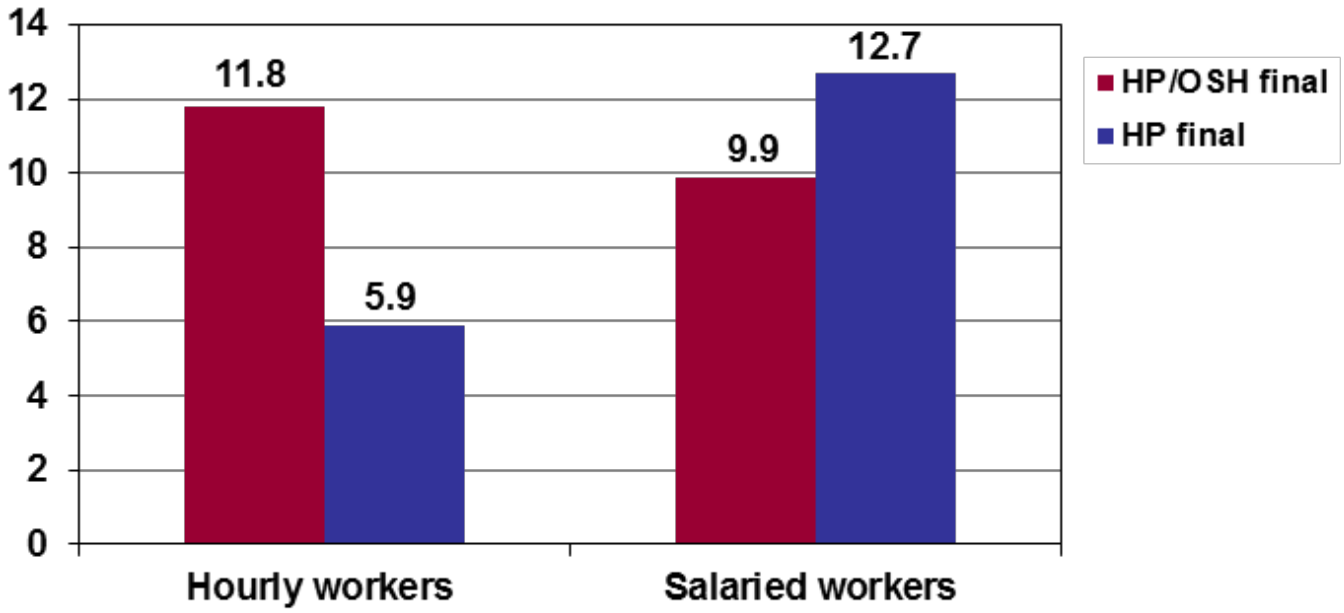
‡ Integrated interventions address occupational health and nutrition, smoking, or both.

Sorensen G, et al. Reducing social disparities in tobacco use: A social contextual model for reducing tobacco use among blue-collar workers. *American Journal of Public Health* 2004;94:230–239.

We hypothesized *a priori* that the integrated OSH/WHP intervention would have the most relevance to workers in hourly positions where exposures to hazards on the job were more common than among salaried jobs. Results of this study for tobacco use cessation for blue-collar (hourly) and white-collar (salaried) workers are presented in Figure 3. Smoking quit rates among hourly workers in the OSH/WHP condition more than doubled relative to those in the WHP condition (11.8% vs 5.9%; $P = 0.04$), and were comparable to quit rates of salaried workers. We found no differences in quit rates between groups for salaried workers. We found no significant changes in fruit and vegetable consumption, either in the sample overall or by job type.

These findings nonetheless indicate the potential significant contribution of an integrated OSH/WHP intervention in promoting smoking cessation among blue-collar workers.

Figure 3. Adjusted 6-Month Quit Rates at Final by Intervention and Job Type



(cohort of smokers at baseline: n = 880)

Sorensen G, et al. Reducing social disparities in tobacco use: A social contextual model for reducing tobacco use among blue-collar workers. *American Journal of Public Health* 2004;94:230–239.

Turning to OSH results, we found (1) worksites in the WHP/OSH condition made statistically significant improvements in their health and safety programs compared with WHP only sites,[82] and (2) significant improvements in an exposure prevention summary rating (developed as part of this study)[166] in the intervention worksites, which was offset by a smaller and nonsignificant improvement in the control worksites, rendering the pattern of results promising but not statistically significiant.[167] We also found that worker participation in intervention programs was significantly higher in the OSH/WHP condition than in the WHP condition,[168] as measured by process tracking of the intervention "dose" delivered in intervention sites. According to estimates by Colditz, if this intervention was disseminated to the population of blue-collar smokers in Massachusetts, an estimated 2,880 cases of lung cancer could be avoided, with additional benefits expected to accrue in other tobacco-related diseases.[169]

We have additionally recently completed a study testing the efficacy of an integrated OSH/WHP intervention in small manufacturing businesses employing working class, multi-ethnic workers.[32] This study provides evidence of the efficacy of integrated interventions in improving physical activity and diet among working class, ethnically diverse workers employed in small manufacturing businesses. Two additional studies still under way are testing the efficacy of integrated OSH/WHP interventions delivered at the individual/interpersonal level of influence. In one study, designed to promote tobacco use cessation and increased consumption of fruits and vegetables among construction laborers, a one-on-one telephone counseling intervention was based on motivational interviewing and a set of written materials designed specifically for this audience, and messages around occupational hazards and fitness for work were incorporated into the intervention.[170] In a second study, we are promoting tobacco use cessation among building trade apprentices during onsite training programs; again, messages about occupational health and safety are incorporated into the intervention. These interventions were designed to target the individual/interpersonal level of influence because the intervention is not delivered at a specific worksite setting, as is

appropriate for construction workers who often move from job to job. Nonetheless, messages about job risks are clearly incorporated into intervention messages. Preliminary results of these studies suggest promising intervention findings.

A final study included in Table 1 provides important evidence on the promise of integrated interventions targeting work organization factors as part of the OSH focus.[30] This study found that manufacturing employees in the intervention condition made significantly greater changes than those in nonintervention control groups on key outcomes, including reduction in ergonomic risks, cardiovascular health risk, and job stressors such as psychological job demands and low job control. Overall, sickness absence in the intervention dropped (15.5% to 7.7%) versus control (14.3% to 9.5%) groups, which yielded a positive financial return on its investment in the project.

To summarize, although research testing the efficacy of OSH/WHP interventions is only in its infancy, emerging evidence to date suggests that these interventions hold significant promise for improving worker health behaviors, especially among working class populations, and they have the potential to contribute to OSH programs and outcomes. This research provides a useful foundation for future research in this area.

Worker health in a Changing Economy

As we begin to define a research agenda to explore the integration of WHP and OSH, it is important to consider several key changes that have influenced the nature of work in the United States during the past few decades. These labor market trends have important implications for future research aimed at interventions integrating worksite health promotion and occupational health and safety, recognizing that "one size doesn't fit all." Interventions may need adaptation and retooling to fit specific worksite settings as well as changes in the overall labor force.

First, there are important shifts in the proportions of workers employed across sectors of the labor market. Importantly, the proportion of workers in manufacturing jobs has decreased from 26.1 % in 1960 to 12.3% in 2003, and during the same period, the proportion in agricultural jobs has decreased from 8.4% to 1.7%. Meanwhile, employment has shifted to the service sector; the proportion of employment in the service sector in 2003 was 78.3%, up from 58.1 % in 1960.[171] The integrated WHP-OSH studies presented above were conducted mainly in manufacturing settings; additional studies testing the integrated model are needed to assess its effectiveness in service sector jobs.

Second, a growing number of workers are affected by corporate restructuring, mergers and acquisitions, and downsizing.[172] For example, Fortune 500 companies alone reduced their total workforce from 14.1 million employees to 11.6 million between 1983 and 1993. With approximately 500,000 U.S. employees facing job loss each year as a result of these transitions, job security in this population as well others around them is affected.[173] Job insecurity may result in job dissatisfaction,[174,175] increasing work withdrawal behaviors,[176] an increase in negative physical health outcomes,[177–179] and higher reports of psychological distress,[176,180] and risk of heart disease.[181,182] In addition, workers with perceptions of low job security commonly report lower organizational commitment, leading to greater employee turnover.[174,175] Another trend is toward the implementation of new systems of work organization, such as lean production,[183] which can increase employee stress and health risks. Finally, national surveys in the United States, Europe and Japan during the past 20 years have shown large increases in job demands and "time constraints."[146] These trends point to the importance of understanding the influence of job insecurity and work organization on health behaviors, and of addressing related stressors within integrated OSH/WHP interventions.

Third, employers have increased their reliance on contingent labor, in order to reduce costs through short-term hiring of employees, to provide employers greater flexibility to adjust to downturns in the business cycle, and to provide employers with a means of assessing new employees before making a full commitment to hiring them on a permanent basis.[184,185] Many companies are hiring contract managers to meet their rapidly changing needs for new and unique managerial perspectives and talent.[186] The 1995 Bureau of Labor Statistics (BLS) Report revealed that the number of workers in contingent jobs ranged from 2.7 to 6.0 million employees, representing between 2.2% and 4.9% of the total

U.S. labor force.[187] Although some have noted these trends as a means of increasing the flexibility of the workplace,[185] others have expressed concerns with consequent reductions in employee rights[188,189] or increased illness risks among temporary employees.[190] These trends have important implications for research on integrated OSH/WHP interventions. With short job tenures, workers may have less exposure to interventions and measurement of behavioral changes associated with interventions is likely to be difficult. In addition, managers may be less committed to contingent workers, as evidenced by the lower level of benefits these workers are often given. In designing integrated OSH/WHP interventions, it is important that contingent workers have the same access to programs and meet the same OSH training requirements as regular workers, in order to promote and sustain worksite health promotion and health protection across all workers in a setting.

Fourth, employer coverage of health-care benefits for employees has declined, and payment has shifted significantly from employers to employees.[191,192] From 1979 to 1998, the percentage of private sector workers receiving coverage from their employers declined sharply across almost all industries and occupations, with the largest declines among low-income workers, blue-collar and service workers, and for workers employed in large firms. In 1983, 45.5 percent of private-sector employees had coverage paid in full by their employer, compared with 26.6% in 1998.[191,192] Benefits coverage has particular implications for health promotion interventions; limited financial coverage of services supporting health behavior changes, such as for nicotine replacement therapy or gym memberships, may reduce workers' success with health behavior change.

Fifth, income inequality is increasing and wages are falling for many workers.[193,194] From 1979 through 2000, the real income of households in the lowest fifth grew 6.4%, while that of households in the top fifth grew 70%, with the top 1% increasing 184%. Over three-fourths of those who started out in the low end of the income scale in the late 1980s remained at the low end of the income scale 10 years later. Since 2000, unemployment has been high, with slow recovery in the jobs lost in the recent economic downturn. The average hourly wage of blue-collar workers in 2001 was $13.73 per hour (equivalent to $28,558 per year),[195] placing them at only 1.6 times (i.e., 100–199%) of the 2001 poverty line of $17,960 for a family of two adults and two children.[196] Unemployment disproportionately affects minority workers and those with lower levels of education.[194] The fact that many workers are at the low end of the pay scale is of importance given the long-standing recognition of the relationship between social class and health outcomes.[197–199] As we describe in Section B, point 2, integrated OSH/WHP programs may be particularly salient in addressing the concerns of workers at highest risk because of their dual exposures to job risk and life risks.

Sixth, rates of unionization are declining. In 2002, 13.2% of all workers in the United States belonged to a labor union, down from 20.1% in 1983, the first year for which comparable data are available.[200] Labor unions have played a significant role in advocating for the health of workers. The private health-care system in the United States was developed largely as a result of collective bargaining.[201] Unions have been strong allies in efforts to promote healthy and safe working conditions.[84] More recently, several unions have become active on worksite health promotion issues such as smoking cessation.[83] Despite their falling membership, unions can be powerful allies for interventions to protect and promote workers' health, particularly among blue-collar and service workers, who are more likely than white-collar workers to belong to a union. The declining union membership additionally underscores the ongoing need for representation of and responsiveness to workers' concerns in the design of broad-based initiatives to protect their health.

Additional changes are on the horizon. The proportion of workers who are immigrants is likely to increase in the coming decades, as has already been observed. Immigration is expected to continue to account for a sizable part of population growth and will further diversify the labor force. Projections suggest that the Hispanic and Asian population will rise from 14% in 1995 to 19% in 2020. Women's projected share in the workforce is expected to increase slightly (46% to 48% between 1998 and 2008). The

racial/ethnic mix is also expected to change across this timeframe, with decreases in the percentage of whites, little or no change for blacks, and increases for Hispanics (of any race), Asians and other races.[33] Thus, it is important that integrated OSH/WHP interventions attend not only to working class populations, but also be designed in recognition of the increasing racial/ethnic diversity in workforce, and with attention to cultural differences, the implications of acculturation, the potential for discrimination, and related social contextual issues. Of course, race and class are inextricably linked in the United States; in many cases, interventions designed for working-class populations are likely also to reach racial/ethnic minority groups, who are over-represented among working class groups. Notwithstanding, it is essential to examine efficacy of OSH and WHP interventions among racial-ethnic subgroups.

In addition, it is expected that the proportion of older workers in the labor force will increase. In contrast to prior decades, in which most of the growth in the labor force was accounted for by workers between 25 and 54 years of age, over the next decade fewer than one in three (31%) of the added workers will be in this category. Instead, nearly half of the additional workers will come from the 55-and-older category, while about one in five will come from the youth labor force.[202] By 2008, the percentage of workers aged 45 and older is expected to increase from 33% to 40% of the workforce, and those aged 25 to 44 to decrease from 51% to 44%[33] It is important that the design of future integrated OSH/WHP interventions take into +account the specific needs of older workers.[203,204]

Research Agenda: Gaps in Current Literature and Key Issues to be Addressed In Future Research

This review provides promising evidence about the potential importance of integrating and coordinating worksite health promotion and occupational health and safety as a means of enhancing worker health. This research, however, is in its infancy, and there remains a broad range of research questions needing to be addressed in order to maximize the potential impact of these interventions. Figure 4 presents an organizing framework for our discussion of five overarching research directions, and specific recommendations are summarized in Table 3. This outline follows research frameworks describing the appropriate sequencing of research within cancer prevention and control[205] and cardiovascular disease prevention.[206] Such research does not always proceed in a linear fashion, but it may require circling back to "earlier" steps in the process to address newly defined research questions.[205,207] We begin with two key foundations for intervention research. First, social epidemiological research is needed to identify key work-related factors associated with hazardous occupational exposures and risk-related behaviors, and to identify the underlying causes of social disparities in worker health. Second, there is a need for methods development research aimed at developing both appropriate measurement tools and new intervention approaches to integrating worksite health promotion and OSH. We describe key directions for testing integrated OSH/WHP interventions, focusing, third, on efficacy studies examining the effects of integrated interventions on both occupational health and safety outcomes as well as health behavior changes, and fourth, on effectiveness studies aimed at evaluating the generalizability of tested interventions to new settings or with new populations. Fifth, we describe research to address the need for assessing the process of intervention implementation, including intervention implementation evaluation, cost assessments, and process-to-outcome assessments. Finally, we look at ways to assess the long-term applicability of these intervention approaches through dissemination and durability research, that is, testing methods to promote the sustainability and dissemination of programs where sufficient evidence is available to indicate that an integrated intervention is efficacious, and to promote maintenance of changes in health behaviors and the work environment resulting from interventions.

This sequence of research phases will necessarily be conducted in a political, economic, and social context that surrounds worksite-based research.[84,208] Researchers from the WHP and OSH fields are certainly aware of the challenges of this terrain, replete with power differences between managers and workers; management's interest in controlling costs and increasing productivity, and how these factors play into their support or lack thereof for OSH and WHP; and workers' concerns about maintaining privacy and other essential rights, and their resistance to management-initiated efforts to "correct" workers' "poor" health behaviors.[108,209] Acknowledgement and articulation of these realities is not only critical to conducting sound research in the workplace, but it also helps to clarify the very questions we pose

and the assumptions underlying them. By questioning these basic assumptions—the "taken-for-granted 'truths,'" to use Eakin's phrase, we are able to shed light on ideologies underlying our research questions.[208] For example, we recognize that for employers, it is critical to have information about the economic implications of integrated approaches for the "bottom line," and several WHP and OSH studies have calculated outcomes such as cost-effectiveness and return-on-investment.[66,70,71] Equipped with this information, employers can determine whether and how to pay for WHP or OSH interventions in the overall economic context of their businesses. By addressing these questions through our research, however, it is essential to acknowledge the limited scope of these research questions from a public health perspective. In addition, cost-based research could be characterized by workers and their advocates as a callous calculation of what workers' health is *worth* to the business. Being clear on our questions, assumptions, and methods is particularly critical for scientists attempting to work across disciplines. Within our own disciplines, we often take for granted many shared assumptions and fail to challenge one another. There is, thus, an inherent set of challenges in inter-disciplinary collaboration, as well as an enormous opportunity to pause, question, and reflect on comfortable assumptions held by individual disciplines.[210]

In this section, following the framework in Figure 1, we describe key directions for future research aimed at integrating OSH and worksite health promotion, with the hope that this framework and discussion will provide a structure for delineating additional research priorities. We additionally examine barriers to accomplishing this research agenda.

Figure 4. Framework for research on integrating OSH and health promotion

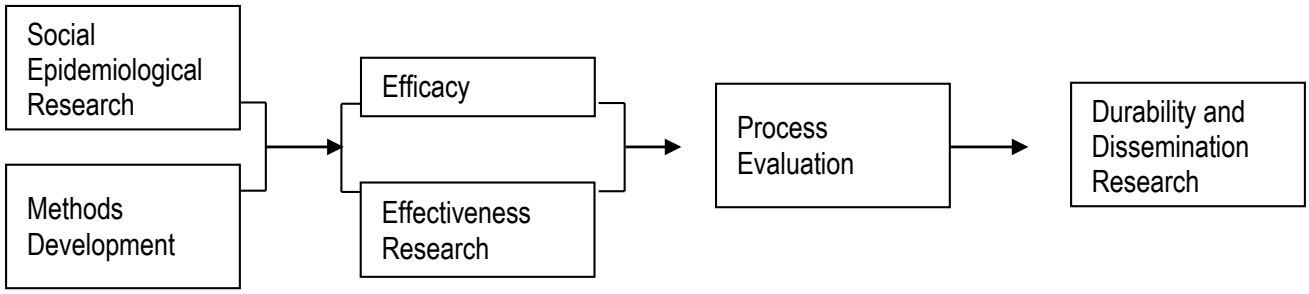


Table 3. Research agenda: Key directions for future research

Social epidemiological research
OSH data by race/ethnicity and gender
Expanding our understanding of social contextual determinants of worker health outcomes
Understanding the dual impact of job and life risk exposures over the life course
Methods development research
Further specification of integrated interventions
Further development of measurement tools
Assessing intervention efficacy
Assessment of intervention efficacy for OSH and worksite health promotion outcomes
Assessment of the efficacy of diverse types of integrated OSH/WHP interventions
Assessing intervention effectiveness
Assessment of the efficacy of interventions for diverse groups of workers
Consideration of a range of research methodologies
Process evaluation
Intervention implementation evaluation
Cost and related analyses
Assessment of worksite characteristics associated with participation
Process-to-outcome analyses
Dissemination and durability research
Research on the sustainability of organizational and behavioral changes
Research on the process of dissemination of tested interventions

G.1 Social epidemiological research

Other research frameworks have noted that a first phase of research progresses from hypotheses development aimed at understanding the basic etiology of the health issue of concern.[205–207] Interventions to improve worker health must be solidly based on an understanding of the patterns and distributions of worker illnesses and injuries in the population, including attention to differences in hazardous exposures and health outcomes by race/ethnicity, gender, and occupational class.[211–213] and of the broader social, cultural, economic, and political processes underlying these disparities.[214] Setting priorities for integrated approaches requires a thorough understanding of the populations that are at greatest risk for adverse health events.

As we examine underlying work conditions influencing worker health, it is important to consider the role of a range of social toxicities in the workplace—including, for examples, workplace-based discrimination and harassment, organizational factors such as hierarchical and authoritarian authority structures, and systemic disrespect.[209] Ascribing worker health risks to either the field of WHP (smoking, diet exercise) or OSH (dust, safety hazards, job strain) poses the risk of keeping these other threats to worker health off the radar screen of our research endeavors. Social epidemiological inquiry is needed that broadly examines a range of influences on worker health, and that additionally explores how "traditional" OSH and WHP health risks intersect with these types of social hazards at work.

Lack of OSH data by race/ethnicity and gender

In the WHP field, there is a deep literature on the distribution of risk-related health behaviors by race/ethnicity, gender, and various dimensions of social class. By contrast, there is a dearth of data on the distribution of occupational hazardous exposures, illnesses, and injuries by race/ethnicity or gender. What literature does exist, however, indicates that workers of color and low-paid workers, both men and women, suffer disproportionate exposures to workplace hazards. For example, in a review of the literature on workers of color, Frumkin et al.[213] assembled data from the mid-1990s confirming the persistence of historical trends in racial/ethnic disparities in occupational exposures, with occupations employing the most black and most Hispanic workers being more hazardous and having higher rates of job-related injuries and illnesses than occupations employing mostly white workers. Work-related illness and injury rates, in cases per 100 full-time workers per year, are 4.34 in occupations with the most black workers and 2.16 in occupations with the most Hispanic workers, compared with 0.85 for occupations with the most white workers.[213] Little data are available to describe the distribution of exposure to job-related hazards among working women, or comparisons of their exposures to those among men.[33,213] Additional research is needed to document the distribution of OSH hazards by socio-demographic characteristics in order to determine priorities for integrated interventions.

Need for expanding our understanding of social contextual determinants of worker health outcomes

In addition to examining the nature of workers' exposures to occupational hazards, understanding the nature and extent of social conditions at work and the ways in which these exposures influence health behaviors and other worker health outcomes is critical to efforts to improve worker health. In addition, it is important to improve our understanding of the ways in which these factors vary across important worker socio-demographic characteristics, as a basis for addressing disparities in worker health outcomes. To guide research on the social determinants of worker health outcomes, we have suggested a social contextual conceptual framework aimed at illuminating the "black box" through which population characteristics influence worker health, focusing initially on health behaviors while also considering the role of occupational exposures within this framework.[5,215] This framework examines the influence of workers' socio-demographic characteristics and socioeconomic position on health behavior outcomes through social contextual factors considered across multiple levels of influence. For example, at the individual level, following the work of Graham,[216–218] we might hypothesize that tobacco use prevalence will be highest among workers with the most numerous and complex role responsibilities; responsibilities at home may have important intersections with workload or job strain (i.e., high demand-low control work) in influencing behavioral outcomes. At the organizational level, it is important to understand the complex interplay between workers' potential occupational exposures and other characteristics of their work (e.g., shift work), job setting (e.g., industry or size of worksite),[147] and the social environment of the work setting.[145] Likewise, Devine et al. found that food choice strategies in low- and moderate-income urban households were differentiated by experiences of work. Individuals who felt their work was demanding but manageable viewed food choices for themselves and family members as a source of pride and satisfaction (positive spillover of work to home), whereas those who felt their work was demanding and limiting characterized food choices as a source of guilt and dissatisfaction (negative spillover).[219] Such information can guide intervention development by identifying modifiable elements of the social context that may be addressed through interventions, and can enhance the relevance of intervention messages by incorporating an understanding of the day-to-day realities of workers experiences.

Need for understanding the dual impact of job and life risk exposures over the life course

There have been increased calls for epidemiologic research that addresses health risks accumulated across the life-course, from infancy to old age.[220,221] Within WHP and OSH, as in other public health scientific fields, most studies capture workers' health burden at a given point in time through cross-sectional surveys, or at best over a series of cross-sectional surveys that spans the life of a typical 3- to 5-year grant period. Attempts to capture life-course experiences through survey questions that ask respondents to recall events from childhood can be fraught with threats to validity. There is a need for long-term cohort studies focused on workers' health that can measure and disentangle the complex web of risks encountered over the life-course and their resulting health impacts. Prospective studies would be able uncover the joint roles of work exposures and health behaviors in early life on later health outcomes, and the intersections of these exposures with a range of job experiences.

G.2 Methods development research

A second phase of research is aimed at methods development, including the development of intervention tools and research methods.[205–207] Before large scale, randomized controlled trials can be appropriately launched, important challenges must be addressed, such as identification of the overall risks and risk perceptions of this population; assessment of the feasibility and acceptability of the intervention in a specific population; assessment of potential participation in an intervention study; development and testing of reliable, valid measures for assessing outcomes within the defined setting; and preliminary small-scale tests of planned interventions.[205] We have identified two broad categories of methods development research that are likely to facilitate integrated OSH/WHP interventions: intervention development and measures development.

Need for further specification of integrated interventions

There is a need for further development and articulation of intervention methodologies that effectively integrate WHP and OSH. Critical issues include the following: (1) development of interventions for various occupational contexts and groups of workers within those contexts, (2) development of interventions for a broad cadre of occupational exposures and health behaviors, and (3) further specification and operationalization of "integrated interventions." Beginning with the first issue, we note that interventions conducted for a specific worksite context and audience of workers—such as blue-collar workers in manufacturing settings (where much of the research to date has been conducted)—cannot be directly applied to other contexts and/or types of workers. For example, interventions in manufacturing worksites would need to be adapted and tested in service sector settings, such as restaurants or retail stores. Likewise, one cannot assume that within a particular worksite context all workers will benefit equally from the intervention, as was shown in the Wellworks-2 study, in which the integrated intervention made a difference in increasing smoking cessation among blue-collar but not white-collar workers. Looking ahead, research findings on the social contextual determinants of worker health provide an important foundation for the development and refinement of integrated interventions designed in response to the work experiences and broader life experiences of diverse settings and groups of workers in those settings.

Second, integrated intervention studies need to investigate additional behavioral and OSH outcomes. Most such studies to date have focused on manufacturing-related job hazards and select health behaviors (e.g., tobacco, physical activity, and diet). Additional studies are needed to examine a broader range of health behaviors and occupational exposures, such as the development and preliminary testing of intervention methods to reduce job strain and identify methods for integrating such interventions

with health behavior interventions. In methods development studies, it is critical to pretest and refine intervention protocols, including process measures to assess implementation (see G.5), because subsequent efficacy and effectiveness studies will rely on careful articulation and implementation of these of standardized intervention protocols in order to assess changes associated with the intervention. Pretesting intervention protocols allow for assessing management's and workers' receptivity to the interventions; for example, workers may provide feedback regarding the extent to which the materials are usable, understandable, relevant, attention-getting and memorable, and credible.

And third, it is essential that in conducting these types of studies that researchers be explicit in their definition and operationalization of "integrated interventions." According to Figure 1, integrated interventions, by definition, address both life and job risks. Important to note, however, is that the unit of intervention can either be at the individual or organizational level, or both. For example, the Wellworks-2 intervention described above targeted both the individual worker and at the organizational level for managers. At the individual level, we provided educational messages to workers about the importance of smoking cessation in the context of hazardous job exposures, which together could increase risk for adverse health events, for example. At the managerial level, we attempted to change management behaviors, focusing on developing systematic approaches to reducing job hazards, as well as policies that would promote healthy behaviors (e.g., providing healthful food options in the cafeteria). In a more recent pair of studies currently under way (see Section E) with unionized building trades workers and apprentices, we are intervening only at the individual level with workers, but integrating messages about how OSH conditions can increase health risks associated with smoking and poor diet. Researchers need to consider and define the unit of intervention for integrated messages.

In addition to defining the level of intervention, it is likewise critical to determine what is actually meant by "integration." As noted in Section E, a worksite may make organizational changes to fuse OSH and WHP within a single box on an organizational chart, assigning responsibility for worker health to a single department or other organizational unit. In other instances, worksites may make organizational changes to structure improved collaboration and communication among those responsible for OSH and WHP. For researchers implementing an integrated OSH/WHP intervention from outside the work organization, it may be necessary to grapple with some questions. If OSH and WHP initiatives are being undertaken in a worksite—in parallel—should that be considered an "integrated approach" to worker health? Or is some deeper level of intersection required, for example *embedding* smoking cessation messages and programs in the context of efforts to reduce exposure to toxic fumes? And what would "embedding" actually look like within a given setting? Implied in such a question is whether the "whole" of an integrated approach is greater than or equal to the sum of its WHP and OSH parts. Can we, in fact, achieve a "synergism of prevention" with integrated approaches—a notion proposed by NIOSH 20 years ago and endorsed in a recent speech by current NIOSH Director John Howard.[2,222]

Need for further development of measurement tools

There is a crucial need for development of valid measures that permit testing of the efficacy of interventions. Of highest priority is the need for measures of change in occupational health and safety outcomes that can be used across types of settings/exposures. In designing integrated OSH/WHP interventions, it is critical to set priorities for OSH intervention targets and to select appropriate outcomes that can be reliably and accurately measured. In OSH research, quantitative exposure assessment, using such measures as air-sampling techniques, is the gold standard for assessing intervention effectiveness; in integrated interventions, however, this type of assessment may not be feasible for a few reasons.[166] First, quantitative exposure assessment may be best applied in settings where only one or a few hazards are being assessed (e.g., the recent Minnesota Wood Dust Study[223]) and is less feasible in settings with multiple exposures, regardless of whether outcomes are measured using exposure assessment methods or by self-report through worker surveys.

In contrast, it is feasible to measure health promotion outcomes across a range of worksites and different types of occupations using the same measures, whether through self-report on surveys or through more objective measures, such as biological samples to verify presence of a nutrient.

Second, statistical power issues must be considered. Assessing intervention effectiveness for OSH outcomes at the worksite level requires that many worksites be included in the study in order to detect intervention-related changes, depending on the type of intervention. Consider, for example, the type of OSH intervention applied in the WellWorks-2 study described above, which aimed to assess efficacy by comparing the extent to which worksite management in the control and intervention conditions made voluntary improvements in OSH conditions and programs at the urging of the intervention researchers, as measured at organizational and environmental levels. The sample size of 15 worksites may have been too small to detect statistically significant differences in the mean changes in outcomes (OSH program score and exposure prevention rating) between the two conditions. On the other hand, classic industrial hygiene interventions that aim, for example, to test whether an intervention such as installing a ventilation system reduces workers' exposure to levels of airborne contaminants, would require fewer worksites to demonstrate the efficacy of the intervention. In the case of the WellWorks-2 type of intervention, conducting quantitative exposure assessments across many worksites, and many different hazardous exposures within and across worksites, would have been difficult and very costly.

In an attempt to advance methods research in this area, as part of the WellWorks-2 study, LaMontagne et al.[166] developed an exposure prevention rating method for the purposes of (1) setting priorities for interventions on hazardous substance exposures in manufacturing worksites, and (2) evaluating intervention effectiveness. Theoretically grounded in the "hierarchy of controls" model,[76] the rating method includes indicator variables to assess the potential for and prevention of exposures at three levels: *materials* (source of the hazard), *process* (path between source and worker), and *human interface* (worker). Initial field application of this rating method in the Wellworks-2 study demonstrated its capability of providing common metrics across various hazardous substances encountered in 131 separate work processes in the study worksites. Additional research on this instrument is needed to refine indicator variables, validate the rating method against quantitative exposure assessment methods and other exposure metrics, and modify the instrument for nonmanufacturing settings.[166]

G.3 Assessing intervention efficacy

The third phase in our research framework is the testing of intervention efficacy. A distinction is generally made between efficacy trials, which provide tests of an intervention under "optimal" conditions, and effectiveness trials, where testing is conducted under "real world" conditions.[205,207] Although the distinction between these phases may be blurred in some tests of public health interventions, we maintain this distinction here to underscore the need for full examination of the generalizability of an intervention to a range of populations and settings, as would be the focus of an effectiveness study (see Section G.4). An efficacy trial provides a test of a well-specified intervention, made available in a uniform manner and standard settings, to a specified target audience.[207] Here, the test would aim to determine an intervention's ability to reduce the potential for workers' exposures to job hazards and/or to produce changes in targeted health behaviors. As outlined in Sections C and D, in the past two decades an increasing number of studies have assessed the efficacy of workplace interventions targeting health behaviors; a growing number of studies have been initiated to assess OSH outcomes. In general, but not always, the randomized controlled design is the accepted standard for assessing the efficacy of these interventions, with change being assessed from baseline to follow-up and compared between conditions, as a means particularly of controlling for secular trends.[31,224–226]

These recommendations build on research conducted separately on worksite health promotion interventions and OSH interventions, as well as on

the nascent research evaluating integrated interventions. As we described in Section E, few randomized controlled studies have assessed the efficacy of worksite interventions integrating worksite health promotion and occupational health and safety. The studies conducted to date have focused particularly on assessing change in cancer risk-related behaviors, with particular emphasis on tobacco; and among blue-collar workers, particularly in manufacturing settings. To move the field forward, we need to know whether integrated OSH/WHP interventions are efficacious in changing both workers' health behaviors and their potential for exposures to hazards on the job. Following the description in Section G.2 above, integrated interventions need to be designed to address a range of job exposures and health behaviors, and the breadth of these interventions needs to be tested, in comparison to both traditional health promotion programs and standard OSH programs.

Need for assessment of intervention efficacy for OSH and worksite health promotion outcomes

Following Figure 1, it is important that we test the efficacy of integrated OSH/WHP interventions in terms of both occupational health and safety and health behavior outcomes, at both the individual and organizational/environmental levels.

Occupational health and safety outcomes: In addition to issues of measurement across a range of worksites and types of hazards, as described above, researchers must also consider the level at which to measure effects of interventions on OSH conditions, and among whom. For example, there is a need for assessing the effectiveness of integrated programs in terms of OSH outcomes at both the worksite and individual levels. At the individual level, measures may include the use of self-report surveys, injury and illness records, or biomarkers for exposures among workers. At the worksite level, outcomes may be measured using quantitative exposure assessment, visual inspections, record audits, a rating method such as one reported by LaMontagne et al.,[166] or surveys of a single or multiple representative of the worksite.

Health behavior outcomes: As we describe in Section E, to date the strongest available evidence supports the efficacy of integrated OSH/WHP interventions in promoting smoking cessation, with emerging evidence pointing to additional significant effects for physical activity and diet. There is a need to examine the efficacy of integrated interventions in influencing a range of other behavioral outcomes. For example, in light of the growing epidemic of overweight and obesity in the United States,[34] a high priority among these outcomes is the ability of integrated interventions to influence weight control and weight management.

Health behavior outcomes are usually assessed by measuring change in worker health behaviors, either through surveys of workers or through other tracking measures (e.g., use of pedometers to measure changes in physical activity or through review of medical records to validate self-reports of participation in prevention screening). As noted in Figure 2, worksite health promotion research has also looked at a range of other individual outcomes, including biological outcomes such as blood pressure, or changes in serum cotinine to verify smoking cessation. In addition, there are measurement instruments to detect worksite-level changes to promote healthy behaviors[227,228] For example, the Heart Check[227] is a 226-item instrument that uses a dichotomous scoring system, with points awarded for favorable characteristics, such as a worksite smoking ban. It has been shown to be sensitive to detecting pre and post intervention changes.

Need for assessment of the efficacy of diverse types of integrated OSH/WHP interventions

In addition to assessing the efficacy of integrated interventions on an expanded breadth of OSH and health behavior outcomes, across multiple levels of influence (see Figure 1), it is necessary to design studies with careful attention to the comparison point of an intervention assessment, as we illustrate in Figure 5. Comparison of integrated OSH/WHP interventions against controls that offer no intervention addresses one key element in understanding the potential of these interventions. It is important, in addition, that we understand the contributions of integrated OSH/WHP interventions *over and*

above the effects of either worksite health promotion alone, or OSH programs alone. The integrated OSH/WHP studies described in Section C were primarily intended to address whether the addition of OSH helped to boost the effectiveness of WHP outcomes. WellWorks-2, for example, compared the results of an integrated OSH/WHP intervention with results of worksite health promotion alone. Additional research is needed to examine the question: Does the integration of OSH and health promotion help to improve OSH outcomes compared with OSH alone? It may also beneficial to examine health behavior change within the context of this comparison. It bears noting that powering a study to detect change at the worksite-level requires a substantially larger number of worksites than studies for which the individual-level outcomes drive the sample size.

Figure 5. Study design: Appropriate comparisons in assessing integrated OSH/WHP interventions

		Inclusion of OSH in intervention?	
		NO	YES
Inclusion of WHP in intervention?	NO	Non-Intervention Control	OSH-Only Intervention
	YES	WHP-Only Intervention	Integrated OSH/WHP Intervention

G.4 Assessing intervention effectiveness

Effectiveness studies provide validation of the generalizability of interventions whose efficacy has already been tested. Effectiveness trials require thorough assessments of program implementation, availability and acceptance, in order to allow researchers to determine if the lack of effectiveness is the result of inadequate program delivery, insufficient participation, or an inefficacious intervention.[207] Here, we focus on the need to understand how the integrated OSH/WHP programs work for diverse populations of workers when implemented in a range of worksite settings. We also recommend the application of a range of research methodologies, in order to maximize the lessons to be learned from different study designs.

Need for assessment of the efficacy of interventions for diverse groups of workers

In Section G.2, we recommended development of interventions for various occupational contexts and groups of workers within those contexts. It is important that we examine the generalizability of evidence-based integrated OSH/WHP interventions, based on adapting interventions for new settings and with different populations, using as a foundation lessons learned from prior research. As we describe in Section F, the changing trends in the workforce and the social inequalities in the distribution of workers' risks provide important information for setting priorities for this replication research. To summarize, key changes in the labor force that have implications for future adaptation and testing this intervention model include the following: (1) the growing service sector, and the increasing number of contingent workers; (2) the changing demographics of the workforce, including the growing number of immigrant workers and older workers; (3) increasing job insecurity arising from corporate downsizing, mergers, and acquisitions; (4) rising income inequalities and related social disparities in risk-related behaviors and hazardous occupational exposures; and (5) declining unionization rates. These changes point to key priorities for future research, to assure that integrated OSH/WHP interventions are generalizable across a range of industry settings, to workers in different occupations and representing diverse backgrounds, and addressing key job and life risks for these settings and populations.

Consideration of a range of research methodologies

As future studies are designed to examine the efficacy and effectiveness of integrated interventions, it is important that the pros and cons of different study designs and methods be considered. In the field of community intervention research, some have raised concerns that exclusive application of the randomized controlled design may restrict our ability to consider the complexity of social settings such as worksites.[225,229] For example, as noted in Section E, the randomized controlled trial may not be an appropriate research design for assessment of the effects of the structural changes in the workplace that clearly require management's leadership and initiative. The randomization of worksites to condition raises further challenges for intervention research in terms of both expense and statistical power.[230–232] The required standardization of the intervention in the randomized controlled trial may limit the intervention's effectiveness by failing to tailor to the needs of the site and to provide a vehicle for incorporating worker input.[233] In addition, it may not be feasible to randomize; indeed, full-scale implementation of integrated OSH/WHP programs must by necessity be initiated by management in collaboration with labor, thereby assuring that programmatic efforts can by systemically incorporated throughout all levels of the organization. Research on the effectiveness of such efforts may need to rely on nonrandomized studies, including demonstration research conducted among convenience samples of worksites. Through the diversification of research methods, including observational studies, qualitative research, and participatory action research, it may be possible to address a broader range of questions that will contribute to improved effectiveness of integrated OSH/WHP interventions.[234–236]

G.5 Process evaluation

We suggest four overarching aims for process evaluation: intervention implementation evaluation; cost analyses; assessment of worksite characteristics associated with participation; and process-to-outcome analyses.

Need for intervention implementation evaluation

The parameters of implementation evaluation have been defined to include assessment of how a program is implemented, what intervention is provided, under what conditions, with delivery by whom and to whom.[207] It is important that future intervention research examine program implementation issues. Recent worksite health promotion trials have included rigorous assessments of the implementation of interventions through process tracking systems measuring such indicators as dose, or the amount of intervention delivered; fidelity, or the extent to which the intervention was delivered as planned; and program coverage, including participation in programs and awareness of environmental changes.[237–242] Likewise, in OSH aspects of the intervention, it is critical to systematically document how an intervention was carried out.[226] These data provide important information that enhances the ability to interpret outcome assessments, identify competing explanations for observed effects, and measure exposure to the intervention.[229,243–245] For example, it is important to determine the dose of intervention necessary to achieve the targeted changes in health behaviors and potential for hazardous occupational exposures. Through intervention implementation evaluation, it may be possible to identify the minimum amount of intervention needed to have an impact, thereby defining cost-effective strategies that efficiently maximize intervention outcomes without sacrificing intervention quality.[246]

Need for cost and related analyses

Second, there is a need for future research to include cost analyses and related measures (e.g., productivity, absenteeism) to assess costs, effectiveness, and benefits of integrated interventions. These findings will provide a basis for decision-making by employers and regulatory agencies, and may be useful in meeting the aim of creating the "business case" for integrated interventions.[9] Such analyses can make use of new systems that allow for tracking costs via insurance claims and disability claims, with links provided to data on program participation and program costs.

Assessment of worksite characteristics associated with participation

It is necessary to gain an understanding of the full range of factors that would promote and inhibit employer participation in integrated programs, as a first step toward developing strategies to engage employers in evidence-based OSH/WHP programs. Glasgow and colleagues have provided a framework for this research through their RE-AIM model, describing several components of intervention impacts.[119] They recommend that studies assess adoption, or the percent and representativeness of worksites that are willing to adopt a program. Within the context of worksite intervention research, for example, we might assess adoption rates in terms of the proportion of worksites that agree to participate in the study among those meeting study eligibility criteria, and compare the characteristics of adopters and nonadopters. In this way, it is possible to assess the external validity of worksite-based studies, that is, the extent to which worksites recruited into trials represent other worksites.[55,247,248]

Surveys of management may provide further information on factors influencing management interest and willingness to participate in integrated programs.[249] Although it is clear that cost assessments can help to make the "business case" for employer participation based on an identification of potential savings in direct and indirect costs as a result of these programs, such research additionally can promote understanding of other motivators, such as employer concern for employee well-being, ability to recruit personnel and reduce turnover rates by offering comprehensive approaches to worker health, and positive community public relations. A better understanding of the full range of motivators would help to identify strategies to promote participation in research and eventual adoption of programs shown to be effective.

Need for process-to-outcome analyses

Third, there is a need for process-to-outcome evaluations in order to improve specification of effective intervention methods through assessment of the pathways through which interventions operate. That is, understanding-centered research that goes beyond an exclusive focus on outcomes to explore mechanisms and processes by which the outcomes occur. As we outline in Section G.1, clear specification of the theoretical or causal model guiding the intervention is needed in order to clarify the ways in which the "black box" of the intervention is expected to work.[224,250] We have suggested a social contextual framework, as described in Section G.1, which specifies mediating mechanisms, meaning the pathways by which the intervention will influence the outcomes, such as social support; and modifying conditions, or the factors that are not influenced by the intervention but can independently influence outcomes, such as social class.[5] Mediating mechanisms and modifying conditions are specified according to a defined theoretical framework. This theory-driven approach offers numerous advantages, including the ability to identify pertinent variables and how, when, and on whom they should be measured; the ability to evaluate and control for sources of extraneous variance; and the ability to develop a cumulative knowledge base about how and when programs work.[251–254] When an intervention is unsuccessful at stimulating change, data on mediating mechanisms can allow investigators to determine whether the failure is due to the inability of the program to activate the causal processes that the theory predicts, or to an invalid program theory.[254]

This understanding–centered research is likewise able to elucidate the benefits and downsides of integrated OSH/WHP programs for workers as well as employers. Cost and related analyses described above contribute to our ability to make a business case for these programs. In addition, we need to understand incentives and benefits for workers to participate in programs and to change health behaviors as a result, and to explore disadvantages and costs to their participation.

There is a need as well to consider the implications of a given intervention for secondary outcomes, determined based on the nature of the intervention. For example, work organization strategies designed to improve productivity and product quality (e.g.,

total quality management, reengineering, team concept, lean production, and patient-focused care) also impact on levels of employee participation, job stress and health risks.[183,226]

G.6 Dissemination and durability research

The overarching aim of this research agenda is broad-based dissemination of evidence-based interventions that can be effectively sustained in worksites across the nation, thereby contributing to long-term improvements in worker health. In general, however, there remains a sizable gap between prevention science and prevention practice.[255,256] Research in the final phase can inform this process by identifying, for example, effective dissemination processes, programmatic characteristics most likely to be adopted and sustained over time, and organizational characteristics associated with readiness for change.

Need for research on the sustainability of organizational and behavioral changes

Research is needed to examine the sustainability of a program within a worksite, as well as the maintenance of health behavior changes and OSH-related changes over time. For example, at the organizational level, it is important to consider: (1) the durability of the effects of the program on health benefits (e.g., worker illnesses, injuries, health behaviors) over time, beyond the initial program; (2) continuation of the program activities within the organizational structure (e.g., continuation of engineering controls to reduce job hazards, continuation of worksite smoking policies); and (3) building the capacity of the worksite to sustain the intervention (e.g., training workers and managers to identify and ameliorate job hazards; increasing knowledge of community-based health promotion resources).[257] Assessing organizational/environmental changes only at the completion of the intervention may reflect a mismatch between the research timeline and the timeline of change as it occurs in workplaces, and therefore it may underestimate intervention impact. Thus, there is a need for studies that examine changes well beyond the intervention period, bearing in mind that the validity of extended follow-up assessments relies on the capability of obtaining high response rates beyond the completion of the intervention. Theories of organizational change and innovation provide a conceptual approach for how new programs ("innovations") become incorporated or "institutionalized" within organizations.[257–263] Institutionalization reflects a process of mutual adjustment whereby changes are made in both the intervention and the organization.[264] Accordingly, the innovation loses its separate identity and becomes embedded within organizational structures and a routinized part of the organization's regular activities.[258,259,265]

Need for research on the process of dissemination of tested interventions

To bridge the gap between research and implementation of evidence-based research, researchers and practitioners need to assure that the intervention has been shown to be effective, and that employers and workers are prepared and ready to adopt, implement, disseminate, and institutionalize the intervention. Planning for dissemination must be structured into intervention design and made an integral part of planning from program inception, rather than a post-hoc consideration.

Dissemination of effective interventions requires the identification of both core and adaptive elements of the intervention.[266–268] Core elements are those features of a program or policy that *must* be replicated to maintain the integrity of the interventions as they are transferred to new settings. For example, core elements might include factors such as the inclusion of tested, theoretically-based behavior change strategies, targeting multiple levels of influence, and the involvement of empowered community leaders.[269,270] Adaptive elements include those features of an intervention that can be tailored to organizational, social, and economic realities of the new setting without diluting the intervention's effectiveness.[266] These adaptations might include timing and scheduling issues or modifications in culturally meaningful themes through which the educational and behavior change strategies are delivered. Dissemination research could help to identify alternatives to conceptualizing transfer of intervention technology from research to the practice setting. Rather than disseminating an exact replication of specific tested interventions, program transfer

might be based on core and adaptive intervention components at both the individual and community/organizational levels, through dissemination research and process evaluation.[241,271,272]

There is a need to learn more about how dissemination occurs in order to increase the effectiveness of the process. Goldenhar and colleagues[226] pointed to several important questions for dissemination research in OSH that are clearly applicable to dissemination of integrated OSH/WHP interventions, including the following: (1) What factors hinder and facilitate the dissemination of effective interventions to appropriate worksites? (2) How can we increase the speed and improve the effectiveness of the dissemination process?[226] Dissemination research may additionally explore the following: What characteristics of worksite and union leaders are associated with dissemination of integrated programs? What personnel and material resources are needed to implement and maintain prevention programs? How can we provide both written materials and training in program implementation that will preserve fidelity to core elements?[266] Dissemination research may also examine worksite organizational factors that may facilitate or hinder the adoption, implementation, and maintenance of integrated OSH/WHP programs. Diffusion theory assumes that the unique characteristics of the adopter (i.e., worksite) interact with the specific attributes of the innovation (risk factor targets) to determine whether and when an innovation is adopted and implemented.[259,273,274]

Dissemination research can also help to identify strategies to increase participation in programs among worksites with limited resources to provide their own integrated OSH/WHP programs, such as businesses employing fewer than 50 people.[111,275] Through effective dissemination of community programs, it may be possible to engage employers through outsourcing and in collaborating with other small worksites to purchase services.[276]

G.7 Barriers to research

To accomplish this research agenda, it is important to attend to several key challenges. First, several methodological issues require careful consideration. As we discuss in Section G.4, there is a need for *diversification of research methods*, with particular attention to the development and adaptation of methods that bridge OSH and WHP. For example, although the randomized controlled design provides one rigorous method for assessing the efficacy of interventions, this study design may not be feasible or even desirable for some research questions, for example, for assessing the impacts of broad-based structural changes that require a level management commitment going beyond that which could be randomly assigned. It is important that a range of both inductive and deductive methodologies be articulated, taking advantage of the strengths of both OSH and WHP research traditions, in order to design rigorous, credible, and reproducible investigations across the full range of research phases. In addition, studies must be designed with careful attention to *maximizing the generalizability* of research findings. Too often only larger, more affluent, stable worksites are available for study, and the results of investigations may not be applicable to small businesses or those with more transient workforces. Worksites selected for inclusion in the studies must be representative of a larger population of worksites, and when individual workers are surveyed as part of the outcome assessment, it is important that they represent the work force from which they were sampled. The self-selection of worksites into studies may contribute to a response bias at the worksite level. In addition, there is a need for *valid and reliable measurement tools* that permit consistent assessment of outcomes across worksites participating in the research, and that are appropriate for diverse groups of workers. Finally, measurement of the full range of outcomes resulting from integrated OSH/WHP interventions requires *access to worksite data* permitting measurement of morbidity indicators, health-care utilization, absenteeism, and related issues.

To accomplish the most useful research, investigators need access to a range of populations, through close collaborations with industry and labor. These relationships are best fostered over the long-term, through ongoing partnerships based on a shared commitment to worker health. Such collaborations are likely to foster opportunities for observing the

benefits to be derived from broad-based organizational changes integrating OSH and WHP. It is imperative that these relationships reflect the growing diversity of the labor market and the range of settings in which workers are employed, as we illustrate in our discussion of labor trends. To be effective with a range of audiences, intervention programs must take into account the assets and health strengths as well as health risks of workers of low socioeconomic status and from racial and ethnic minority groups.

Full implementation of these recommendations regarding interventions and research needed may also require changes in the ways that funders view and support OSH and WHP. Categorical funding of research initiatives has furthered the segregation of these fields. A comprehensive view of worker health would be supported by systematic funding of interdisciplinary, collaborative research and training.

Conclusions

In conclusion, as we move forward with an agenda for integrating OSH and worksite health promotion, it is critical that rigorous scientific evidence be the cornerstone of our planning. Advancing knowledge in this area requires that we attend to barriers for scientists, including the real work of assembling multi-disciplinary teams and identifying funding sources to support integrated studies. Research to develop and test effective intervention strategies integrating OSH and WHP requires an interdisciplinary approach. Experts in these areas read different journals, attend different professional meetings, and employ different research methodologies. Indeed, these diverse backgrounds have contributed to differing ideological perspectives about responsibility for worker health. The belief that worker health begins with individual behavior change sets in motion a different set of intervention strategies from the legal formulation in the Occupational Safety and Health Act, which starts from the assumption that management bears primary responsibility for worker health and safety on the job.[1] Overcoming the segmentation of these fields ultimately will require an inclusive, comprehensive model of work and health, providing for resolution—or at least understanding—of our differences assumptions, vocabulary, research methods, and intervention approaches.[277] It is possible to expand communication streams across disciplines to support transdisciplinary/inter-disciplinary strategies, for example, through shared journals or further shared symposiums such as the NIOSH symposium for which this document was created.

One vehicle to promote this requisite collaboration may be through the creation of multi-disciplinary centers of excellence, bringing together researchers across disciplines and with diverse perspectives, yet with a shared focus on a common endpoint: the health of workers. To advance the field, it is important that these multidisciplinary teams of include representation of occupational health and safety, industrial hygiene, behavioral and social sciences, organizational change, health promotion, labor education, and cost analysis, among other areas, with the ability to apply both quantitative and qualitative research methods.[1,149] Together, researchers in such centers may be able to create broad-based partnerships with industry and labor in the design and evaluation of feasible and innovative interventions integrating OSH and WHP. An emerging science of interdisciplinarity can help to inform the development and structure of these centers. Stokols has articulated, for example, key processes that can contribute to the success of transdisciplinary collaboration.[210] Through careful planning and purposeful and strategic operations, these centers of excellence may further advance the field by developing and applying rigorous research methodologies to evaluate the efficacy, generalizability, sustainability, and disseminability of these integrated interventions across a range of worksite settings.

Implementation of these research recommendations is also likely to necessitate changes in the ways that funding agencies such as the National Institutes of Health and NIOSH view worker health

proposals. The budgets for these agencies are also vastly discrepant, with NIOSH receiving far fewer resources than NIH institutes such as the National Cancer Institute. An interagency collaboration to jointly support integrated OSH/WHP interventions would provide much-needed resources to advance scientific discovery. It is important that such interagency funding extends rather than supplants current NIOSH efforts, thereby protecting the central function of NIOSH focused on worker health protection. A related issue is the way that funders currently review research proposals. At present, proposals to address health behavior interventions are handled by certain review panels in NIH, while occupational health intervention proposals are separately addressed by a special occupational health review panel. Given the unique expertise represented by these panels, it may be difficult for investigators to convince members of one or the other review panel of the importance of integrated interventions, let alone to receive a sophisticated critique of study methods unique to each discipline. If NIH agencies and NIOSH join forces to support integrated intervention research, it would also be important to convene an ad hoc reviewer panel representing expertise in multiple relevant disciplines.

We have attempted to define a comprehensive agenda for future work, structured in a step-by-step fashion. The development and dissemination of effective intervention methods will be enhanced as research is implemented across the full spectrum of the phases of research—from methods development studies through dissemination research. By combining what we have learned to date from testing of worksite health promotion interventions and OSH interventions, we are well poised to launch the next generation of research in support of worker health.

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Examining the Value of Integrating Occupational Health and Safety and Health Promotion Programs in the Workplace

An Update of a Report First Released in 2004
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Introduction

A few months ago, colleagues at the National Institute for Occupational Safety and Health (NIOSH) asked me to revisit a background paper I wrote in 2004 to coincide with the launch of the Steps to a Healthier U.S. Workforce initiative that year. My assignment was to do some *minor* editing and updating of the manuscript and write a brief introduction, which I agreed to do. The exercise forced me to re-read the original document, which I had not done in years, and re-examine its basic premises. The attached updated background paper follows the same outline as in the original manuscript, with only minor tweaks to the content and with the addition of case studies describing companies adopting an integrated approach to health, safety, and productivity management for their workers.

The 2004 Steps initiative, now renamed Total Worker Health, aims to "protect, support, and enhance the health of workers through comprehensive programs for safe and healthy work, integrated with health-supportive environments and access to adequate health care."[1] A central tenet of the initiative is to simultaneously address workers' health protection and health promotion within an organization. Historically, these disciplines have not communicated well or interacted much with one another. Health *protection* is primarily focused on safety issues, risk management, workers' compensation claims, and exposure to workplace hazards and toxins. In contrast, health *promotion* is directed at helping employees adopt healthy lifestyles to prevent debilitating disease and disability. This involves promoting primary and secondary prevention to support workers in their efforts to become physically active, eat a healthy diet, manage weight, quit tobacco use, manage stress, and not drink excessive amounts of alcohol—to name a few of the health risks typically addressed by what is colloquially referred to as "wellness" programs.

NIOSH, the federal agency in charge of generating knowledge in the field of occupational safety and health and transferring that knowledge into practice, convened the "Steps" conference with the aim of bringing together experts from the two parallel disciplines of health protection and health promotion to share their experiences, insights, methods, and approaches. The larger aim, then and now, is to better the lives of workers by integrating health, safety, and productivity management activities at the workplace.

The 2004 background paper focused primarily on building a business case for health protection and health promotion integration. It cited studies showing that workers' poor health, both physical and mental, and the health risks that precede illnesses are associated with increases in health-care use, absenteeism, disability rates, safety incidents, and workers' compensation claims, as well as a reduction in productive work output, referred to as "presenteeism." Having set the stage for greater coordination among disciplines by arguing that poor health affects more than just direct medical expenditures, the paper went on to describe what in 2004 was an emerging business strategy called *Health, Safety, and Productivity Management*. It then explained the reasoning behind integrating diverse and often competing organizational functions into a cohesive and coordinated whole, but also the barriers to integration efforts. The report outlined a "simple" four-phase model for integration and articulated specific actions organizations can take to implement each of the phases. It also identified as best practices the common threads or themes that run across successful integration efforts. The report concluded by offering recommendations for government, industry, unions, nongovernment organizations, academia, and other stakeholders to accelerate the adoption of integrated health, safety, and productivity management programs.

With seven years of hindsight, the basic rationale for health promotion and health protection integration is still relevant and may be even more pressing in today's world. Most experts agree that for U.S. business to remain competitive in a global economy, American workers need to be smart, adaptive, creative, and productive. Underlying these requirements are necessary structural and normative changes that ensure workers remain healthy and

safe. A successful, growing economy requires investment in education and training programs, as well as improvements in infrastructure, both traditional (e.g., upgrading highways, bridges, and airports) and nontraditional (e.g., expanded broadband coverage, electric transmission systems that accommodate new energy sources, and widespread adoption of electronic medical records). Also, to stay ahead of competing economies, the United States needs to encourage and nurture entrepreneurial activities by supporting increased investment in research and development focused on innovation.

What does all this have to do with employee health and safety? People, sometimes referred to as "human capital," are essential in meeting the above goals, and these people need to be healthy and productive. One striking example of the clash between workers' health and economic growth can be seen in the consequences of an epidemic rise in obesity. Today, two out of three U.S. adults are either overweight or obese, which places them at increased risk for developing obesity-related disorders, such as type 2 diabetes, cardiovascular disease, stroke, some forms of cancer, osteoarthritis, depression, gallbladder disease, and respiratory disease.[2] These health problems lead to an estimated 280,000 to 325,000 premature deaths each year, sometimes during individuals' most productive work years.[3]

Not only is obesity a society-wide problem, it is hurting U.S. businesses. On a national scale, in 2003, obesity-related disorders resulted in 39.3 million lost workdays, 239 million restricted activity days, and 62.7 million doctor office visits.[4] Schulte et al., in their review of workplace literature, highlighted clear relationships between workers' obesity and consequent injury, asthma, musculoskeletal disorders, immune system response, neurotoxicity, stress, cardiovascular disease, and cancer.[5] Finkelstein et al. estimated medical and absenteeism expenditures for obese full-time employees to be in the range of nearly $400 to more than $2,000 per person per year, compared with normal-weight workers.[6] Henke et al. calculated the excess costs associated with 10 modifiable health risks for PepsiCo employees and found that obesity was significantly associated with increased workers' compensation costs.[7] Similarly, Ostbye et al. showed a relationship between employees' health risks and workers' compensation costs for Duke University as an employer.[8] Other authors demonstrating the link between obesity and safety-related incidents include Goetzel et al., Kuhnen et al.,[9] and Darden et al.[10] In spite of an ambitious national health objective to reduce the prevalence of obesity among adults to less than 15% by 2010,[11] the situation is worsening rather than improving.

Understanding this relationship between obesity and business costs, employers are seeking ways to stem the tide of overweight and obesity among their workers and do so in a responsible and ethical way. For many employers, that means providing workers with a "healthy company culture" that promotes positive health habits and offers easy access to health promotion programs that include components focused on obesity management. To encourage participation in these programs, many companies now offer financial or other incentives to employees for participation, and in some cases for achieving certain health improvement goals.

Public sector initiatives that support employers in their obesity management programs are also expanding. In 2009, the Centers for Disease Control and Prevention (CDC) launched a new public website called LEAN *Works*!,[12] which uses materials from the *Guide to Community Preventive Services*[13] as a platform for recommendations on policies, programs, and tools aimed at reducing obesity rates at the worksite. Additionally, the CDC is now developing a new organizational assessment tool based on evidence reviews by its Community Preventive Services Task Force. This tool, called the Health Score Card, will help employers of all sizes assess the extent to which they have implemented best-practice health promotion programs at their worksites. This tool will complement other employer-directed efforts developed nationally, by states, and by business coalitions.[14,15]

In 2004, there was a growing body of research pointing to evidence that worksite programs "worked." That notion was tested in a systematic literature review by Soler et al. in the CDC Community Guide, published in 2010.[16] The conclusion of the review

was that comprehensive, well conceptualized, theory-based worksite programs *do* exert a positive influence on certain health behaviors, biometric measures, and financial outcomes important to employers. The Community Preventive Services Task Force found *strong* or *sufficient* evidence that worksite programs can reduce participating employees' rates of tobacco use, dietary fat consumption, seat belt nonuse, high blood pressure, total serum cholesterol levels, high-risk drinking, and number of days absent from work because of illness or disability. Their review also found improvements in workers' physical activity, overall health and well-being scores, and healthcare use, especially in terms of reduced hospital admissions and days of care.

At the same time that the CDC Task Force review was published, a review by Harvard economists pointed to the potential of a financial payoff from wellness programs. The 2010 review by Baicker, Cutler, and Song concluded that worksite programs can save money and, in fact, had the potential for achieving a positive return on investment (ROI).[17] Their cost savings estimates, drawn from a review of many decades of research, showed that good programs could achieve a $3.00 to $1.00 ROI from medical and absenteeism savings, over a 3-year time horizon.

All of these studies and reviews bode well for NIOSH and the CDC, which for years have advocated for a greater integration of workplace health promotion and disease prevention programs, alongside employee protection and safety programs. The rationale then, in 2004, and now, in 2012, is to remove the "silos" of accountability so that greater health and cost efficiencies can be achieved.

With 157 million American working-age adults spending a significant portion of their waking hours at work,[18] employers have an opportunity to reach a large segment of the American people who would not normally be exposed to or engaged in organized health improvement and safety programs. Among the various constituencies involved in health care, employers have the strongest interest in keeping their workers safe, healthy, and productive. Thus, the promise and potential for achieving large-scale health and economic improvement among working-age adults are undeniable.

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Introduction and Purpose

As was true in 2004 when this report was first written, the U.S. workforce is changing rapidly. As a society, we are moving toward a knowledge-based economy that relies heavily upon the creativity, mental and physical stamina, and intellectual capacity of workers. Our economy is becoming much more dependent on "knowledge" workers as many traditional service and manufacturing jobs migrate to other countries. As noted in a 2001 speech by Federal Reserve Board Chairman Alan Greenspan, "… in 1900, agricultural and manual laborers composed about three-quarters of the workforce. By 1950, those types of workers accounted for one-half of the workforce, and though still critical to a significant part of our economic value-added, today compose only about one-quarter of our workforce. Work is becoming less physically strenuous but more demanding intellectually, continuing a century-long trend toward a more-conceptual and less-physical economic output."[1]

As we progress from a brawn-based economy to a brain-based one, the productive output of workers has assumed a greater importance. Fortunately, the overall productivity of American workers has risen dramatically over the past several decades. For example, in 2002, output per worker hour grew at an annual rate of more than 2.5 percent, compared with a rate of roughly 1.5 percent during the preceding two decades.[1] For the period of 2001–2004, worker productivity increased an astonishing 4.5 percent.[2]

Clearly, a large portion of these productivity gains are attributed to the billions of dollars spent on new technology and capital investment. Yet, another significant portion is a consequence of improvements in individual and organizational efficiencies, in many cases forced upon organizations that strive to remain competitive in a global market. As Greenspan explains, "It is, of course, difficult to separate rates of return based on the innovations embedded in new equipment from the enhanced returns made available by productive ideas. From an accounting perspective, efficiency gains, broadly defined as multifactor productivity, have accounted for roughly half the growth in labor productivity in recent years."[3]

At the same time, in order to stay competitive, organizations are adopting a "lean workforce" philosophy, and many traditional manufacturing jobs are being sent overseas.

This paper examines the role of worker health as a key contributing factor to increases in workplace productivity, and the emergence of organizational practices that support the integration of occupational health, safety, and productivity management programs. It explores answers to the following questions:

- What is the context for examining the relationship between worker health, safety, and productivity gains?
- Can a business case be developed for introducing and maintaining an integrated model of health, safety, and productivity management? Is it feasible to advocate for a coordinated approach to worker health at a time when the overall business imperative is focused on cost cutting?
- What have employers done to advance employee health, safety, and productivity efforts?
- What methods are used to measure and monitor health, safety, and productivity outcomes in the workplace?
- Is there evidence that improvements in the health and well-being of workers can achieve economic benefits?
- What can be learned from successful efforts at integrating health, safety, and productivity management initiatives in American businesses?

- What is needed to promote research and fill critical knowledge gaps, to disseminate information about what is already known in this field, and to identify and reinforce successful practices?

This background paper directly addresses these and related issues. It describes how workers' poor health, either physical or mental, puts their productivity and safety at risk. Workers and their employers are beset by increases in health-care costs, absenteeism, disability rates, safety incidents, and workers' compensation claims, as well as a reduction in productive work output, otherwise known as "presenteeism." It describes an emerging business strategy called Health and Productivity Management (HPM) which has been in the forefront of advocating for integrated employee health, safety, and productivity management programs. The report offers a rationale for integrating diverse and often competing organizational functions into a cohesive and coordinated unit, but it also discusses the barriers to such efforts. It describes the overall process that many employers have used to implement an integrated model and reviews some of the common threads that run across several successful integrated program implementation efforts. The report points to examples of best practices and quantitative results reported by these organizations, and it concludes with some suggestions for next steps to be considered by government, industry, unions, nongovernment organizations, academia, and other experts. These suggestions focus on policies and circumstances that would enhance the development of more integrated health, safety, and productivity management programs and their adoption by U.S. employers.

We begin with a discussion of the context for the recent surge of interest in integration efforts directed at employee health, safety, and productivity management.

An Integrated Approach to Employee Health, Safety, and Productivity Management

Integrated health, safety, and productivity management programs are emerging as a business imperative aimed at improving the total value of human resource investments. These programs rely upon the joint management of benefits and programs that employees may access when they are sick, injured, or balancing work/life issues. They include health insurance, disability, and workers' compensation, employee assistance, paid sick leave, and occupational safety programs. Also included are activities meant to enhance morale, reduce turnover, and increase on-the-job productivity.

An integrated health, safety, and productivity management model evolved over the past decade. What led to its emergence? What prompted business leaders to actively pursue an integrated approach as a business imperative? Below we review some of the forces that supported a growing interest in and adoption of integrated health, safety, and productivity management programs among American businesses.

Rising Health-care Costs

U.S. healthcare costs continue to escalate, with no immediate relief in sight. In 2004, when this report was first released, healthcare spending totaled $1.8 trillion, or 15.5 percent of the gross domestic product (GDP)[4]—a significantly larger portion of national wealth than the 11.1 percent reported 15 years earlier.[5] In 2011, annual U.S. health-care spending was fast approaching the $3 trillion mark. Health-care spending is projected to account for 18.4 percent of GDP by 2013, when more than one out of every four dollars of personal consumption will be spent on health care.[4]

For employers, the expense associated with providing health benefits to employees is becoming increasingly worrisome. In 2004, annual health insurance costs had increased an average of 12.5 percent since the prior year.[6] A survey by Mercer Human Resource Consulting found that employers expected health-care costs to rise 12.9 percent in 2005 if benefit plan designs remained unchanged.[7]

In 2003, the annual cost of providing health insurance benefits averaged $3,391 for employee-only coverage and $9,075 for family coverage.[8] Back then, employers paid 84 percent of the premium for employee-only coverage and 73 percent for family coverage.[8] However, with productivity-related expenses factored in, the costs to employers were significantly greater. Parry et al.[9] estimated that the overall health and productivity cost burden to employers averaged $16,091 per employee in 2002. This calculation included direct payments for health benefits and indirect payments attributable to lost productivity. Some of the expenses associated with lost productivity included hiring replacement workers when an employee is absent (absenteeism) and reduction in services, loss of output, and missed sales opportunities when employees are distracted or less attentive, especially when affected by poor health (presenteeism).

When all of these expense components are presented individually and in aggregate, employers begin to understand that health-care means more than paying doctor, hospital, and drug bills. Health also impacts their employees' safety and productivity. Workers in poor health, and those with behavioral risk factors, cost the organization more than can be measured by adding up medical expenses; the spillover effects on other areas such as safety, morale, and productivity are significant.

Employer Response to Rising Health-care Costs

However, not all employers are as broadminded and aware of the economic consequences of poor health. When examining their organization's balance sheet, employers focus mainly on rising health-care costs. They are appropriately worried that these expenses will erode their profitability and make them less competitive in a global marketplace. According to consulting firm Deloitte and Touche[10] and a survey conducted by the Benefits Roundtable,[11] about 90 percent of senior managers rate "protecting employers from rising health-care costs" as their number one or number two priority.

How do employers plan to battle the rise in health-care costs? Among the options being considered are the following:

- Withdraw or significantly curtail health-care benefits to employees;
- Shift a larger portion of expenses to employees by charging more for health benefits in the form of increased premiums, higher deductibles, greater coinsurance requirements, and wider use of consumer-driven health plans—plans that are designed to offload much of the cost of care by introducing higher thresholds for submitting medical claims and requiring employees to pay a larger proportion of their bills;
- Change providers' behavior and fees by negotiating additional discounts for services, offering incentives for more efficient care practices, rewarding providers for adhering to evidence-based treatment guidelines, and channeling patients away from less cost-effective and unsafe providers;
- Support state and federal legislation that would lessen burdensome mandates and shift costs from the private sector to the public sector;
- Change end-user consumer and patient behaviors by encouraging individuals to use fewer services or use services more efficiently, and by supporting their efforts in self-care and smart consumerism; and
- Prevent costly diseases from occurring in the first place by providing effective health promotion and disease prevention programs and services.

In many cases, employers are considering several combinations of the above solutions. Certainly one important development in the past few years has been the steady erosion of employer-sponsored health benefit plans. Traditionally, of the more than six million employers in the United States, 66 percent offer health benefits to employees, and almost all larger employers, with 50 or more employees, offer such benefits.[12] However, more and more employers are deciding to drop health-care coverage for their employees because of rising costs. A 2004 Census Bureau report found that about 1.4 million more people were uninsured in 2003 compared with the previous year. The percentage and number of people covered by employment-based health insurance fell between 2002 and 2003, from 61.3 percent (175.3 million) to 60.4 percent (174 million).[13] As expected, the number of people without health insurance also grew, to 45 million—an increase from 15.2 percent to 15.6 percent.

In sum, employers face significant health-care cost challenges. A central question many ask is whether they should continue to provide health-care benefits to employees and whether such benefits affect the employer's standing in a very competitive global marketplace. Historically, employers provided health benefits to recruit and retain their best workers and remain competitive among peers who recruited from the same pool of job applicants. Also, benefits were offered to protect workers from paying for catastrophic health events. Today, health-care payments are directed primarily at the treatment of chronic health conditions, not at catastrophic events. Consequently, employers require a different type of business case argument for continuing to provide effective health-care coverage to their employees—one that emphasizes the safety and productivity benefits of good health as well as the significant losses likely to occur when health is compromised.

Many progressive employers understand this concept intuitively and have struggled to collect the right types of data to support their beliefs. Business cases for increased investment in integrated worker health, safety, and productivity management programs have been developed and provide evidence that these programs can achieve a positive return on investment (ROI) and consequently improve the performance of organizations.

How are Health, Safety, and Productivity Related?

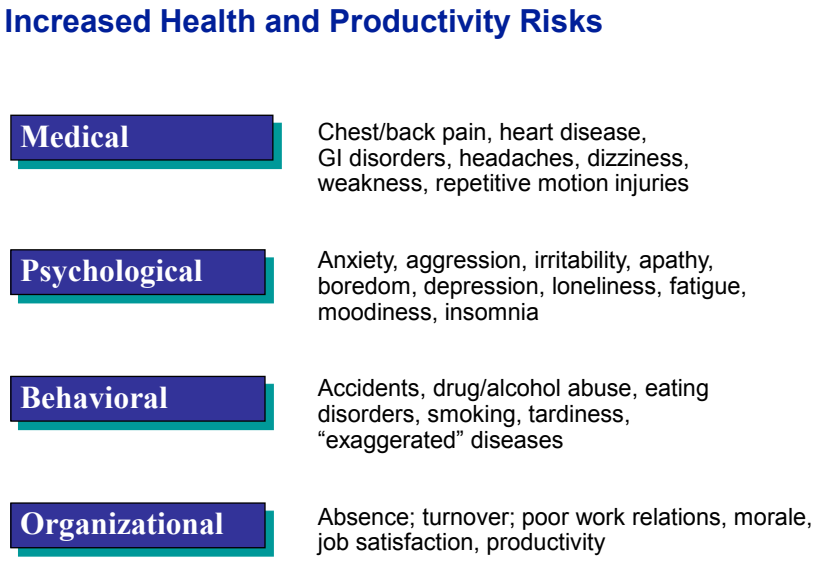
Enlightened employers understand the various factors that account for their total employment costs. They realize that direct costs include wages paid to employees in the form of salary, bonuses, stock, savings plans, and commissions. They also understand that they pay for what is sometimes referred to as fringe benefits, which include health insurance, short- and long-term disability coverage, and workers' compensation.[14] A third component, often overlooked, consists of "other labor costs." This category of expense includes the "people" or "human capital" costs for programs that increase productivity and morale (e.g., training, health promotion, fitness facilities, picnics, fun events) and reimbursements to workers for lost time due to absenteeism. For example, the employer pays for unnecessary replacement worker wages, routine overstaffing or overtime premiums, and the largely intangible costs of dealing with morale issues, interpersonal problems, and sub-par performance related to health problems.

Over the past several years, literature has emerged demonstrating the relationship between poor health and employer costs. For example, a study by Goetzel et al. showed that employees who are depressed and highly stressed cost employers significantly more in health-care expenses compared with those without these psychosocial risk factors.[15] Other studies have documented the relationship between poor health and productivity losses. Claxton et al.[16] demonstrated that when workers are appropriately treated for depression, their absenteeism drops. Cockburn et al.[17] documented differences in workers' productive output when treated for allergies with different types of antihistamines. Burton et al.[18] showed a direct relationship between modifiable health risk factors and work output for telephone call center operators at a bank.

Several investigators have developed innovative methods to quantify these productivity losses and translate them into dollar terms, for specific health and disease categories[19,20,21,22,23,24,25,26] or across multiple health conditions.[27,28] These and other studies have set a framework for future research that examines the relationships between employee health, organizational performance, and work output (i.e., productivity).

When one couples individual health concerns with organizational stressors such as downsizing, lackluster senior management, poorly communicated policies, and an environment without clear purpose, the potential for productivity losses becomes even more pronounced. Negative organizational announcements and adverse business developments may occur within a larger socioeconomic context and may further dampen worker enthusiasm and motivation to perform at peak performance levels. Job and personal stresses, along with other job pressures, may manifest themselves as symptoms reflecting increased health, safety, and productivity risks for the individual and organization. Such symptoms may present themselves as medical conditions, psychological disorders, behavioral problems, and organizational malaise (Figure 1).

Figure 1



Employers may be stymied in their response, not knowing where to place intervention emphasis and which departments or functions are responsible for fixing problems. Senior managers may assume that the medical department handles medical issues, employee assistance handles psychological problems, labor relations handles labor-management controversies, and organizational development handles low morale. Given the fragmented nature of organizational structures, employers may struggle to come up with a "given" solution to these varied problems, or they may introduce independent solutions that are divorced from other related and possibly complementary efforts.

Employers Search for Solutions

Certainly, there are myriad interventions that internal program managers and commercial vendors can offer to remedy individual and organizational problems. They include the introduction of programs to better manage health, disease, disability, stress, safety, work-life balance, absence, demand for services, pharmacy benefits, and other human resource issues.

However, in evaluating opportunities for interventions, senior managers should first ask whether any of these programs really work. Have they been shown to be effective? Do they achieve improvements in any of the categories listed above, and are they cost-effective? Unfortunately, the "jury is still out" with regard to the efficacy and cost-benefit of alternative interventions available to employers (Figure 2).

Figure 2

- Manage disease
- Manage disability and absence
- Manage health and demand
- Manage stress
- Strengthen EAP
- Re-engineer
- Reorganize
- Create incentives
- Cut pharmacy benefits

In terms of solutions, three distinct schools of thought have emerged in the literature. One school encourages a focus on the individual employee through the provision of and financial support for health education, lifestyle modification, behavioral change, and self-management interventions. A second school is focused on changing the organization by introducing occupational health and risk management programs focused on ergonomics, "sick building" phenomena, changes in policies, and introduction of new benefits. A third school is focused on changing societal practices through policy changes, legislation, infrastructure improvements, and mandated programs, e.g., changes in OSHA regulations, introduction of new legislation (such as the Americans with Disabilities Act or the Family and Medical Leave Act), or reform efforts directed at health care and workers' compensation.

Although it may be easier to introduce solutions that focus simply on the individual, organization, or society, the reality is that these are very much intertwined, and a comprehensive, integrated approach is necessary. An integrated health, safety, and productivity management model was first developed by DeJoy and Southern[29] and has since been expanded and elaborated upon by several other researchers and practitioners in the health, safety, and productivity management community.

Although an integrated model is preferred, it is important to recognize that different types of interventions fall into each of the three schools of thought mentioned above. At the individual level, solutions need to consider job and task factors associated with individuals' work as well as the factors they bring to their job from outside. Job and task factors include the physical and psychological demands of the job, such as exposure to toxins, erratic work schedules, repetitive-motion tasks, heavy-lifting requirements, threats to personal safety, poor task pacing and control, job ambiguity, and lack of decision latitude.

Individual factors also include health, safety, and behavioral/lifestyle habits related to smoking, exercise, eating/nutrition, safety, alcohol/drug use, preventive care, and so forth. Furthermore, individual psychological and attitudinal factors can affect job performance. They include health knowledge, behavioral skills, personal representation of health or illness (e.g., a "worries well" or invulnerable "walking time bomb" persona), perception of individual susceptibility, self-efficacy, and perceived behavioral control. Other attitudes toward work and one's immediate supervisor also play an important role in determining job performance.

At the organizational level, the following factors may influence worker health, safety, and productivity; organizational structure and climate (management style); corporate culture and values; and union–management relations. For example, an especially oppressive work culture can lead to adverse outcomes at an organizational and individual level.

Finally, from a societal perspective, certain extra-organizational forces can support or impede the health, safety, and productivity of workers. They include legal, economic, and social factors such as the state of the economy, unemployment rates, training and advancement opportunities, global competition, the growth of dual-career families, introduction of national administrative bodies and legislation (such as OSHA, Americans with Disabilities Act (ADA), Family and Medical Leave Act (FMLA), health-care reform), deregulation, and other larger societal events influencing the workplace.

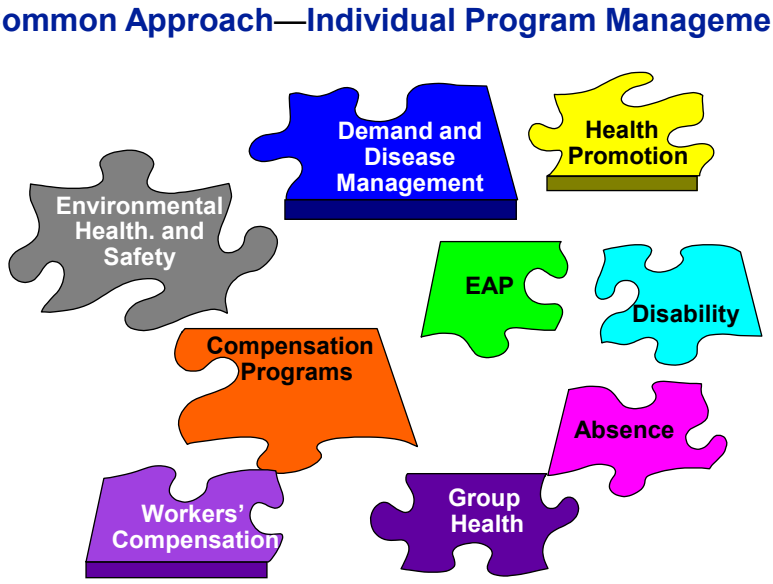
Developing an Integrated Health, Safety, and Productivity Management Model as an Alternative to Fragmented Organizational Structures

Where, then, should senior managers focus their attention: the individual worker, the organization, or society as a whole? The answer is "all of the above," but in a thoughtful and coordinated fashion. The approach advocated here is to develop and institutionalize an integrated model of worker health, safety, and productivity as an overall business strategy.

Focus for a moment on the organization as a whole. It is more the norm than the exception that health, safety, and productivity issues are addressed separately and discreetly by different functions within

the organization: employee benefits, employee assistance, risk management, occupational medicine, safety, organizational development, operations, human resources, employee relations, labor relations, and other departments. Organizations use fragmented, department-specific strategies in an attempt to manage individual and organizational risks, although oftentimes these risks are common to several functions simultaneously within the organization and might be better managed through cooperative arrangements (Figure 3).

Figure 3



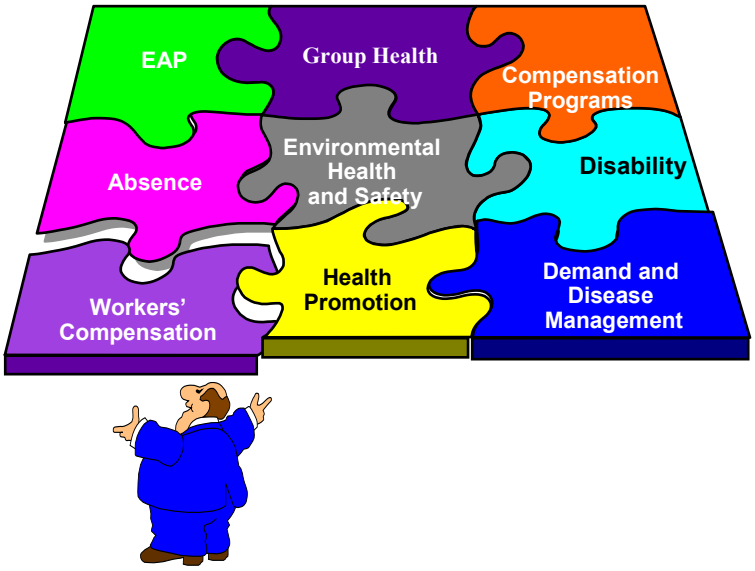
In a "silo-based" structure, each organizational function attempts to handle company-wide issues separately, using a variety of interventions. At an organizational level, every department stakes out its own turf and its own fiefdom. Problems are addressed individually, one at a time, and in an uncoordinated fashion. In contrast, an integrated health, safety, and productivity management approach allows business leaders to think about broader organizational problems and develop interdepartmental links to address these problems with greater efficiency in a more complex landscape.

An Integrated Model for Improving Health, Safety, and Productivity

Given the cacophony of individual, departmental, and functional approaches to solving common organizational problems, a need emerges for increased coordination and better integration across disparate organizational structures. An integrated health, safety, and productivity management model establishes a new paradigm for working across departments to form a coordinated, synergistic, unidirectional set of solution packages. This approach is often necessitated by resource constraints and increasingly complex people management requirements. Consequently, individual department heads recognize that they can no longer afford to do their job in piecemeal fashion. The new paradigm forces managers to concentrate their efforts on improving the health and well-being of employees as a whole, not as individual cases, regardless of where the organizational benefit programs reside (Figure 4).

Figure 4

HPM—Putting the Pieces Together



Arguments For and Against an Integrated Health, Safety, and Productivity Management Approach

Although the above discussion articulates some of the reasons why organizations may wish to implement an integrated health, safety, and productivity management model, there are still some significant barriers. Below are several reasons for moving ahead with an integrated approach and some key obstacles to such a movement.

Arguments in favor of integration and coordination of functions include the following:

- Cost efficiency can be achieved and duplication can be eliminated when resources and experiences are shared across departments and functions.

- Developing and applying common metrics, so that a uniform story can be told with data and measures that are commonly understood and accepted, allow organizations to achieve efficiencies.

- A health, safety, and productivity management approach will lead to reduced competition for senior management attention and scarce resources.

Although these arguments make sense at face value, there are also some significant barriers to a health, safety, and productivity management model:

- Program managers often want to protect their turf and therefore lack interest in sharing resources, knowledge, and experience with others viewed as internal competitors.

- Managers may complain that they lack the time to devote to "nonessential" tasks and processes; they may view integration efforts as "busy work" that distracts them from their "real" jobs.

- Managers may declare that different departments and organizations function under different sets of rules. Some departments may be subject to federal or state regulations, others may be in charge of implementing organized labor contracts, and yet others may be responding to specific senior management directives.

- There may not be momentum to change the ways things have always been done, because "they work" and there is a reluctance to "fix something that isn't broken." In addition, employees may argue that even if they wanted to, they could not integrate and coordinate their activities because of "hard coded" reporting relationships and a lack of authority to introduce new structures. Further, they may argue that senior management needs to authorize a reorganization for such activity to take place.

- Opposition forces may argue that there is no evidence that an alternative model or models that emphasize integration are better than existing structures and work practices. Furthermore, they may assert that the idea may appear to work in theory, but it would cost more than it would save and not produce a short-term ROI.

Making a Business Case for Integration—Posing Hypotheses

These arguments for or against an integrated model have merit. Certainly, from a higher vantage point, an integrated health, safety, and productivity management model makes sense. However, from the middle manager's perspective, such an approach may seem to be a waste of time or just another example of a short-lived management initiative that is ineffective and potentially harmful. These are tough obstacles to overcome. For an integrated model to succeed, it must be based on a solid theoretical foundation and supported by empirical evidence. Also, it must be easy to understand and straightforward to implement.

An important early step in the process of creating an integrated model is to organize a multidisciplinary and multifunctional team empowered to design, implement, and evaluate a program focused on the health, safety, and productivity of the workforce. The team must be clear in its purpose and aware of the series of challenges it faces. In many ways, these challenges can be viewed as research hypotheses[30] that need to be supported or discredited, depending upon results of investigations and the data derived from those investigations.

Here are some common hypotheses associated with the development of integrated health, safety, and productivity management programs:

- Poor employee health is responsible for unnecessary and avoidable health, safety, and productivity losses.

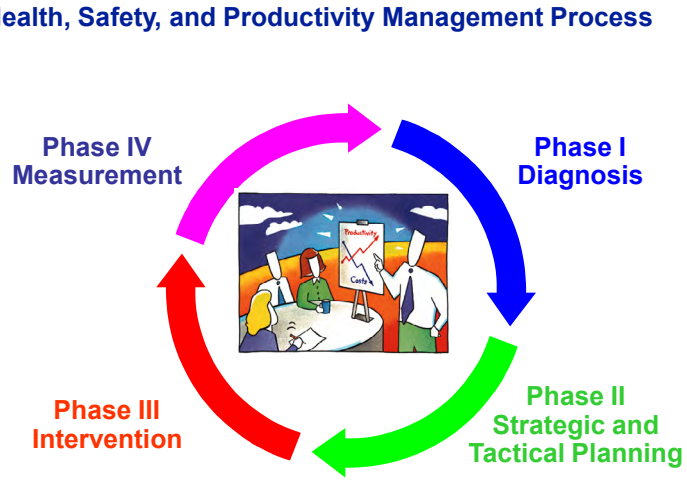
- Employee health can be improved through well-founded, evidence-based, well-implemented, and measurable health, safety, and productivity management interventions.
- Providing health benefits alone is not enough; employers need to take an active role in delivering health education, awareness building, risk reduction, and counseling programs that support health, safety, and productivity enhancement efforts.
- Administration of health benefits, health promotion, workers' compensation, nonoccupational disability, occupational health and safety, behavioral health, organizational development, and other relevant functions can and should be coordinated in order to maximize the impact of a "package" of human resources programs.
- Improvements in employee health will not only reduce medical care costs but also enhance worker safety, productivity, and organizational competitiveness.
- Successful health, safety, and productivity management programs can save more money than they cost and thus achieve a significant and positive ROI for the organization.

Integrating Health, Safety, and Productivity Management Programs—A Practical Approach

The previous sections have discussed factors that lead organizations to consider an integrated model, barriers that stand in the way, and formidable challenges involved in making a business case for integration. This section moves beyond the conceptual issues driving organizations toward a fully integrated health, safety, and productivity management model, to discuss the practical steps that organizations can take to design and implement a successful program.

Figure 5 presents a schematic diagram of the process needed for implementing health, safety, and productivity management. The first step involves diagnosing where the organization is at greatest risk—people-wise, program-wise, or expense-wise. This is done through various data analytic projects focused on the organization as a whole and also on its employees. There are two levels of diagnoses—one at the broad global or macro level and the second at the more discrete micro level to unearth specific problems or issues requiring attention (Figure 5).

Figure 5

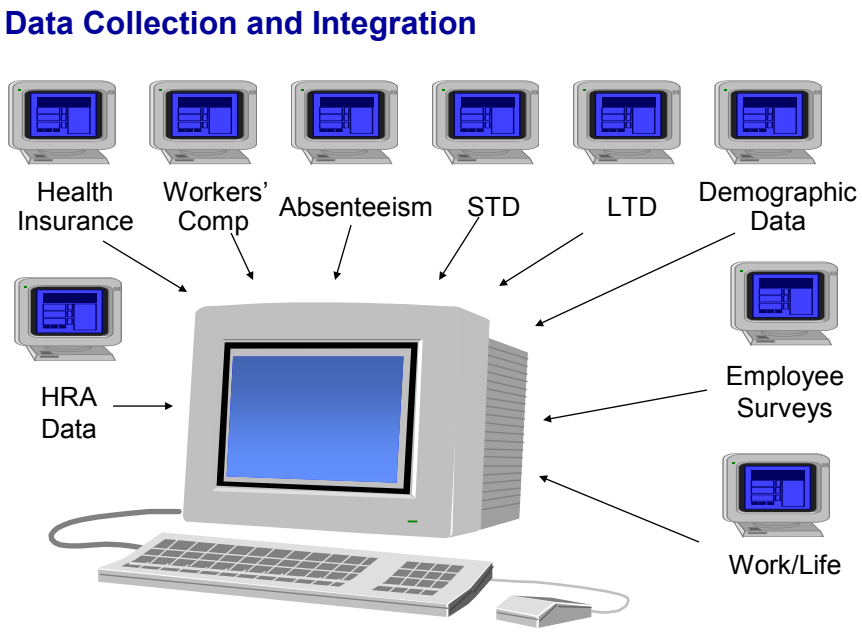


The diagnosis phase is followed by a prescriptive phase, in which an interdepartmental team meets to review and further query the diagnostic data; discuss and evaluate alternative intervention options; and develop strategic and tactical plans to implement a health, safety, and productivity management solution. The third phase involves the actual implementation of a package or set of solutions that fall into four broad categories: care or disease management; health promotion or health management; workplace environment; and organizational climate and culture. Finally, the fourth phase requires measuring and evaluating whether the interventions worked and determining why they worked or failed. This may lead to further fine-tuning of the program, and the process begins once more. Below we describe each of these phases more completely.

Phase I—Diagnosis

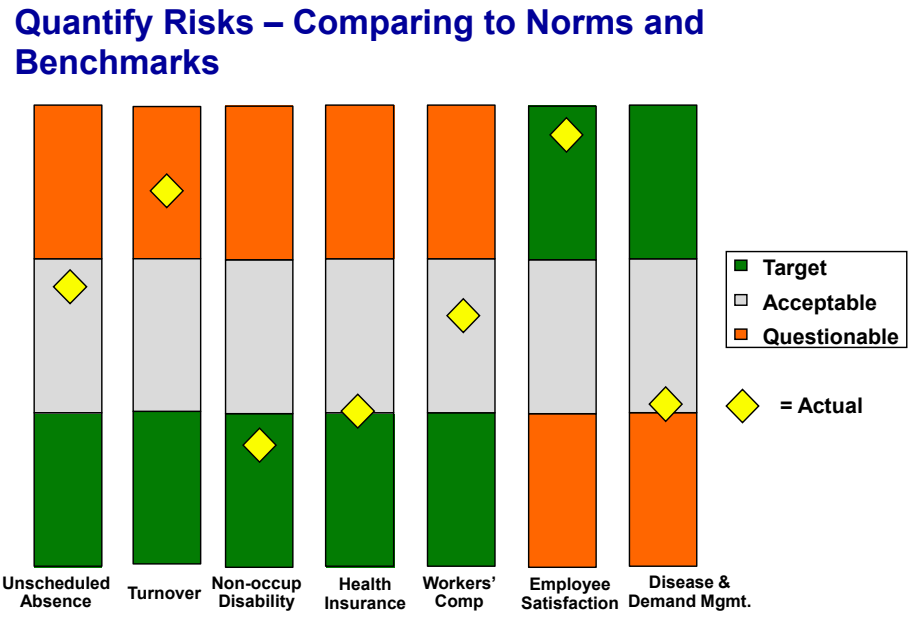
The health, safety, and productivity management process is contingent upon the availability and application of reliable, valid, actionable data used to diagnose whether a problem exists, how big the problem may be, and where attention should be directed to address the problem. As noted above, there are two levels of diagnoses. At a macro level, the organization collects and assembles disparate data that are typically scattered across departments, in small and large computers, and at vendor sites. The intent is to bring together these data elements, at least at the global level, for examination and interpretation, and most importantly to somehow combine them to tell a cohesive and compelling story (Figure 6).

Figure 6



When feasible, it is best to compare and contrast the organization's experience to norms and benchmarks established by reputable third parties. This helps determine whether the organization's experience is above, below, or at norm, and whether there is potential for improvement (Figure 7). Similarly, different parts of the organization can be compared with one another, assuming common metrics are developed, to determine their relative standing organizationally.

Figure 7



A follow-up step involves examining the organization's data at a more finite or micro level. This is done to hone in on specific problem categories and identify the source of those problems. For example, the organization may wish to determine where its benefit costs and service utilization are highest, and whether the drivers for these expenditures can be determined. This often involves analyzing data from group health care administrative files, human resources demographic and eligibility files, absence records, short and long-term disability claims, workers' compensation records, health risk data, program participation files, and various survey databases. This task is complex and sensitive, especially because individual, person-level data are examined and the confidentiality and anonymity of workers must be preserved. However, specialty data warehouse and data analysis organizations that perform this type of work are available and frequently hired to conduct data aggregation, analysis, and evaluation tasks for the organization.

Macro Analyses—Establishing Benchmarks and Best Practices in Health, Safety, and Productivity Management

When introducing health, safety, and productivity management programs as a business strategy, internal champions must first develop a business case for examining and managing diverse human resource processes in a coordinated and synergistic fashion. This can be done by first quantifying the aggregate costs of providing health, safety, and productivity management programs to workers. Typically, employers examine their program expenses one area at a time and are able to report those expenses only within any given benefit or program, such as group health, occupational safety,

disability, or workers' compensation. Consequently, managers are generally unaware of costs associated with other programs and are almost never able to estimate total health and related lost productivity costs for the organization.

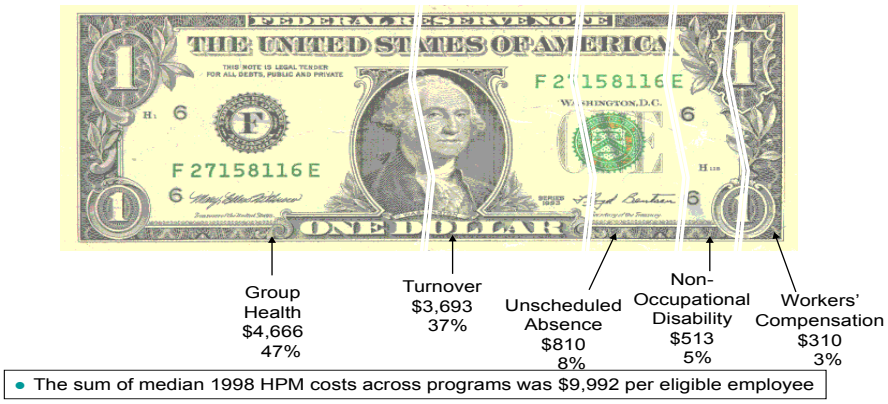
To get a "big picture" view of health, safety, and productivity management program expenses, the organization may wish to first count up the dollars spent on employees, by each program and across programs. How are those dollars distributed? Where are the biggest expenses and where are the biggest opportunities? How do the organization's metrics compare to benchmarks? What are the savings opportunities based on the difference between current values and benchmarks?

In Appendix A, we present an abstract of an article that describes the process and results of a benchmarking study conducted by Thomson Reuters (Medstat at the time), the American Productivity and Quality Center (APQC), and the Institute for Health and Productivity Management (IHPM), along with 43 employers. The study describes an effort to collect and analyze data reflecting these 43 organizations' metrics for health, safety, and productivity (referred to in the study as HPM). Below are some general findings from that study, which can be replicated within any given organization. Also discussed are the results from a qualitative study performed as part of these benchmarking efforts that attempted to identify and synthesize common themes that run across best practice health, safety, and productivity management organizations. These themes were derived from site visits to nine organizations: Coors Brewing Company, Champion International Corporation, Steelcase Inc., Texas Instruments, Union Pacific Railroad, 3M Corporation, ChevronTexaco, General Electric Company, and Navistar International Transportation (now called International Truck and Engine).

Conducting a Macro Diagnostic Analysis—Aggregating Health, Safety, and Productivity Management Expenses for the Organization

In the above referenced benchmarking study, we determined that median health, safety, and productivity management expenses per employee per year were $9,992 (in 1998 dollars). These estimates were derived by summing employer expenses for the following five core program categories: group health, turnover, unscheduled absence, nonoccupational disability, and workers' compensation. Group health costs constituted the largest proportion of total health, safety, and productivity management costs, followed by turnover, unscheduled absence, nonoccupational disability, and workers' compensation (Figure 8). When other programmatic expenses related to employee assistance, health promotion, occupational medicine, safety, and work/life services were added, total costs for health, safety, and productivity management increased to $10,365 per employee per year (in 1998 dollars).

Figure 8. Establishing the "Cost Burden" of Poor Health Median HPM Costs Per Eligible Employee (1998 $) Medstat/IHPM/APQC Benchmarking Study



Comparison of organizational median health, safety, and productivity management expenses to best practice values (operationally defined as the 25th percentile or better) showed that the potential cost savings across the five core health, safety, and productivity management program areas was $2,562 per employee per year, or 26 percent of the median total health, safety, and productivity management costs (Figure 9).

Figure 9. Median HPM Opportunity Per Eligible Employee for All Survey Participants

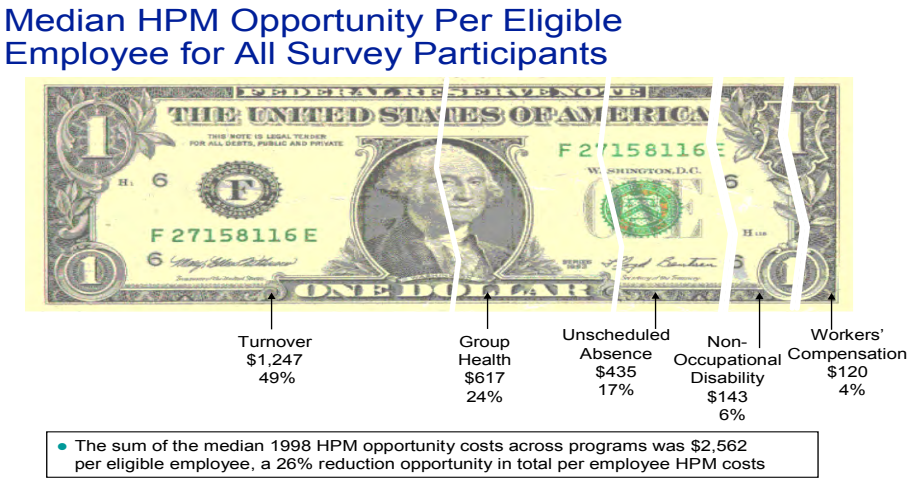


Table 1 summarizes the data for each of the core program areas examined in the study. Reported in the table are the minimum, maximum, 25th, 50th, and 75th percentile values for key utilization and cost measures across the 43 organizations that participated in the study.

Results from this benchmarking effort were reported to each participating organization, and internal champions used the results to advocate for an integrated health, safety, and productivity management approach. The analyses helped "size" the extent to which the organization was currently investing in human resources initiatives and the potential for savings through coordinated activities. The report pointed to specific programmatic areas where the experience of the organization was poor or where the organization was performing well (as measured against peers). Some organizations used the report to set goals for improvement: for example, to achieve values comparable to those of best practices.

Table 1: Key Utilization and Cost Measures Collected from HPM Benchmark Study Participants, by Category (1998 Data)

HPM Program Categories	Min	Max	Percentiles		
			25	50	75
Group Health	$3,127	$6,421	$4,049	$4,666	$4,978
Non Occup Disab	$225	$1,084	$370	$513	$682
Work Comp	$93	$863	$190	$310	$505
Total Unscheduled Abs Unscheduled Abs (H) Unscheduled Abs (S)	$131 $137 $308	$1,864 $859 $1,337	$375 $312 $440	$810 $442 $868	$1,207 $510 $1,272
Total Absence Rate Absence Rate (H) Absence Rate (S)	0.18 0.43 0.60	3.95 7.25 2.08	0.76 0.92 0.71	1.72 1.02 1.32	2.64 1.92 1.94
Total Turnover Turnover (H) Turnover (S)	$1,826 $848 $1,684	$10,317 $7,986 $16,241	$2,446 $2,147 $3,344	$3,693 $2,595 $5,240	$6,284 $3,929 $6,887
Total Turnover Rate Turnover Rate (H) Turnover Rate (S)	2.21 5.54 2.23	46.01 64.52 30.63	6.18 10.83 5.79	8.54 17.83 9.29	15.26 25.64 10.39

Note: Costs shown are per eligible employee, by category
(H): Rates or costs for Hourly employees
(S): Rates or costs for Salaried employees

One key exhibit used in the benchmarking report was the dollar bill icon, which highlighted the organization's total investment in health, safety, and productivity management programs and facilitated an "apples to apples" comparison of costs. The "carved up" dollar bill was used to effectively communicate to senior management the considerable sums already invested in employee health and well-being. From that platform, organizational champions could argue that improved coordination can, and should, reduce overall costs and enhance employee health, productivity, and the quality of work life. By highlighting areas for improved coordination, and by placing a dollar value on an integrated approach, internal champions showed that such an integrated approach was not simply theoretical, but practical.

The qualitative study findings reported below further highlighted practical advice to companies that wished to model their programs after organizations achieving best practice outcomes and emphasized the promise of cost savings resulting from such efforts.

Leveraging Health and Productivity Management Benchmarking Data at The Dow Chemical Company

Several organizations have used the health, safety, and productivity management benchmarking study, or similar analytic approaches such as those developed by the Integrated Benefits Institute,[31] to justify increased investment in integrated programs and improved coordination across existing human resource functions. Internal staff at The Dow Chemical Company used data from several benchmarking studies to formulate a financial argument for continued investment in health improvement and risk reduction programs for the company.

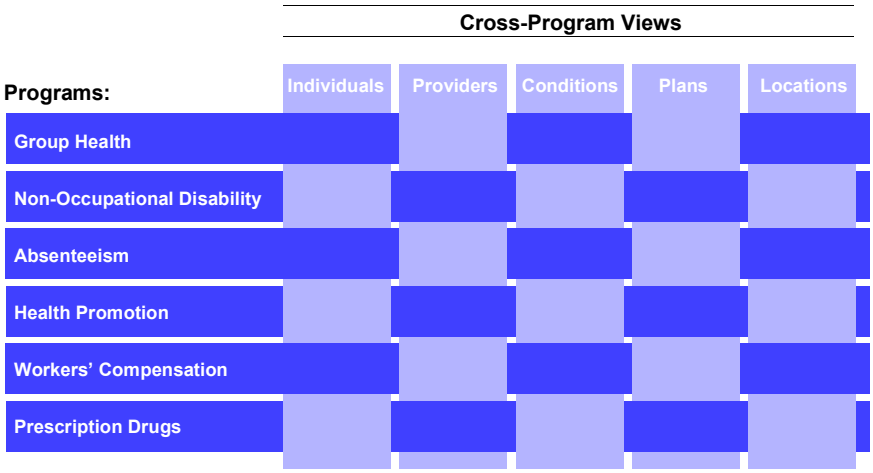
Dow's Health and Human Performance staff quantified for senior leadership the large sums that the company was spending in several areas, to address the broad impact that employee illness may have. From their benchmarking study, Dow staff estimated that the gap between actual expenditures and the values derived from the experience of best practice organizations was approximately $30 million annually (in 1998 dollars). That savings opportunity, coupled with a delineation of the company's different programs and services aimed at improving employee health and productivity, convinced senior managers that more attention should be devoted to coordinating these activities. Such coordination could deliver multiple health-related programs more effectively and efficiently. In addition, the analysis triggered a reframing of health, safety, and productivity management programs offered by the company as investments to be carefully managed, rather than inevitable costs of doing business. As an example, Appendix B presents the "business case" made by Dow staff in support of increased investment in coordinated delivery programs.

Micro Analyses—Establishing Opportunities for Integrating Health, Safety, and Productivity Programs by Linking Relevant Databases

The benchmarking studies described above lay the foundation for implementing an integrated model within the organization. Once that foundation has been established, it is necessary to drill deeper into program-specific data and, if available, multiprogram integrated databases. Many organizations have established data warehouses where health, safety, and productivity management data are stored (Figure 10). In most cases, these organizations have hired outside contractors to assemble, clean, organize, and enhance their databases so that common metrics can be established across multiple employee benefit programs.

Figure 10

HPM: The Key to Success — Integrated Information



As reported by several investigators,[32,33] a large category of expense can be found in the payment of medical claims. Estimates vary, but it is safe to assume that medical costs comprise one third to one half of total health, safety, and productivity management expenditures. They are generally easier to examine than other expenses, since methods to analyze health insurance claims have advanced in this country over the past 30 years.

Thus, in terms of a hierarchy of analysis, medical claims data are analyzed first, along with benefit program eligibility data and data collected from "carve out" benefit firms (e.g., prescription drugs, behavioral health, vision, dental). Next, short-term disability claims are linked to employees' medical experience, along with their absenteeism records. When feasible, workers' compensation claims are also linked to absence, disability, and medical claims. These combined data generally comprise the foundation of a health, safety, and productivity management database for an employer and are based upon administrative or archival records.

Other health, safety, and productivity management data may be collected by the employer but generally are from employee self-reports on a number of different survey instruments. (See IHPM's Gold Book for a compendium of instruments currently available to measure presenteeism in the workforce.[34]) For example, many employers have begun to collect presenteeism data from workers that allow the employers to quantify and often "monetize" on-the-job productivity losses associated with certain health conditions or other work-related issues. Employers may keep employee morale, attitude, or climate data on individual or departmental levels. Employers may also link health risk, behavioral, and biometric data collected by health risk appraisal (HRA) instruments or obtained from health promotion vendors or medical screenings conducted in occupational medicine clinics. When health and productivity management program participation data are collected, these too can be appended to employee files.

Several examples of studies involving creation and analysis of integrated databases are found in the Appendix section of this document. Appendix C

presents an abstract of a study in which medical data were linked to absence and disability data for six large employers. Appendix D presents an abstract of a follow-up study in which employee presenteeism records were also linked to medical, absence, and disability data. Appendix E describes a study whereby HRA data were integrated with medical and eligibility data for another group of six large employers.

The above discussion summarizes the different tasks that can accompany the diagnostic phase of any health, safety, and productivity management initiative. In many ways, we have described a "best case" scenario where multiple data files are available to be analyzed by the organization or its data vendor. All too often, such data aggregation and analysis activities are not feasible, and less sophisticated methods are employed to diagnose health, safety, and productivity management problems in the organization. These include examining summary reports provided by various department managers, conducting interviews with key staff, or administering a straightforward risk assessment survey.

The diagnostic phase is iterative in the sense that new information can always be made available to determine emerging problem areas where previous problems were resolved. The diagnostic process continues as health, safety, and productivity management initiatives are introduced. Data used in diagnoses are then revisited during each of the follow-up phases and used for program evaluation purposes.

Presenting Initial Diagnostic Findings to Decision Makers

An important step in the diagnostic phase of a health, safety, and productivity management project is analyzing and synthesizing the data so that decision makers can interpret the information and transform the results into actions. High-level presentations to senior managers with limited time should focus on overall conclusions, presented in "bullet" format or as simple graphs. In contrast, presentations to middle managers, program administrators, analysts, and other involved parties are usually more comprehensive.

It is important that all of the relevant data, both positive and negative, be presented to decision makers. The internal program champion should help decision makers interpret the results and reach appropriate conclusions so that senior managers are then able to evaluate and verbalize alternative action items. The presenter should prepare the audience for future results by speaking about ongoing research activities, other studies that are planned, or follow-up studies to those currently presented.

Once the diagnostic phase is finalized, the group can move forward to Phase II, which is prescriptive in nature and involves establishing tactical and strategic direction for the health, safety, and productivity management initiative.

Phase II: Prescription for Action—Establishing a Strategic and Tactical Direction for Health, Safety, and Productivity Management

A central theme of this report is that to be successful, individuals championing an integrated approach to health, safety, and productivity management within an organization need to become involved in and lead efforts at coordinating initiatives across diverse and often competing functions. Developing a cogent and workable integrated health, safety, and productivity management strategy involves the cooperation of leaders from several departments. The nature of most organizations is that each program manager has control over a certain domain. Seldom do managers meet in the same room to work in a synchronized fashion with one another. Thus, the catalyst for change must emerge from senior management, who can direct changes in organizational policies and procedures. Equally important is the task of engaging middle managers in the initiative and gaining the buy-in of rank-and-file employees. In short, change must be initiated from the top, but to be successful and long-standing it must be supported by employees at all levels of the organization.

Thus, a senior leader must orchestrate a process where seemingly disparate interests come together

to develop an integrated solution to organizational difficulties. It should be made clear that no single corporate function can directly impact more than a couple of system dimensions. However, there is enormous potential to achieve change if all the functions are conceptualized as being part of an integrated approach to solving problems. For example, certain functions, typically business operations, will have a direct influence on a worker's job design and tasks. They will affect worker motivation and work attitudes. Other functions, such as benefits, health promotion, employee assistance, and occupational medicine, will exert influence on individual aspects of worker health and prompt workers to act in certain ways; however, they have little influence on job design, organizational climate, and work group dynamics.

The internal champion must therefore develop a coordinating or steering committee comprising functional leaders. The purpose of a multifunctional tactical and strategic work group is to articulate the organization's overriding aspirations and philosophy regarding worker health and safety and provide a general framework for achieving these objectives. The philosophy should be clear about the establishment of complementary goals related to employee health, cost containment, worker productivity, safety, quality of life, and corporate image. It should be made clear that these issues are not independent, but rather interdependent.

To remove barriers across departments and functions, senior management should sponsor the steering group (coordinating council) and appoint its leader. This will facilitate centralized planning and integration of health-related programs, while breaking down barriers in communication and implementation.

The health, safety, and productivity management coordinating council's first task should be to review the data and analyses prepared during the diagnostic phase of the project. Using all the available data, council members can highlight major issues or "hot spots" requiring attention. Along with these quantitative data, the group may wish to collect qualitative data from individual or focus group discussions with key managers or groups of workers. These discussions may lead to further insights into the work environment and its problems or, conversely, into areas that appear to be working better than average.

Quantitative data, for example, might provide important information on the nature, frequency, and severity of illnesses, disabilities, or injuries. Organizational audits and discussions with key staff may uncover deficiencies in ergonomics, task design, or interpersonal communications. Further investigation may unearth issues related to workload; heightened risk factors such as poor posture, lack of physical activity, smoking, and improper diet; and poor management-worker relations leading to a negative organizational climate.

The challenge for the health, safety, and productivity management council is to not become overwhelmed with the amount and density of data available from the diagnosis phase. The key is to develop a prioritization process that allows the group to array issues in terms of importance and modifiability. Dow Chemical has made important strides in this area in its development of a Health and Productivity Management–Economic Valuation Tool (HPM-EVT) (Appendix F).

Next, some very practical decisions need to be made regarding the cost of interventions; their degree of effectiveness; the size of the employee population affected; time constraints; potential internal and external partners; acceptability and sustainability of interventions; and potential side effects or secondary gains. Through a series of discussions and consensus-building activities, the coordination group can select one or several interventions, or a package of interventions, to implement, preferably at pilot sites where results can be compared with sites not exposed to the interventions.

For example, assume that during Phase I the organizational diagnostic assessment uncovers a severe problem with high levels of stress in the workplace. In a traditional model, individual workers may be invited to participate in a stress management seminar, where they learn coping skills or relaxation techniques, or visit a mental health practitioner

for cognitive-behavioral therapy. In a health, safety, and productivity management model, the sources of stress would be identified and a coordinated intervention approach would be applied. For example, stress associated with boring/monotonous jobs may be addressed through job redesign, workflow changes, and organizational modification. Workers may be cross-trained to assume several role functions in order to reduce the repetitiveness of their tasks. They may be assigned new supervisors or work teams. They may be given more flexibility in how they use their time in getting tasks done. Overtime requirements and shift duty may become more predictable, or workers may be invited to stress management seminars and receive more free time for physical activity and fitness training. Stress related to job insecurity or regional economic problems can be addressed through improved management communication about the state of the business, increased access to employee assistance and job retraining programs, or other means.

Importantly, interventions are packaged, rather than provided in an individualized and uncoordinated manner by different departments and disciplines. They combine environmental and behavioral approaches and focus on the individual, the organization, and the environment all at once.

Finally, some employers may wish to develop an ROI simulation model that projects the results of alternative health, safety, and productivity management initiatives. For example, at Dow Chemical, program leaders began developing a business case document for health improvement and risk reduction among workers. Their business case used, as one of its elements, a cost projection model for company health-care spending over the upcoming 10 years. Besides projecting future costs, the model also projected savings and ROIs based upon assumptions related to the success of its risk reduction efforts. To make these projections, Dow relied upon prior research that documented the relationship between modifiable health risks and a company's health-care costs.[35, 36, 37, 38] Dow's staff sought to translate health and medical care issues into language that would be familiar to corporate business leaders in charge of the financial health of the organization. Consequently, health, safety, and productivity management initiatives recommended by Dow's staff could be seriously considered by company officials in a manner similar to other operational priorities.

The ROI simulation study prepared for Dow was based on demographic and workforce characteristics of its employee population, as well as several behavioral and biometric health risk factors gathered at baseline. These data formed the basis for a subsequent estimation of Dow's payments in future years and the calculation of ROI and net present values.

Four possible scenarios were developed and subsequently compared with the base year. A scenario where employee health risks were assumed to remain constant over 10 years produced savings of about $8.0 million (in 2001 dollars), and annual cost increases averaging about 3.1 percent (adjusted for inflation). An intervention program that achieved significant risk reduction in the population (at the rate of one percentage point per year over 10 years) resulted in $50.8 million in savings and annual cost increases of only 1.4 percent. A more modest program that achieved a 1.0 percentage point improvement in health risks over 10 years achieved $12.7 million in savings and an annual increase of about 2.9 percent in health-care expenditures. The three scenarios produced benefit-to-cost ratios of $0.65, $4.14, and $1.04 to $1.00, respectively. A final scenario created to determine the break-even point for program investment determined that in order to save $1.00 for every $1.00 invested, Dow's efforts in risk reduction would have to achieve a .09 percentage point reduction in each of 10 risks per year, over 10 years.

The ROI analyses performed for Dow focused only on medical expenditures. As noted above (see appendices for study examples), medical costs constitute a fraction of total company health, safety, and productivity management expenses, which include the cost of employee absences for illness, short-term disability, workers' compensation program use, and employee turnover. If productivity expenses follow the same patterns of growth as do medical expenditures, then Dow's total health and productivity expenses would be expected to increase by almost

$40 million in 10 years (in 2001 dollars), under the assumption of no changes in employees' health risks; however, savings from significant risk reduction programs would offset the increased expenses.

Phase II concludes with a final work plan for interventions and action programs recommended by the council. These must be agreed to by senior management and appropriately resourced. Once the interventions and actions are approved, the organization can move to its next phase of program implementation.

Phase III—Intervention

Once the coordinating council has decided which set of interventions to offer, the next step is to introduce and effectively manage these programs. Outlined below are several packages of interventions that are traditionally delivered within a function or department. They are listed here as broad categories, without details as to how they are designed and implemented. Several authors have described these interventions, and there is a growing body of literature focused on the ROI from any one category of programming. (See, for example, review articles by Goetzel and colleagues.[39,40])

The Institute for Health and Productivity Management (www.ihpm.org) helped define these categories and prepared white papers describing the elements of each set of interventions. Thus, for the sake of simplicity, only four main categories of programs and examples are listed here:

Care Management

- Acute/chronic disease management, sometimes referred to as tertiary prevention, which includes efforts to prevent complications of existing disease (e.g., disease management programs directed at such conditions as diabetes, congestive heart failure, low back pain, asthma, and depression);
- Work related injury, disability, and illness management; and
- Medical or large case management.

Health Promotion and Disease Prevention (Health Management)

- Primary prevention efforts aimed at currently healthy individuals, using behavioral risk factor reduction and lifestyle modification methods (e.g., programs that increase physical activity, support healthy diets, prevent obesity, prevent smoking, manage stress, prevent falls, encourage moderation of alcohol consumption, maintain social connections and support structures, and ensure appropriate immunizations);
- Secondary prevention efforts directed at early detection of disease (e.g., screening for cancer, hypertension, high blood glucose, hypercholesterolemia, unhealthy body weight); other efforts to ensure compliance with Clinical Preventive Services guidelines set by the U.S. Preventive Services Task Force; counseling on quitting smoking; and
- Self-care, consumerism, and demand management programs.

Workplace Environment

- Occupational and environmental medicine;
- Ergonomics and job design;
- Employee safety;
- Onsite clinics for acute care and treatment of injuries;
- Medical surveillance programs; and
- Return-to-work and job accommodation.

Corporate Culture and Organizational Health

- Clarity about and communication of socially responsible organizational values;
- Clear organizational policies emphasizing employee health and safety;
- Focus on workplace stress reduction and work-life balance; and
- Organizational efforts to improve work climate, morale, and employee attitudes, including periodic assessment of these organizational dynamics.

Phase IV—Program Monitoring and Evaluation

The health, safety, and productivity management programs designed and implemented by organizational staff may be extraordinarily effective, but unless program managers collect valid and reliable data on their impact, those initiatives may not survive long-term. Therefore, program managers are encouraged to establish effective measurement and monitoring systems that document program results. These can take the form of standard "dashboards" and "report cards" that are generally descriptive in nature and capture key metrics at regular intervals.

Periodically, program managers need to also conduct more rigorous evaluation studies that cover a longer time period, typically years, and control for alternative explanations of program results. Well-designed studies generally include before and after data points for treatment sites, compared with sites not exposed to the programs (comparison sites). Better studies examine program impacts on entire populations rather than on participants alone. Proper data collection, analysis, and reporting help to more fully document program accomplishments and fine-tune modifications in intervention design and execution. Most importantly, measurement systems provide the metrics that justify ongoing investment in the company's programs, assuming those investments pay off.

Program evaluation methods and procedures are well documented in several texts and articles. Ozminkowski and I have published practical guides on program evaluations that can be applied to health, safety, and productivity management program studies.[41] Furthermore, we have reported[42] on the difficulties of conducting applied research in corporate settings and recommended ways to overcome many of the common obstacles encountered in such research. Much of the applied research done for businesses has focused on the financial impact of health, safety, and productivity management programs, since these impacts are foremost in the minds of program sponsors. We report below some of the economic studies evaluating health, safety, and productivity management programs.

Health, Safety, and Productivity Management Program Results

Most evaluations of health, safety, and productivity management programs have been published in what is referred to as the "gray literature"—case studies describing program impacts that are reported by professional trade organizations rather than in peer-reviewed scientific journals. Notable exceptions include evaluations focused primarily on the impact of worksite health promotion programs. Among the financial impact studies most frequently cited, and those with the strongest research designs, are evaluations performed at Johnson & Johnson,[43, 44] DuPont,[45] Bank of America,[46, 47] Tenneco,[48] Duke University,[49] and the California Public Retirees System.[50] Other notable studies examining financial outcomes

were conducted at Procter & Gamble[51] and Chevron Corporation.[52]

Over the past 10–15 years, several organizations have applied for and received the C. Everett Koop Health Project Prize for Excellence in providing health, safety, and productivity management programs to workers, with documented health improvements and cost savings (see http://www.sph.emory.edu/healthproject/). Appendices G and H provide some examples of organizations with programs in the area of health, safety, and productivity management that qualified for the award.

Return on Investment Results

In 1999, Goetzel and colleagues reported on their literature review of ROI studies directed at health, safety, and productivity management programs.[53] The review found that ROI estimates ranged from $1.40 to $13.00 saved per dollar spent on the program, depending on program type. Traditional health promotion programs achieved a median ROI of $3.14 to $1.00. The review acknowledged that negative results were not likely to be reported in the literature and that the quality of some of the studies was less than optimal.

Aldana[58,59] in 2001 performed a comprehensive literature review of the financial impact of health promotion and disease prevention programs on health-care costs. In his analysis of 32 program evaluations focused on health-care cost outcomes, Aldana uncovered four studies that used randomized designs,[11] with quasi-experimental designs with comparison groups, and 17 that did not use a control or comparison group. The average study duration was only 3.25 years, and only four of the studies revealed negative results, but none of those studies used randomized designs.

Of the 32 studies examined by Aldana that focused on health-care cost outcomes, thirteen calculated cost/benefit ratios associated with the interventions. For these studies, financial returns averaged $3.48 for every dollar expended. One ROI study employing an experimental design[47] reported a benefit to cost ratio of 5.90 to 1.00. As above, several caveats were highlighted in the Aldana review, many of which related to the difficulty of achieving adequate internal validity when conducting "real-life" research in a corporate setting.

Other literature reviews that focus on health promotion and disease prevention programs' financial impact include those by Pelletier,[54,55,56] Chapman,[57] Aldana,[58,59] and Goetzel et. al.[60,71] They highlight a growing body of evidence supporting a business case for corporate investment in employee health improvement. The most recent studies have used sophisticated econometric methods to evaluate the financial impact, and many analyzed data over several years (with some extending for three to five years and one lasting 11 years).

Health and Productivity Management—Some Lessons Learned

Although the movement toward greater integration and coordination among organizational functions is still relatively young, there are some common themes that run across various attempts at health, safety, and productivity management that can be reported. These were highlighted in our benchmarking study focused on the qualitative features of successful programs.

Common Themes of Best-Practice Organizations

The health, safety, and productivity management benchmarking study discussed earlier also reported qualitative information related to best practices determined through site visits. These visits resulted in the formulation of 10 themes that were common to most if not all of the organizations recruited for the project. These are outlined below.

1. Alignment of health, safety, and productivity management efforts and the overall business purpose of the organization. Health, safety, and productivity management staff recognized that the main purpose of the organization was to deliver products and services that are competitive in the market, not manage employee health. The health, safety, and productivity management team's role was to support the organization's primary mission

by acting as a strategic partner to help the organization attain its business objectives.

2. Interdisciplinary team focus. During site visits, best practice companies brought together staff from many diverse functional areas such as human resources, employee benefits, risk management, employee assistance, safety, legal, labor relations, disability management, medical-occupational health, employee relations, work-life, attendance management, health promotion, quality, and security. These functions worked cooperatively across their companies' silos to achieve common goals.

In most cases, health, safety, and productivity management teams decided that a top-heavy infrastructure was not always necessary. While some companies restructured to create a formal interdisciplinary health, safety, and productivity management group, many more experienced internal obstacles that kept these components apart from one another. Nonetheless, managers collaborated despite organizational barriers. Department or function leaders did not need to be convinced that there was a need for an interdisciplinary approach. They were already "sold" on this concept.

3. Champion or a team of champions. At each meeting, it was evident that one person or a group of key individuals drove the process and championed an integration vision at all levels of the organization. These champions exhibited determination to "make things happen"—an overwhelming sense of purpose and passion about health, safety, and productivity management.

4. Senior management and business operations as key members of the team. While in many cases a health, safety, and productivity management approach developed as a grass-roots initiative, senior management and operations leaders quickly became engaged. The senior leadership recognized that by supporting an integrated model, it could achieve effective business operations. At companies with successful health, safety, and productivity management programs, the links to finance and funding sources were apparent. Senior management, business operations, and the integration team worked hand-in-hand with a mutual appreciation of each other's contribution to the process.

5. Engagement of prevention, health promotion, and wellness staff in the process. These individuals believed in and practiced healthy lifestyles, employee empowerment, and self-responsibility and consequently advocated the establishment of a "healthy company" culture. Health promotion leaders, and their supporters in medical and occupational medicine, were able to clearly articulate the links between employee health and well-being and the effectiveness of the organization as a whole. They drove research and internal analyses that documented the relationship between health and productivity for their organization.

6. Emphasis on improving quality of life, not just cost-cutting. Repeatedly, managers talked about improving organizational processes and "doing the right thing" for their employees. There was an expectation that if an organization improved the quality of work life, then productivity would also improve and cost containment would result naturally. The health, safety, and productivity management team was not only focused on managing the 20 percent of employees who consumed the most program resources; it was also concerned about attending to the needs of the other 80 percent, whose health and well-being influenced their work.

7. Data measurement, reporting, evaluation, and ROI studies. While high costs may have driven the integration initiative, in most instances evaluation protocols and elaborate data reporting systems were not prepared ahead of time. The philosophy of the health, safety, and productivity management team was "just do it" and develop the ability to evaluate results later. Leaders decided to launch projects that were likely to quickly improve efficiency, quality, and cost. Once actions were taken, these organizations realized they needed to show quantitative data and develop systems for ongoing monitoring and tracking of progress.

Data and reporting systems were developed with three main purposes in mind: (1) highlight areas for potential intervention and improvement, in

order to set priorities and quantify the potential for savings; (2) provide ongoing reporting and data monitoring to the business units, in order to hold them accountable for improved performance; and (3) evaluate outcomes, ROI, and areas for further investment.

8. Communication that is constant and directed throughout the organization. Health, safety, and productivity management leaders realized that they needed to keep their activities on the front burner for key stakeholders. They needed to communicate purpose, tactics, and results to fellow team members, business operations, the front line, and senior management. The packaging of information was critical. It needed to be organized in a way that the target audience would understand and apply the information.

9. Constant need to improve by learning from others. In order to remain cutting-edge, these best practice organizations strived to learn new ideas and approaches from others through a variety of techniques, including benchmarking. They also felt comfortable in openly sharing their experience and stories as a way of teaching and coaching. There was little guardedness or embarrassment about failures or mistakes; some felt they learned more from failures than from successes. These organizations were proud of their accomplishments and enjoyed the spotlight that uncovered both achievements and unsuccessful risk-taking initiatives.

10. Having fun. Health, safety, and productivity management team members appeared to be excited, enthused, and motivated by their work. There was a "positive energy" flowing through the room, with ample opportunities to introduce humor and good-natured challenges to fellow team members.

A second series of site visits were conducted about a year later. The major focus of the second benchmarking study was to understand the different measurement, evaluation, and reporting systems established by best-practice companies for documenting intervention program results to senior managers. The main themes from this second round of benchmarking visits are reported below. It was noted that best-practice companies do the following:

1. Are changing their definitions of productivity to include metrics that extend beyond traditional measures of "output per worker." Productivity is now being viewed as a broader term that includes service delivery, relationship building, ability to innovate, knowledge improvement, creativity, loyalty, and the ability to work within a team structure.

2. Rely upon understandable mission/vision statements that enable health, safety, and productivity management–related functions to "operationalize" their goals and objectives. Often, safety-related measures are used as the link between integration efforts and the organization's mission.

3. Consider many factors that impact workforce productivity, beyond those associated with specific health conditions—for example, corporate culture and employee attitudes. In addition to assessing direct measures of productivity, organizations are discovering that indirect measures may be as important. They are building integrated databases that link diverse but often interconnected variables such as employee attitude, organizational culture, health-risk factors, medical disorders, and psychosocial influences. Some leading-edge organizations are attempting to demonstrate the impact of these factors on customer satisfaction levels and corporate earnings.

4. Concentrate on targeted, well-understood health, safety, and productivity management–related metrics. Reporting mechanisms (e.g., report cards and dashboards) are straightforward and descriptive. These organizations have defined their key metrics and determined best ways to present these measures to various constituencies within their organization. They have developed communication processes to keep important management activities "top of mind" for senior management.

5. Act on their beliefs that internal benchmarking is as important as external benchmarking. Best-practice organizations have developed sophisticated methods to capture organization-wide data on

several key indicators and to compare business units with one another on the basis of internally developed norms. These organizations use organization-wide benchmarking studies to improve their average or median values over time and narrow the range between the best- and worst-performing units. hey first focus on internal benchmarks to secure buy-in from operations leaders and then transition to an external focus when asked how the organization compares to competitors. When an organization is able to compare itself with competitors, it is much more likely to gain the attention and support of senior management.

6. Link key data elements to develop a comprehensive view of employee health and productivity. The influence of health on productivity is increasingly based on the impact of multiple health conditions rather than any one or two. Organizations express widespread interest in developing integrated health, safety, and productivity management databases that connect disparate data at the individual level. Those advocating development of an integrated data "warehouse" believe that having access to multidimensional data allows them to gain a more comprehensive picture of employee health and productivity, which, in turn, facilitates the design of more effective interventions.

7. Use the process of applying for a national award as a catalyst for gathering and reporting health, safety, and productivity management-related data. The process of gathering and reporting data across functional areas is an effective tool for breaking down the walls between organizational silos.

8. Demonstrate ROI for specific health, safety, and productivity management-related programs, both prospectively and retrospectively. These organizations lead the development of methods to document an ROI arising from their health, safety, and productivity management efforts. Program champions know how to develop ROI estimates to gain approval for specific programs. Rigorously conducted ROI studies—performed by outside or inside researchers and aimed at documenting bottom-line impacts—are still rare in organizations. When performed, they lend enormous credibility to the organization's health, safety, and productivity management efforts.

Remaining Issues and Caveats

As noted earlier, organizational efforts to introduce and maintain innovative health, safety, and productivity management programs are still in the early stages of development. Although significant advances have been introduced in the past 5 to 10 years, the field is still evolving and there are many issues that remain unresolved. At the NIOSH Steps to a Healthier Workforce symposium, held in Washington, D.C., in October 2004, concepts articulated in this background paper were presented to the attendees and session discussants. The moderator and discussants for the session were Russell Toal, M.P.H., Joseph Fortuna, M.D., Jim Ramsay, Ph.D., and Steven Moffatt, M.D. Their comments, critiques, and suggestions complemented many of the points addressed in this report. Below are listed some of the key observations offered by the reviewers.

External Forces Affecting Organizational Productivity

It is certainly true that individual and organizational health affect the performance of organizations and their competitiveness in the marketplace. However, there are many other forces impacting organizational output that are largely unrelated to health. One such force is globalization and the ever-increasing influence of international competition. This worldwide movement brings with it greater availability of inexpensive foreign labor and consequent outsourcing of jobs overseas. Also, since foreign installations are generally not burdened by the cost of providing health-care insurance and medical services to employees, managers have less incentive to introduce the types of programs described here. Thus, a different type of business case must be developed for multinational organizations: one that emphasizes improvements in individual productivity and organizational competitiveness rather than reductions in health-care costs. This expanded business case must be especially well crafted for

employers with major sites outside U.S. borders and for those moving jobs overseas.

Difficulty of Developing Multifunctional Teams

Earlier in this document, we described potential barriers that may stand in the way of introducing and maintaining an integrated, multifunctional organizational work group focused on improving health, safety, and worker productivity. One important barrier noted is the difficulty of convening this type of group and maintaining its focus over time. There are often "turf battles" across departments. Functional leaders may be concerned about losing their autonomy and influence within the organization. Individuals assigned the task of convening or participating in multifunctional groups may not be given the necessary time or resources to do the job well. Individual and team incentives may not be aligned. Finally, senior management may not be fully "on board" with the process.

To develop successful teams, these substantial obstacles to integration must be recognized and addressed. Departmental representatives need to understand how the team approach will benefit them personally and organizationally. A "what's in it for me" personalized business case must be developed. Expanding the team to include major "influencers" in the organization is also recommended. If possible, physicians and other health-care professionals should be included on the team since they often bring both credibility and content expertise related to health, safety, and productivity interventions. Finally, representatives from business operations, especially those accountable for profit and loss statements, need to be engaged in the process.

One topic not well addressed in this paper is the role of safety officers and their influence on the integration process. While safety is mentioned as an important element of an integrated approach, more research and greater insights are needed regarding this important component. On the plus side, in many cases, safety may be the "hook" with which integration efforts become rooted within the organization, since safety programs are statutory and are viewed as "must have" rather than "nice to have." On the minus side, safety officers may view themselves as apart and distinct from other human resource functions and operating under a separate set of rules. Further, safety programs often rely upon antiquated measures of performance and may not address the root or actual causes of accidents, especially those associated with poor management processes. In short, greater integration and cooperation across disciplines, including safety, are difficult but necessary for health, safety, and productivity management programs to succeed.

Relevance to the Public Sector

Although much of the discussion and most of the examples used in this report have focused on private sector initiatives, the concepts and approaches described apply equally well to public sector employers. Simply stated, employees work for private enterprises, government agencies, and nonprofits, and the issues raised in this discussion are relevant to these employees regardless of who signs their paychecks. Also, unions play a critical role in shaping organizational structures and initiatives, and they too need to be included in the planning and implementation processes. In many cases, public sector employers working for local and state agencies, universities, and nonprofit organizations are quite large and exert significant influence in the communities where they are housed. Thus, the concepts articulated here can be applied in all types of workplaces and, in fact, public sector organizations may be more suitable to function as "laboratories" for testing novel approaches to integration.

Importance of Culture

The review panel emphasized the importance of creating an organizational culture and climate conducive to integration efforts. An organization that clearly articulates a set of norms and values emphasizing the importance of individual contributions to organizational success, as well as the value of human capital in achieving organizational goals, will be most successful in putting in place an integrated model of health, safety, and productivity management. The organization's leadership must clearly express its vision as it relates to human capital management,

and it must do so with vim and vigor on an ongoing basis. Further, managers must offer vehicles for achieving that vision. Importantly, leaders must provide innovative structures that support cooperation across functions. The message from management must be that health, safety, and productivity management is the joint responsibility of individual workers, their managers, and senior leadership of the organization. This message reinforces a culture of shared responsibility and diminishes the notion that employees are "to blame" for increasing human resource expenses.

The Role of Academia

Currently, there is a gap between what is known from scientific research and what is applied in a "real world" setting. Universities and research centers that receive funding from public sources need to work harder to fill the information-application gap. Academic and research institutions need to more broadly and clearly communicate what is currently known about what "works" in health, safety, and productivity management and how successful programs can facilitate organizational efforts at integration. They also need to do a better job in developing practical tools and "off the shelf" practices for translating knowledge into action. For example, they can play a significant role in developing case studies and best-practice models that are made available to organizations wishing to introduce innovative programs at their sites.

To support these efforts, universities should develop multidisciplinary programs and educational curricula to teach health, safety, and productivity management. Students entering these programs would come from various disciplines, including medicine, engineering, business, economics, and organizational psychology. They would emerge as external "change agents" or consultants supporting integration efforts or as internal program champions ("intrapreneurs") advocating integrated models. Ideally, medical and doctoral degrees in health, safety, and productivity management would be conferred to graduates of these programs.

Conclusions

This background paper reviewed efforts by U.S. employers to coordinate health, safety, and productivity programs with the aim of achieving greater organizational efficiency and maximum health and dollar impacts. It discussed the origins of the integration movement, the rationale for employer efforts in this area, barriers to successful program adoption, and processes for employers to follow when designing, implementing, and evaluating an integrated health, safety, and productivity management model.

As noted, work in this field is still emerging. However, there are ways to provide a boost to champions of an integrated approach. Below are recommendations for three broad areas: research, dissemination, and implementation activities. Some of these are far-reaching, while others might be more easily accommodated. The intent is to put forward a broad range of policies and practices that can be implemented by government agencies, industry, unions, nongovernmental organizations, and academia, to promote research to fill critical knowledge gaps, disseminate information about opportunities for integration, and identify and reinforce successful implementation practices.

Research Opportunities

There is a need for better research in the area of health, safety, and productivity management efforts, especially as these relate to economic outcomes—a key concern to businesses. Below are some applied research questions that would form the foundation for a research agenda on this topic.

Practical Employer-Related Research Questions

- What is needed, in terms of evidence, for employers to adopt a health, safety, and productivity management mindset?
- What types of data are necessary to convince senior managers to invest in improved employee health, safety, and productivity?
- What forms do organizational health, safety, and productivity management programs take? What are the similarities and differences among programs?
- Which investments in health, safety, and productivity management are easiest to justify ("no brainers"), and which are more difficult?
- How can employers involve their health plan providers as partners in health, safety, and productivity management efforts?
- What outcomes have employers achieved from integration efforts? How have they measured these outcomes, and how credible are the results?
- What are the lessons learned, and what advice would employers offer to businesses that are contemplating health, safety, and productivity management initiatives?

Academic Research Questions

- In relative terms, to what extent do the health and well-being of employees drive individual productivity and business profitability? How does health compare to other productivity drivers such as compensation and incentive reward structures, improved work processes, availability of capital and equipment, composition of an employee's work group, specific management style, organizational climate, and general business climate?
- What are the productivity gains or losses associated with appropriate management of certain health and disease conditions such as depression, stress, anxiety, or other psychosocial conditions; musculoskeletal disorders; migraine headaches, pain, or arthritis; heart disease, stroke, hypertension, or hypercholesterolemia; allergies or asthma; diabetes; overweight; and smoking?
- How can productivity be measured objectively? What is the value of the various self-report instruments available in the marketplace? How good are they in terms of validity, reliability, practicality, and interpretability of the data? Is there a need to develop a generally accepted productivity scale (similar in acceptance to the SF-36 quality of life scale)?
- Why should health plans pay attention to safety and productivity concerns of employers?
- What is needed to develop a succinct and well-accepted business case for increased coordination among health, safety, and productivity functions within an organization?
- Is the complexity of implementing an integrated health, safety, and productivity management model "worth it?"
- To what extent do health, demand, and disease management intervention programs affect worker productivity? What is the ROI?

Policy-Related Research Questions

- To what extent do the health, safety, and well-being of American workers affect the nation's economy and international competitiveness?
- What level of societal investment in health, safety, and productivity enhancement is "appropriate?" When do you reach a point of diminishing returns?

- With regard to investing in people vs. technology, which produces a larger health, safety, and productivity payoff?

- Are efforts to increase worker productivity also creating increased worker stress and work-life imbalance?

Knowledge Dissemination Opportunities

In addition to formulating well-crafted research questions, we face the challenge of communicating knowledge already gained from prior research and disseminating findings from new studies. Part of the problem is that employers and policy makers suffer from "information gaps" regarding the value of health, safety, and productivity management programs. They do not have access to reliable and practical data. Business people do not read scientific journals; instead, they read the *Wall Street Journal*, the popular press, and their professional journals. Occasionally, scientific research is reported in the press, but such reporting is abbreviated and oftentimes misleading.

Our challenge, therefore, is to translate relevant findings from scientific studies and disseminate this knowledge to decision makers in the business community through the popular media. To do a better job in this area, it is necessary to involve public relations and media experts who are responsible for carefully crafting communications so that findings are presented in a straightforward and credible fashion.

One immediate way to gain employers' attention is to highlight organizational costs associated with physical, psychological, behavioral, and organizational risk factors among employees. Employers are eager to understand the cost drivers affecting their business and the measures they can take to reduce those costs. When provided with well-crafted messages that are intuitive and data based, employers will respond with an internal "call to action."

Similarly, government officials need to learn from the private sector how to improve health, safety, and productivity practices in businesses. Employers regularly gather at industry conferences to share their stories of successes and failures. Government officials need to attend those meetings to learn from employers' experiences "in the trenches."

Government officials also need to adopt efficient processes used by private sector businesses to diagnose human capital problems, review the options, make decisions, and implement action steps. Business leaders often complain about government inefficiency and burdensome regulations that lack proof of efficacy. It would benefit government officials and business leaders to have a meaningful dialogue focused on health, safety, and productivity management issues facing employers and how federal agencies can support the business community in making informed decisions regarding these programs.

For example, business leaders want to know which programs are most effective and cost-effective. They need help deciding the characteristics of vendors that offer high-quality services. They would like to learn about quality improvement processes that work. Open communication between business and government leaders may be one of the best ways to more directly involve companies in improving the health, safety, and productivity of employees and communities.

Another method to disseminate knowledge about "best practices" is to support initiatives that honor and reward organizations with documented health improvements and cost savings emanating from their health, safety, and productivity management programs. Examples of such awards include those conferred by The Health Project (C. Everett Koop Annual Prize); National Business Group on Health; Wellness Councils of America; and American College of Occupational and Environmental Medicine. Ideally, an annual prize for excellence in providing health, safety, and productivity management programs would be presented by a senior governmental official in a highly publicized award ceremony.

Implementation Opportunities

There are several ways in which the government can encourage implementation of evidence-based health,

safety, and productivity management programs. For one, the government can provide financial incentives to businesses that implement effective programs. The government can create tax credits or rebates that partially offset the cost of developing and operating scientifically credible programs.

As a secondary recommendation, employers should be educated on ways to promote participation in health, safety, and productivity management programs through the use of financial or other incentives. When employees are offered incentives to participate in programs, their rates of engagement increase dramatically. Employers can encourage participation in programs by using such incentives as discounts, credits, or rebates on medical plan premiums. These financial incentives should be structured so that they promote participation in programs in an ethical, legal, and responsible fashion.

Businesses should also be encouraged to cooperate with health plan and medical providers offering these programs to members. This allows small employers in a community to become engaged, since their workers are in a pool of people whose health is managed by insurance plans with a presence in the community. Health, safety, and productivity metrics could be developed for a given community (similar to Healthcare Effectiveness Data and Information Sets measures developed by the National Committee for Quality Assurance) and reported at the plan and community level. Workers would then have access to these measures when choosing where to work and deciding in which health plans to enroll. Providing "report cards" and "dashboard" metrics to employees about their organization and health plans will improve the quality and performance of integrated programs for that community.

Government agencies can also take a more active role in providing technical assistance to employers who wish to develop, manage, and evaluate these programs. Government officials can fund studies that apply good scientific methods to evaluate various aspects of human capital programs and publicize the results more broadly. One line of research relevant to this discussion focuses on economic incentives and tax credits to encourage more businesses to develop health, safety, and productivity management programs.

Government agencies should also act as models for effective programming. They should enhance the quality of their internal programs and develop and promote best practices to be emulated by the private sector.

Finally, government officials should closely examine the relationship between statutory safety program requirements, such as those mandated by OSHA, and their possible links to health, safety, and productivity management initiatives. A question they should ask is whether statutory requirements encourage or discourage innovation in this area.

Summary

Employers can gain efficiencies and achieve greater impacts by integrating their health, safety, and worker productivity management programs. Over the past decade, employers have put in place several innovative programs that may or may not be founded on evidence. We need to distinguish program elements that are effective from those that are not and determine whether common learning can be gained by examining these initiatives. Research is therefore needed to uncover what works, and why. It is interesting to note that most of the "science" emanating from studies of health, safety, and productivity management efforts has emerged from private sector initiatives and has also been funded privately. Consequently, even though the research is growing in both volume and rigor, it is still relatively primitive as compared with large-scale, well-designed government-funded studies.

It is important, therefore, for government agencies to establish special research funds that are specifically earmarked for studying the science underlying *in situ* worksite health, safety, and productivity management programs, as well as the effectiveness of these programs in improving health, lowering costs, and increasing worker productivity. Researchers in charge of these studies must be encouraged to use the most rigorous scientific methods so that conclusions have a strong theoretical and scientific base and are not reliant on conjecture, anecdote, or belief.

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Appendix A: Health and Productivity Management—Establishing Key Performance Measures, Benchmarks and Best Practices

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Abstract

Major areas considered under the rubric of HPM in American business include absenteeism, employee turnover, and the use of medical, disability, and workers compensation programs. Until recently, few normative data existed for most HPM areas. To meet the need for normative information in HPM, a series of Consortium Benchmarking Studies were conducted.

In the most recent application of the study, 1998 HPM costs, incidence, duration and other program data were collected from 43 employers and almost 1 million workers. The median HPM costs for these organizations were $9,992 per employee, which was distributed among group health (47 percent), turnover (37 percent), unscheduled absence (8 percent), nonoccupational disability (5 percent) and workers' compensation programs (3 percent). Achieving "best practice" levels of performance (operationally defined as the 25th percentile for program expenditures in each HPM area) would realize savings of $2,562 per employee (a 26 percent reduction). The results indicate substantial opportunities for improvement through effective coordination and management of HPM programs. Examples of "best practice" activities collated from onsite visits to "benchmark" organizations are also reviewed.

Appendix B: Business Case Example—The Dow Chemical Company

Overview

For several years, human resources and health services staff at Dow have recognized the need to improve disability management. This has generally been described as one component of an overall management strategy, which should be in place for "human capital management" or "health and productivity management." Various committees, teams, and individuals have investigated this area and made recommendations. In order to move ahead and capture the value that has been articulated, an accountable, knowledgeable leader needs to be charged with responsibility to create and implement a plan in this area.

Situation

- Dow already makes a significant investment in human capital.
- The "maintenance" costs associated with this human capital investment are substantial.
  - A significant percent of the maintenance costs are associated with "health."
  - health benefit plan
  - long-term disability
  - salary replacement for short-term disability
  - workers' compensation
  - occupational health services
  - health promotion
  - epidemiology
  - industrial hygiene
    - safety initiatives
    - sick leave
    - demand management
    - case management
    - return to work planning
    - restricted work assignment
    - absenteeism
    - Employee Assistance Program (EAP)/psychological services
    - ADA compliance
    - FMLA compliance
- The many elements of maintenance costs are related and often interdependent.
- The management of these several aspects of maintenance costs at Dow is disconnected.
- With the reduced workforce, it is ever more critical to minimize time away from work.
- In this era of the "knowledge worker," having high productivity among the workforce is a key competitive advantage.
- Over the past 5–7 years, many premier companies have recognized the advantage of integrated health management for their health-related services.
- There is an opportunity to capture, manage, and improve the "maintenance" expenditures associated with the human capital investment.
- Optimal integrated management of these several health-related elements can produce much greater value from human capital investment through increased productivity.

Opportunity

- The area most in need of improvement at Dow is absence and disability management.
- Overall objectives of an integrated disability management program would include the following:
  - accurate methodology for

quantifying impact of absence from work

- reduction in overall disability/ absence hours
- minimized legal exposure
- reduction in direct costs
- improvement in service
- improvement in reporting

- Specific examples of some of the opportunities available in improved management include the following:
  - defined goals and objectives
  - clarification of internal vs. vendor roles and managing hand-off processes better
  - selection and coordination of vendors
  - implementing the use of performance metrics
  - implementation of an integrated database

Appendix C: The Health and Productivity Cost Burden of the "Top 10" Physical and Mental Health Conditions Affecting Six Large U.S. Employers in 1999

Citation: Goetzel, R.Z., Hawkins, K, Ozminkowski, R.J., Wang, S. The Health and Productivity Cost Burden of the "Top 10" Physical and Mental Health Conditions Affecting Six Large U.S. Employers in 1999. *Journal of Occupational and Environmental Medicine,* 45:1, 5–14, January 2003.

Abstract

A multi-employer database that links medical, prescription drug, absence, and short-term disability data at the patient level was analyzed to uncover the most costly physical and mental health conditions affecting American businesses. A unique methodology was developed involving the creation of patient episodes of care that incorporated employee productivity measures of absence and disability. Data for 374,799 employees from six large employers were analyzed. Absence and disability losses constituted 29 percent of the total health and productivity-related expenditures for physical health conditions, and 47 percent for all of the mental health conditions examined. The 10 most costly physical health conditions were angina pectoris; essential hypertension; diabetes mellitus; mechanical low back pain; acute myocardial infarction; chronic obstructive pulmonary disease; back disorders not specified as low back; trauma to spine and spinal cord; sinusitis; and diseases of the ear, nose and throat or mastoid process. The most costly mental health disorders were bipolar disorder, chronic maintenance; depression; depressive episode in bipolar disease; neurotic, personality and nonpsychotic disorders; alcoholism; anxiety disorders; schizophrenia, acute phase; bipolar disorders, severe mania; nonspecific neurotic, personality and nonpsychotic disorders; and psychoses. Implications for employers and health plans in examining the health and productivity consequences of common health conditions are discussed.

Appendix D: Health, Absence, Disability, and Presenteeism Cost Estimates of Certain Physical and Mental Health Conditions Affecting U.S. Employers

Citation: Goetzel R.Z. Long S.R., Ozminkowski R.J., Hawkins K., Wang S., Lynch W. Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers. *Journal of Occupational and Environmental Medicine*, April 2004; 46:4, 398–412.

Abstract

Available evidence about the total cost of health, absence, short-term disability, and productivity losses were synthesized for 10 health conditions. Cost estimates from a large medical/absence database were combined with findings from several large, published productivity surveys. Ranges of condition prevalence and associated absenteeism and presenteeism (on-the-job-productivity) losses were used to calculate average and lower-bound estimates of condition-related costs. Based on average impairment and prevalence estimates, the overall economic burden of illness was highest for hypertension ($392/per eligible employee per year), heart disease ($368), depression and other mental illnesses ($348), and arthritis ($327). Presenteeism costs were higher than medical costs in most cases, and represented 18 percent to 60 percent of all costs for the 10 conditions, depending upon whether lower bound or average presenteeism cost estimates were used. Significant variation in methods to estimate prevalence and presenteeism was noted among existing survey tools. Caution is advised when interpreting any particular source of data, and the need for standardization in future research is noted.

Appendix E: The Relationship between Modifiable Health Risks and Health-care Expenditures: An Analysis of the Multi-Employer HERO Health Risk and Cost Database

Citation: Goetzel, R.Z., Anderson, D.R., Whitmer, R.W., Ozminkowski, R. J., Dunn, R.L., Wasserman, J., and the HERO Research Committee. "The Relationship Between Modifiable Health Risks and Health Care Expenditures: An Analysis of the Multi-Employer HERO Health Risk and Cost Database." *Journal of Occupational and Environmental Medicine*, 40:10, October 1998, 843–854.

Abstract

This investigation estimates the impact of 10 modifiable health risk behaviors and measures and their impact on health-care expenditures, controlling for other measured risk and demographic factors. Retrospective two-stage multivariate analyses, including logistic and linear regression models, were used to follow 46,026 employees from six large health-care purchasers for up to 3 years after they completed an initial health risk appraisal. These participants contributed 113,963 person-years of experience. Results show that employees at high risk for poor health outcomes had significantly higher expenditures than did subjects at lower risk in 7 of 10 risk categories: those who reported themselves as depressed (70 percent higher expenditures), at high stress (46 percent), with high blood glucose levels (35 percent), at extremely high or low body weight (21 percent), former (20 percent) and current (14 percent) tobacco users, with high blood pressure (12 percent), and with sedentary lifestyle (10 percent). These same risk factors were found to be associated with a higher likelihood of having extremely high (outlier) expenditures. Employees with multiple risk profiles for specific disease outcomes had higher expenditures than did those without these profiles for the following diseases: heart disease (228 percent higher expenditures), psychosocial problems (147 percent), and stroke (85 percent). Compared with prior studies, the results provide more precise estimates of the incremental medical expenditures associated with common modifiable risk factors after we controlled for multiple risk conditions and demographic confounders. The authors conclude that common modifiable health risks are associated with short-term increases in the likelihood of incurring health expenditures and in the magnitude of those expenditures.

Appendix F: Dow Chemical Health and Productivity Management Economic Evaluation Tool (HPM-EVT)

The initial development of the HPM-EVT arose from a request from Dow for help in identifying its best opportunities for interventions designed to jointly manage health care, disability, employee absence, workers compensation, health promotion, worker productivity and other health, safety and productivity management programs. Dow recognized that employee health and well being not only influence medical care expenditures but also the productivity of workers and the overall competitiveness of the company. Dow also recognized that illness and employee well-being influence productivity in a number of ways, both in terms of time off from work and its associated consequences, and in terms of unproductive time spent on the job that arises from individual illness or caregiver responsibilities. The HPM-EVT that Dow envisioned was designed to address the following issues that confront many large businesses:

1. Documenting how much money the company spends on health care and productivity losses.

2. Estimating how much money could be saved as a result of better management of health and productivity-related problems or from the adoption of health, safety and productivity management interventions designed to maximize individual health and productivity.

3. Identifying the underlying drivers of health and productivity problems observable in the workforce.

4. Assessing the status quo—what the company does now to address these underlying drivers, and where gaps exist between drivers of health and productivity problems and current programming efforts.

5. Establishing how well current programs work, what is their return on investment, and how well new programs could work to address health and productivity problems.

6. Determining where the best intervention opportunities lie for limiting unnecessary medical or productivity-related expenditures, enhancing worker health, and allowing the company to fully realize the gains from a highly productive workforce.

7. Creating an empirically based system to prioritize intervention opportunities in light of limited funds and the political realities of the workplace.

8. Predicting the financial impact of individual interventions or combinations of interventions designed to improve health and productivity, thereby limiting the influence of factors that drive health and productivity losses.

Taken together, this information can help senior corporate managers more effectively address health and productivity challenges in their organization, limit benefit program expenditures, and increase the value of their health, safety, and productivity management programs.

For example, suppose an investigation of healthcare claims and disability program data reveals high prevalence and high cost associated with musculoskeletal disorders and arthritis. Suppose as well that these are key reasons for missing work or performing at lower than optimum levels of productivity. An investigation of the underlying drivers for these problems might reveal a host of factors that aggravate muscle and joint problems. These might include poor ergonomic design of workstations; unfit and overweight workers; lack of access to appropriate physicians, medications or other treatments; poor worker morale at certain locations; unclear and poorly communicated work rules; poor safety procedures; or other factors. Appropriate interventions might include effective disease management programs, ergonomic redesign of workstations, revision of health and fitness

programs, clearer communications of corporate policies, etc. The HPM-EVT is designed to assist with the identification of priority issues requiring immediate attention and the identification of appropriate intervention strategies to address these issues. The tool helps focus attention on underlying drivers, supports a search for solutions to address health, safety and productivity management problems, and forecasts the net impact of applying alternative interventions to control these problems, to better manage worker health and productivity.

The HPM-EVT is designed to help corporate planners identify a variety of intervention programs to address problems that reduce productivity. These might include the following:

- Health and disease management interventions (for musculoskeletal disorders, diabetes, heart disease, asthma, allergies, depression, anxiety, influenza, hypertension, etc.).

- Health promotion interventions (for smoking, exercise, nutrition, obesity, stress management, etc.).

- Integrated absence management programs (for incidental absence, disability management, workers' compensation, etc.).

- Organizational health programs (policies and procedures, corporate communications, training, EAP, work/life, etc.).

The impact of these intervention programs on health and productivity outcomes can then be estimated prospectively using this tool. Finally, a key feature of the HPM-EVT is that a multitude of problems can be analyzed simultaneously and the user can introduce several "what if" scenarios to test ideas internally before investment requests are filed. The tool helps establish which problems are most pressing, and rank alternative interventions to control those problems.

In short, the HPM -EVT allows senior managers to evaluate the simultaneous management of several issues that contribute to higher healthcare expenditures and productivity loss. Better management is expected to lead to higher revenues and profits and healthier, more productive employees.

Appendix G: Examples of Organizations That Have Documented Health Improvements and Cost Savings from Integrated Health, Safety, and Productivity Management Programs

Caterpillar's Healthy Balance Program: The program features a strong incentive to participate, top-down management support, well-developed and well-implemented programming, data-driven interventions, and well-staffed and supportive programs. Participation rates are excellent; 37,000 out of 41,000 eligible employees participated in the program in 1998. A follow-up health risk assessment showed a significant decline in smokers in a high-risk group—from 19 percent to 15 percent. For the 2,321 employees completing the high-risk program, overall health risks declined by 14 percent. Participants in the high-risk program also reduced their doctor visits by 17 percent and hospital days by 28 percent.

CIGNA Corporation Working Well Program: CIGNA's Working Well program is a well-funded, multi-component initiative directed at CIGNA's 38,000 U.S. employees. The Working Well Moms lactation program is geared toward encouraging and supporting breast-feeding at home and at work. The program achieved breast-feeding duration rates of 72 percent at 6 months and 36 percent at 12 months, resulting in prescription drug, health care, and absenteeism savings for the company and its employees. The Flu Shots program, which provides free immunization inoculations, resulted in significant differences in absence rates between intervention and control group employees. In addition to a high participation rate for the program (39 percent), a randomized clinical trial established a return on investment of 3:1. Employees who received flu shots experienced 29 percent fewer absenteeism days than controls, saving the company $33 per inoculated employee.

DaimlerChrysler/UAW National Wellness Program: The program, targeted at DaimlerChrysler's 95,000 employees in the United States, aims to improve worker health and help employees become wise health-care consumers. In 1997, the health-care costs of HRA program participants were $114–$146 lower than the costs of nonparticipants. Those who completed the HRA and then participated in at least one additional wellness program had costs that were $200 lower than for nonparticipants. Over time, differences in health-care costs between participants and nonparticipants ranged from $5 to $16 per employee per month. Over a 6-year period, 1,930 white collar employees at company headquarters who completed two or more HRAs reported reducing their driving risk by 51 percent, smoking by 33 percent, excess alcohol consumption by 32 percent, mental health risk by 26 percent and poor nutrition by 23 percent.

Fannie Mae Partnership for Healthy Living: The program, begun in 1994, is offered free of charge to all Fannie Mae employees and their spouses/domestic partners. The comprehensive program includes health screenings and targeted follow-up intervention programs. The program has achieved excellent overall participation and follow-up rates (60–80 percent). Multiple health risk assessments have shown that 53 percent of all high-risk employees drop at least one risk factor by their third annual HRA screening. The program has saved $1.5 million in medical costs and $1.0 million in employee absence. A return on investment analysis based on 1,650 employees for the period of 1994–1996 concluded that the program returned $1.09 to $1.26 for every dollar invested.

Union Pacific Railroad—Project Health Track: The Health Track Program is focused on 10 risk factors and chronic health conditions. Because Health Track has been successful in documenting health improvements and cost savings, it has been declared one of eight Big Financial Deals (BDF) at UPRR for the year 2001–2006. An econometric analysis performed by outside evaluators for UPRR and published in a peer-reviewed journal found that the dollar difference between program elimination and successful program continuation,

whereby a 1 percent reduction in 10 risk factors is achieved per year over a 10-year period, produced $99.4 million in savings for the railroad. A return on investment (ROI) of $4.07 for every dollar invested was projected for the company over 10 years, assuming the program continues at current performance levels. UPRR has demonstrated that continuous quality improvement, theory-driven programming, and rigorous evaluation are the key ingredients for success.

Northeast Utilities—WellAware Program: The WellAware Program targets all 15,000 NU employees and their spouses at 60+ worksites throughout the northeast. Approximately 2,500 participants completed two HRAs between 1998 and 2000. Results were impressive—there was a 31 percent decrease in smoking, 29 percent decrease in sedentary lifestyle, 11 percent decrease in cholesterol risk, and 5 percent decrease in stress. An HRA followed by a targeted high-risk program was shown to be more effective in reducing health risks than an HRA alone. A coronary artery disease program showed positive pre/post trends in medication compliance, cholesterol levels, exercise, diet, and smoking rates. A return on investment (ROI) of 2.6 to 1.0 was calculated based upon a reduction in re-hospitalization rates for heart disease patients (from 12.0 percent to 2.2 percent—averting almost nine hospitalizations in a 12-month period).

Citibank Health Management Program. In 1994, Citibank, a global financial services company with 130,000 employees worldwide and 51,000 employees in the United States, implemented a comprehensive health management program targeted at all U.S. employees and expatriate staff. The program, which attracted about half of the eligible population, included administration of a HRA, targeted high-risk interventions, and disease and demand management programming. An external economic evaluation, published in a peer-reviewed journal, documented a return on investment of $4.50 for every dollar invested in the program. Senior management was impressed with the financial results but also wanted to determine whether the program achieved significant health improvements and risk reduction for participants. A series of five follow-up evaluation studies were commissioned, and results were again published in a peer-reviewed journal[1]. Data analyses revealed statistically significant risk reductions in 8 of 10 risk categories. In addition, participants in the high-risk program achieved even greater health improvements than those who only participated in the HRA program. These health improvement findings, coupled with impressive ROI results, convinced Citibank management to enhance and expand the program.

FedEx Corporation—Health Risk Reduction and Cost Reduction Programs. FedEx offers a variety of Human Capital Management programs to its more than 200,000 employees. Its management philosophy and culture focuses on "people—service—profit" in that order. Its varied programs include FedEx Safety Above All, FedEx Employee Benefits (with programs directed at demand management, utilization management, catastrophic case management, and disease management), Cigna Well Aware, CareMark Care Patterns, Maternity Education Benefit Fairs, Smoking Cessation, LifeWorks, Health and Wellness Centers, and Employee Assistance Programs. Compared with expected values, FedEx's programs resulted in cumulative 5-year medical benefit cost savings of about $579 million. Additionally, 6-year cumulative cost savings related to decreases in medical-related lost time from work were estimated at approximately $497 million. FedEx Fitness Program participants reduced their overall benefit costs from $1,210 to $1,021 (16 percent) in the year following program enrollment, while nonparticipants' total benefits decreased from $2,104 to $1, 947 (7 percent).

Motorola—Global Wellness Initiatives. Motorola offers Wellness Initiatives to its 56,000 U.S. employees. The company invests approximately $6 million annually in the development and operation of its wellness and work/life programs. Over a 3-year period, participants in the Wellness Centers and Wellness Reimbursement Benefit Programs increased their annual lifestyle-related health-care costs by 2.5 percent, while nonparticipants' costs increased by 18 percent. This translated to an annual savings of $6.5 million in lifestyle-related medical expenses and $10.5 million in disability-related

expenses. These savings yielded a $3.93 to $1.00 return on investment (ROI). A flu vaccination program achieved a $1.20 to $1.00 ROI during the 2001–2002 flu season. Additionally, 46 individuals concluded an 8-week tobacco cessation program in which 15 became tobacco free.

Johnson & Johnson—Health and Wellness. Johnson & Johnson Health and Wellness is an outgrowth of the company's LIVE FOR LIFE program, which originated in 1979. In developing its health and wellness initiatives, Johnson and Johnson brought together experts in health education, behavior change, risk reduction, and disease management to create programs to improve workers' health and productivity. Currently, the program integrates health promotion activities with disability management, occupational health, employee assistance and work-life programs. The cornerstone of the program is an HRA with follow-up risk reduction and health improvement interventions. More than 90 percent of eligible employees participate in the Johnson & Johnson programs and receive financial incentives for their participation.

Peer reviewed studies performed for Johnson and Johnson by Medstat found that the Health and Wellness Program improved the health of employees and saved the company money. In a study tracking health risks of workers over a 2 ¾-year period, researchers found significant reductions in health risks in the areas of cigarette smoking, sedentary lifestyle, high cholesterol, high blood pressure, nutrition, seat belt use, and drinking and driving. Certain risk factors worsened, however, including high body weight, high fat intake, risk for diabetes, and cigar smoking. A financial impact analysis performed by Medstat and spanning a 9-year study period found that the health and wellness program saved Johnson & Johnson about $225 per employee per year in medical care utilization costs. That savings, coupled with savings from administrative streamlining of the program, produced overall savings of about $8.6 million per year for the company, during a 4-year period examined by the researchers. This latest set of findings complements a series of studies performed over the past two decades that have documented positive program impacts on health-care costs, absenteeism, health improvement, risk reduction, and employee attitudes.

Fairview Health Services—Fairview Alive. The Fairview Alive Program, first introduced in 1996, now serves approximately 13,000 eligible employees. The program offers employees an employee *heath kit* that includes a personalized health assessment and a self-care book. Employees are encouraged to obtain necessary preventive screenings. Incentives are offered to those who participate in health improvement programs. Fairview also provides onsite education classes, self-study materials, community health education programs, a high-risk personalized risk reduction and counseling program, and other programs designed to improve worker health and productivity. Of those eligible to participate, about 74 percent take advantage of some aspect of the program.

A longitudinal assessment of risk factors in a subset of the population that participated in two HRA administrations found a reduction in average health risks from 4.4 to 3.6 risks per participant, a 19 percent reduction. An independent evaluation by Watson Wyatt Worldwide found that medical cost increases for participants in the program were about $100 lower than for nonparticipants resulting in medical cost savings of about $400,000. In addition, lost injury days and workers' compensation costs increased at a much lower rate for participants when compared with nonparticipants. This resulted in an additional cost savings of about $500,000 for the organization.

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Appendix H: Additional Information Related to Employers Instituting Health, Safety, and Productivity Management Programs

- 3M
- Bank One/JP Morgan
- Boeing
- Caterpillar
- Chevron
- Daimler Chrysler
- Dell, Inc.
- Direct TV
- Dow Chemical
- Federal Express
- GE Energy
- Glaxo Smith Kline
- IBM
- International Truck & Engine
- Johnson & Johnson
- NASA
- Perdue Farms
- Pfizer
- Pioneer Hi-Bred
- Pitney Bowes
- Procter & Gamble
- Texas Instruments
- UAW-GM
- Union Pacific Railroad
- USAA

3M

The Minnesota Mining and Manufacturing Company, known worldwide as 3M, was founded in Two Harbors, Minnesota in 1902.[1] 100 years later, 3M has grown to become an international diversified technology company with more than 55,000 products ranging from pharmaceuticals to office supplies to electrical circuits. Today, the company has nearly 35,000 active employees in 32 states.[2,3] Numerous departments and policies work hand in hand at 3M to effectively promote health and wellness: the Corporate Safety and Health Policy; the Global Safety and Health Plan; the Global Safety and Health Plan Self Assessment; and the Environmental, Health and Safety (EHS) Management System.[4]

More than 15 years ago, 3M began conducting ergonomic awareness campaigns in an effort to reduce the quantity and severity of musculoskeletal disorders. Since the program expanded in 2001, placing the focus on preventing and identifying ergonomic-related illnesses, the ergonomic incident rate and the ergonomic lost time incident rate have both declined by 43%.[5]

To provide a quantifiable measure of workplace health and safety, 3M introduced the EHS Scorecard in 2001.[6] This tool tracks the health and safety of employees at all levels of the company: from the warehouse to corporate headquarters. Metrics included on the EHS Scorecard include workplace climate, utilization of employee assistance resources, disability and workers' compensation claims, and stress symptoms. Financial incentives are offered to 3M locations that utilize the EHS Scorecards in conjunction with prevention activities.[7] The results of the EHS Scorecards are used to set future health and safety promotion agendas.

3M strives to promote behavioral health as a tool to enhance worker productivity. Educational materials and consultations are provided to employees to assist them in reducing the effect home events have on the workday. Handouts and seminars cover topic areas that include adjusting to illness or personal loss, stress, depression, and general health concerns. Other tools offered to employees include a 24-hour nurse hotline; maternity-related services; health coaching to manage chronic and/or complex conditions; and, at some locations, onsite occupational health nurses.[8] These resources have been utilized by employees throughout the United States: over 22,000 calls have been placed to the nurse hotline, more than 1,300 health- and safety-related consultations have occurred, and educational materials have been distributed to nearly 17,000 U.S. employees.[9]

To advance worker safety, 3M makes large investments in protective gear and in-depth training materials for all employees. In 2005 alone, $3.4 million was spent to provide items like safety eyeglasses and safety shoes to all workers. The company has spent more than $107 million in the last 3 years to improve overall worker health and safety.[10]

3M locations in Wisconsin and South Dakota have been recently recognized by the Occupational Safety & Health Administration (OSHA) for providing employees with exemplary worksite conditions. The safety rating at these sites is consistently higher than the national average, with safety standards far exceeding the requirements established by OSHA.[11,12,13]

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Bank One/JP Morgan

Bank One, itself the product of numerous Midwest bank mergers, recently merged with JPMorgan Chase in 2004 to become the third-largest banking institution in the United States[1] Before the acquisition, Bank One employed nearly 74,000 workers at 1,800 locations, nearly 70% of which were women.[2] This financial institution has a long history of incorporating health into the workplace: the first corporate medical director was appointed in 1902, and the company has provided a worker wellness program continuously since 1982.[3,4] Dr. Wayne Burton, senior vice president and current corporate medical director, and Daniel Conti, director of the EAP, currently work together with the Human Resources department, the March of Dimes, the University of Michigan's Health Management Research Center, and the Mayo Clinic to oversee administration of the Wellness Program.[5,6]

The Wellness Program was first initiated in 1982 at First Chicago NBD (which merged with Banc One to form Bank One in 1998). The program began as a complement to the company's short-term disability management program, though the two later grew together with the common goal to share preventive health-related information to improve overall employee well-being and productivity. While the exact offerings of the Wellness Program is different at each location, with larger offices featuring more onsite accessibility to fitness centers and clinics, all employees have access to the same basic benefits, including health education materials and activities, disease management services, and annual HRAs.[7]

Educational pamphlets, newsletters, brochures, and videos are distributed company-wide. Larger worksites feature seminars, lectures, and workshops regarding a number of health-related topics, and also provide employees with access to disease management programs for depression, diabetes, and asthma. Similarly, smoking cessation, prenatal education, influenza vaccinations, and other preventive health programs are offered to employees free of charge. In some cases, program participants can earn monetary or other rewards. For example, employees who are either nonsmokers or attempt to become nonsmokers receive a $28 per month reduction on their health insurance costs.[8] To encourage physical fitness, discounted health club memberships are available, while various annual medical examinations are offered at many worksites to promote regular health assessments.[9]

All employees are currently offered an annual electronic HRA based on Healthier People, Version 4.0 (a product of the Carter Center of Emory University) modified by the University of Michigan's Health Management Research Center to meet the company's reporting needs. Since 1987, Bank One has used its Corporate Medical Department's Occupation and Medical Nursing Information system to integrate personnel, medical costs, short-term disability, laboratory, wellness, and occupational nurse counseling into one central database.[10] This has provided Bank One with a repository of employee health information that has been utilized to perform numerous studies regarding the impact illness has on worker presenteeism.[11,12,13]

Because of the company's large female population, women's health issues have been a primary target for the Wellness Program. Working with the March of Dimes since 1987, Bank One has provided the Healthy Moms—Healthy Babies program, which offers prenatal education courses led by occupational health nurses, exercise and nutrition information, and prenatal exams.[14] More than 2,000 Bank One employees have participated in the Healthy Moms—Healthy Babies program since 1987.[15] To encourage program participation, a financial incentive is available to women who complete the prenatal classes before the 16th week of pregnancy. Similarly, lactation rooms and private refrigerators for breast milk storage are located in at least 12 Bank One offices.[16] Also in reaction to the large number of female employees, the larger Bank One locations provide access to emergency child care so that the absence of a child care provider does not inhibit worker presence.[17]

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Boeing

Headquartered in Chicago, Illinois, Boeing is best known for its production of commercial airliners, though the company also produces military aircrafts and missiles, as well as assists NASA with the Space Shuttle and related communication systems.[1] According to its Web site, Boeing is one of the leading sales exports for the United States and employs 150,000 personnel in the United States and 70 other countries. Their major areas of operation in the United States are Puget Sound, Washington, Southern California and St. Louis.

Boeing works with vendors to provide adequate health and wellness options to their employees. In 2002, Boeing teamed with Group Health Cooperative's Center for Health Promotion, utilizing its Free and Clear® smoking cessation program. According to a recent press release, the program has a 25–30% success rate.[2] The process includes telephone counseling, screenings, and recommendations; when necessary, the company also sends replacement therapy directly to the participant's home.

Boeing has partnered with Regence BlueShield, which serves most of the state of Washington, but also supports employees involved in nationwide programs. Boeing employees have an opportunity to review several health insurance plans to decide which one is right for them. In addition, the "Regence Advantages" is a set of health and wellness opportunities for employees to get assistance and discounts with Boeing/Regence partners. For example, for those looking to lose weight, Boeing/Regence have partnered with Jenny Craig, Inc., a well-known weight loss and nutritional counseling company. The Boeing/Regence partnership also provides employees and dependents with gym membership discounts at any GlobalFit participating fitness centers across the country. According to the Regence Web site, employees can save up to 60% on gym memberships and enjoy month-to-month contracts, rather than long-term contracts.[3]

Regence has designed the "Health Improvement Program" specifically for Boeing employees, which provides chronic disease management for conditions including asthma, diabetes, chronic obstructive pulmonary disorder, and chronic back pain. Employees who suffer from chronic back pain, for example, have access to telephone support from expert clinicians, receive mailings, and have access to Web-based content that provides information and resources to improve or maintain their current condition. This program works with employees' primary care physicians by providing them with documentation of what Regence has sent to the employee, as well as information tailored to the health-care professional.[4]

Boeing employees are also offered information on how to choose the best hospital if they need to be admitted for any reason. The goal in providing this information to Boeing employees is educating employees on which hospital would best suit their needs will reduce the number of preventable deaths caused by medical errors.[5]

Boeing also teams with Achieve Solutions to provide staff with an EAP. The EAP operates through a comprehensive Web site covering many areas of health and wellness, including obesity, drug abuse, depression, and aging. This Web site also provides several quizzes and calculators to assist people in determining their health status.[6]

The International Association of Machinists & Aerospace (IAM) is another partner helping to promote health and safety education in the workplace through the IAM/Boeing Joint Program. The joint program has three components: the Health and Safety Institute, Vocational Programs, and the Quality Through Training Program. According to its Web site, the goal is for collaboration between the two groups so that employees are safe and healthy both on the job and at home. The Institute is split by worksite/region, with divisions in Auburn/Frederickson, Everett, Portland, Tukwila/Fort Dent, and Wichita. Employees can impact their personal workplace by filling out a Safety, Health and Environmental Action Request (SHEAR), which is effective in changing the physical work environment, altering the working environment to avoid chemical spills, and reducing the potential for falls.[7]

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Caterpillar

Caterpillar, Inc. is the world's leading manufacturer of mining and construction equipment, natural gas, turbine and diesel engines, and other related products and services. Headquartered in Peoria, Illinois, Caterpillar employs nearly 95,000 individuals worldwide.[1]

Caterpillar's Healthy Balance Program lies at the core of the company's health promotion initiatives. After a comprehensive review of the health promotion literature and in-depth analysis of the company's absenteeism rates, medical experience, and associated health risks in the early 1990s, Caterpillar introduced the Healthy Balance Program in 1997, which consists of the administration of health risk assessments, personalized health education messaging, high-risk stratification and disease management/counseling interventions, coordination with community programs, and distribution of customized self-care books and quarterly newsletters to employees.[2,3] In addition, the program administers an ongoing evaluations and communications of findings to employees, a toll-free health information hotline, and a companywide intranet Web site. All components of the program are customized to consider employee readiness-to-change behaviors and self-efficacy. Key features of the program include top-down management and support; strong incentives for participation; continuous quality improvement; and the inclusion of spouses in initiatives. In terms of tracking and evaluation, a data warehouse facilitates on-going process improvement and rigorous analyses of program outcomes.[4] The data warehouse incorporates health risk assessments, program participation, absenteeism, and medical claims data to produce these reports.[5]

According to 1999 evaluation results, the Healthy Balance Program has been successful in reducing overall medical related expenditures, while also improving the health status and reducing associated health risks of program participants. A net savings of $700 million in medical related expenditures is expected by 2015. Medical-related expenditures of nonparticipants increased 35% per year, while expenditures for participants increased only 25% per year. Reductions in aggregate health risks were achieved for participants in the high-risk cohort by 14% (n = 2,321) and by 6% for participants in the low- risk cohort (n = 22,114).[6]

In 2000, Caterpillar's Healthy Balance Program was awarded the C. Everett Koop National Health Award.[7] Caterpillar works closely with the health promotion vendor Crane Gilmore and Associates, Inc for the sales, marketing, and client support of the Healthy Balance Program.[8] In 1998, Caterpillar's Technical Services Division partnered with OSF HealthCare Systems, an integrated health-care network of facilities to administer health promotion initiatives and deliver quality health-care services to employees in the Illinois region under the umbrella of the "Quality Quest" initiative.[9]

Caterpillar is a partner along with many other U.S. organizations in a Partnership for Workplace Mental Health, sponsored by the American Psychiatric Foundation.[10] Caterpillar's EAP, Work.Life.Solutions, offers employees resources, assistance, and referrals on issues ranging from work stress and emotional

health to workplace safety issues, including emergency preparedness, back injuries, carpal tunnel syndrome, substance abuse, and domestic violence in the workplace.[11,12] Specific occupational health and safety courses are also offered through the Caterpillar Institute.[13]

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Chevron

Headquartered in San Ramon, California, Chevron is a global energy company with approximately 62,000 employees in 118 countries worldwide.[1] As the second-largest integrated energy company in the United States, Chevron is involved in every facet of the natural gas and oil industry, including chemical manufacturing and sales; exploration and production; geothermal and power generation and refining; marketing; and transportation.[2] The "Chevron Way" corporate mission and values framework outlines the company's vision "to be *the* global energy company most admired for its people, partnership and performance."[3] This vision calls on every contractor and employee to manage risks to avoid accidents, injuries and illnesses, and strive for operations that are incident-free.[4]

Despite reorganization and downsizing, Chevron has continued to link health, productivity, and safety initiatives to business trends and priorities. Chevron made a company-wide commitment to health promotion more than 18 years ago, and has since developed from a program consisting of one fitness center to a program that has won nationally recognized health and productivity management awards such as the American APQC designation and the 1998 C. Everett Koop National Health Award. Safe operations became a part of Chevron's vision metrics in the early 1990s, giving safety and injury reduction even higher visibility and awareness on the part of management. Improving health through work culture and environmental change has been a key feature in the evolution of Chevron's health and safety initiatives.[5] The recent addition of "success sharing," where employee bonuses are tied to safety performance, demonstrates the companies cultural support for improved safety.[6]

Health has traditionally been viewed as a means to improve safety at Chevron. Health promotion has been linked to safety initiatives by highlighting how on-the-job injuries are tied to health risks. As a result, there has been an increased managerial interest in health interventions and health risk assessments.[7] Chevron's Health and Medical Services provide employees a comprehensive Health and Wellness program. Health programming and initiatives consist of awareness building, assessment of employee health risks, and counseling to promote behavior change. In the United States, Chevron locations with 1,000 or more employees provide access to Health Quest Fitness Centers to employees, retires, and dependents.[8] Evaluation results from the Health Quest Fitness Center study demonstrate that participation resulted in an overall reduction of health-care expenditures, in addition to reductions in both inpatient admissions and hospital days.[9] Some sites also offer onsite medical clinics in addition to the health promotion programming to address employee first aid, medical treatment, and safety needs.[10]

Chevron's Employee Assistance WorkLife Services (EAP/Worklife) address employees' work, personal, and family concerns. EAP/Worklife initiatives provide confidential counseling services and programs covering family, mental health, substance abuse, and shift work issues that are adapted to the needs of employees worldwide from diverse communities and cultures.[11] According to evaluation results, interventions for alcohol and drug risk reduction (including policy change and individual EAP counseling and referrals) have been successful, particularly in reducing substance abuse-related risks among high-risk participants.[12]

Although individuals are the primary focus of these programs, there is an understanding that such an approach may be limited. As a result, Chevron's health initiatives focus not only on individual-level results, but incorporate work culture and environmental initiatives that often align with specific business unit or work group needs. To stimulate cultural change, business units measure progress toward achieving health and safety goals by implementing "wellness best practices" and coaching is provided to individual management leaders about how their own health behaviors or actions may influence or reinforce the behaviors of their employees.[13]

Chevron's Health and Medical Services unit has participated in helping safety experts analyze data, plan, and implement safety initiatives. By focusing on safety in terms of "process," Chevron has shifted

attention to cultural change, the work environment, and improvements in employee health to attain health and safety goals. Fitness centers have been linked to the safety "process" in terms of improving employee strength and fitness levels, while non-traditional safety programs such as healthy shift work, back injury prevention, obesity, ergonomics, fatigue prevention, and poor nutrition are offered to employees. Other health and safety initiatives include alcohol and drug risk reduction (such as work place policies, drug/alcohol testing); on-the-job safety training; and emergency preparedness. Chevron Health and Medical Services also supports the Benefits Planning and Design team in its goals to reduce costs and promote a productive and healthy workforce. By assisting in the management and oversight of the 70+ health and mental health plans, Health and Medical Services provides input into the design of preventive care benefits, the development of performance standards, and the planning and design of health and self-care initiatives.[14]

Chevron supports its integrated approach to safety and health through its internal Operational Excellence Management System, by linking health and safety goals to management compensation and business objectives. The philosophy is that zero incidents is an attainable goal and that all accidents are preventable. Minimizing risk equates to lower cost, better business opportunities, and better financial performance.[15] Chevron is also working to centralize and standardize disability management into an integrated database, a technology based tool, to provide management feedback on disability workers compensation. This technology creates an opportunity to integrate health promotion programming with disability management by linking health promotion initiatives to reductions in absence management and productivity outcomes. Integrated databases can inform management and provide employees timely access to health management programs.[16]

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DaimlerChrysler/UAW

With locations worldwide, DaimlerChrysler is the world's second-largest manufacturer of commercial vehicles, supplying trucks, minivans, sports utility vehicles and passenger cars. The company, with nearly 95,000 U.S. employees, currently manufactures under recognizable brands such as Jeep, Chrysler, Mercedes-Benz, and Dodge.[1] In a recent Executive Message, the chairman of DaimlerChrysler, Dr. Dieter Zetsche, commented on the company's approach to employee sustainability, "... we are committed to ... meeting social needs within our company and society in general."[2]

Working in conjunction with the United Autoworkers (UAW) union, DaimlerChrysler has provided employees with access to the National Wellness Program since 1985. First beginning at only two locations, the program is now available to employees at more than 110 facilities, with more than 32,000 active participants in 2000.[3,4] The National Wellness Program, funded by the DaimlerChrysler Human Resources department and UAW, works hand-in-hand with outside providers to supply a comprehensive program that is customizable to meet the needs of each individual location.[5] These providers include StayWell® Health Management, functioning as the health promotion program provider, TPA, the medical claims administrator, and a confidential third-party that merges data and provides quality assurance.[6]

Through the years, the National Wellness Program at DaimlerChrysler has received numerous recognitions for their commitment to improving employee health. For example, they have received 29 gold-medal awards from the Wellness Councils of America (WELCOA), were recognized as the 2000 recipient of the C. Everett Koop National Health Award, earned the Workforce Optimas 2001 Partnership Award, and accepted the 2003 Corporate Health and Productivity Management Award from the Institute for Health & Productivity.[7,8]

Employee feedback and company growth have encouraged the National Wellness Program to maintain an evolving program that is adaptable to the differing needs of company locations. The program expanded during the early 1990s, being integrated as a union bargaining tool in 1993.[9] Among other benefits, the current National Wellness Program offers employees annual HRAs; annual or bi-annual health screenings, depending on individual risk level; educational workshops, demonstrations, literature, and videos; and telephonic counseling through NextSteps™ for employees at high-risk for health-related issues.

When examining a study sample of 26,411 employees aged 40 to 65 at 14 DaimlerChrysler worksites, Serxner et al. found that the combination of HRA completion in combination with participation in other wellness activities translated in a savings of up to $543 per employee, as compared with workers who were not active in the program. Similarly, the total savings was relative to the number of HRAs completed within the 5-year time period, increasing with each additional HRA or wellness activity.[10] These findings not only demonstrate the effectiveness of the National Wellness Program, but also provide support for role follow up activities have on improving health.

Adaptability is central to the success of the National Wellness Program at DaimlerChrysler, as the company is both a white- and blue-collar employer attempting to serve the needs of a diverse workforce. While the basic program through StayWell® is administered at all sites, each individual location works with a team to tailor activities and awareness campaigns for each job type, as well as for the risks faced by the majority of employees at each worksite. For example, employees with administrative jobs are provided with activities and materials geared towards reducing eye strain and stress, while manufacturing workers require curriculum aimed at preventing back injuries.[11]

Improved physical fitness has been an established goal for participants in the National Wellness Program, as all U.S. locations with more than 500 employees provide onsite health and fitness counselors. For example, 60 StayWell® employees work full time to administer program activities at 26 worksites.[12] Approximately two to five health-related

educational seminars are conducted at each site per month, with topics ranging from fitness to disease prevention. Examples of nutritional activities include having employees record the number of vegetable servings or amount of liquids consumed each day. Through participation in such campaigns, workers can earn WellBucks, a play money incentive that can be used to redeem health-related products such as pedometers.[13]

With a 98% employee satisfaction rate regarding the quality and benefits of the National Wellness Program in 1999, DaimlerChrysler has been able to incorporate health and wellness into the corporate environment through specialized programs at each worksite.[14] The programs continue to be offered to current employees throughout the company.

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Dell, Inc.

Dell Inc. (Dell) is an innovative technology and services company, and is currently the global leader in computer system sales to businesses, institutional organizations, and individual consumers. Headquartered in Round Rock, Texas, Dell employs approximately 78,700 individuals worldwide, with annual revenues reaching $57.9 billion.[1]

Dell's Environmental Health and Safety team works towards improving the safety of all Dell operations and employees by working with manufacturing, process, design, and facility engineers to develop innovative safety programs.[2] Key safety initiatives include: employee-led emergency and safety response teams as part of OSHA's Voluntary Protection Program (VPP); behavior-based safety and injury prevention through positive reinforcement and peer-to-peer behavior observations to encourage lifestyle changes that will reduce risky and unsafe behaviors; employee stretching in manufacturing areas at the start of shifts to prevent muscle strain; ergonomic programs at manufacturing and office locations to prevent injury; and health and safety training programs focused on topics such as emergency response, ergonomics, and use of protective equipment.[3] In 2005, Dell earned membership in OSHA's "Star" VPP for its safety and health management initiatives, rewarded in part for maintaining illness and injury rates below the national industry average.[4]

Dell's health improvement program, "Well at Dell," offers various services to employees including a 24-hour nurse advice hotline; lifestyle coaching; disease and chronic condition management; personal health records and health surveys administered through WebMD; and the ability to earn dollars to pay for eligible health-care expenses not covered by traditional health insurance (i.e., chiropractic care, dental work, and acupuncture) through a "health rewards account" by participating in various health improvement initiatives.[5,6] Study results demonstrate that since the launch of the program in 2004, more than half of all U.S.-based employees have participated in "Well at Dell." Participants have experienced a 10% decrease in health-care costs compared with prior years, due specifically to decreases in emergency room visits and inpatient admissions.[7]

Occupational health clinics are available at larger office locations and main manufacturing campuses to provide onsite health care and advice to employees. Many of these office and manufacturing locations also contain onsite wellness/fitness centers. Dell contracts with MediFit, a nationally recognized health promotion and fitness vendor, to manage "Well at Dell" onsite fitness centers.[8] Together wellness and medical staff provide employees with health education seminars on myriad health topics, health screenings (i.e., blood pressure or cholesterol), tests and vaccinations, and ergonomic evaluations of office workstations.[9] Dell offers employees and its dependents access to an EAP administered by Value Options, which provides counseling in areas such as stress, depression, family issues, and substance abuse.[10]

Dell integrates health and productivity data from areas such as long-term disability, short-term disability, absenteeism, presenteeism, workers' compensation, behavioral health, EAP, medical utilization, health improvement, and pharmacy to drive its organizational and health goals.[11]

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DirecTV

With more than 9,000 employees in 2005, DirecTV is the largest U.S. provider of direct broadcast satellite services.[1] DirecTV's parent company, Hughes Electronics, provides basic disease management services to all employees through TAPHealth.[2] Since implementing the program, Hughes Electronics' human resources department reports a nearly 3-to-1 return on investment. DirecTV has gone further with its wellness program, Work Well+Plus, offering numerous additional benefits to employees at the company's 10 locations.

Work Well+Plus offers DirecTV employees access to worksite health promotion activities and disease management programs for diabetes, asthma, back pain, and congestive heart failure. An annual HRA is also available to employees. To increase participation, employees are offered an initial gift certificate upon completion of an HRA, and also receive up to $250 annually to spend on preventive services and $300 reductions on yearly health-care premiums.[3] These incentives have helped to increase participation across DirecTV locations, as 65% of employees took part in the HRA in 2003, as compared with about 50% in 2002.[4] Working with the Occupational Health Group (OHG), DirecTV also now provides employees with access to onsite nursing staff in some locations, as well as other case management tools.[5]

After an evaluation of employee health-care expenditures, DirecTV decided to first concentrate its health promotion efforts at the site with the highest yearly costs—the Boise, Idaho-based call center where about 1,300 employees offer customer service and telephone support.[6] Working with its disease management vendor, CorSolutions, a new program was developed to offer personal coaching to help workers reduce health risks and receive additional Web-based health-related education.[7,8] Through a pay for performance component, incentives are offered to physicians who treat DirecTV employees and those receiving the services. Preliminary analyses of the programs effect demonstrate that employees with acute or chronic conditions experience a 10% to 12% decrease in productivity per day compared with healthy employees.[9]

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Dow Chemical

Headquartered in Midland, Michigan, The Dow Chemical Company (Dow) is a global leader in science and technology. Dow provides innovative agricultural, plastic, and chemical products and services to more than 175 countries in diverse markets such as food, health and medicine, pharmaceuticals, transportation, and personal and home care products. Dow employs more than 43,000 people around the globe and has annual sales of $49 billion.[1]

Dow's Environmental Health and Safety policy states, "Our goal is to eliminate all injuries, prevent adverse environmental and health impacts, reduce waste and emissions, and promote resource conservation at every stage of the lifecycle of our products."[2] Dow Chemical's Health and Human Performance initiatives include EAPs, Health Promotion, Industrial Hygiene, Occupational Health, Workplace Diversity, Safety, Group Health Benefits, Human Resource Development, Employment Accident Benefit, and Organizational Effectiveness. Dow's Health and Human Performance Strategy focuses on four main areas: (1) mental health interventions to improve employee effectiveness; (2) injury and illness case management; (3) evaluation of interventions via a fully integrated health management database; and (4) optimal program communication and administration through a centralized communications framework.[3] In 2004, a new Dow Health Strategy focused on the integration of Health Services and Human Resources Benefits, including the EAP, with support from Public Affairs. This strategy was developed to maximize ways in which the company could support Dow employees and their families.[4]

Dow provides its employees with an overall Workplace Medical Testing program, "Health Assessment," that incorporates required OSHA regulatory testing and other voluntary health surveillance programs, such as biometric screening and the administration of health risk assessments. Dow uses the results of medical and health assessments to provide preventive recommendations to employees and as an entry point for more comprehensive counseling on lifestyle risks.[5] In 2004, more than 90% of Dow's eligible population participated in the voluntary health assessment.[6] Case management counseling and health advocacy services by occupational health nurses promote optimal health outcomes and personal safety for employees who were either previously injured or ill. As of 2004, more than 1,000 U.S.-based employees using the case management services have received expedient and appropriate care for both work- and non-work-related injuries and illnesses. [5] The success of Dow's comprehensive health management strategies are because of the ongoing support of leadership, including shareholders and corporate leaders, leaders in business units, human resource leaders, employee health and safety leaders, and employees.[7]

Dow's formal health promotion initiative "Up With Life" began in 1985. The initiative later evolved in 1988 to form a corporate global resource health promotion center to serve Dow operations worldwide to improve the health and productivity of employees.[8] The "Up With Life" Health Promotion program, focusing on mental health, smoking, AIDS awareness, hypertension, back safety, cholesterol, lactation support, mammography screening, and overweight initiatives, won the C. Everett Koop National Health Award in 1994 for its positive health and financial outcomes. Evaluation results demonstrated that "Up With Life" participants averaged between 15–21% lower medical costs than nonparticipants.[8] Dow built its business case for investment in health promotion in 1998 by calculating the company's U.S. health-care expenditures (including disability, workers compensation, absence from work, and turnover) and comparing these estimates to "best-practice" organizations in the industry with exemplary health improvement initiatives. This "gap analysis" provided insight into the potential saving from a coordinated, comprehensive health strategy. The results of this "gap analysis" was increased senior management support and the integration of employee health into day-to-day business strategy.[9]

In 2000, The Dow Chemical Company was one of three national winners in the American College of Occupational and Environmental Medicine's (ACOEM) Corporate Health Achievement Awards.

Exemplary health and safety initiatives that drew accolades from ACOEM include: training on various topics such are ergonomic injuries, heat stress, behavior-based safety practices, and correct use of chemicals; extensive toxicology and vital statistics databases used to link chemical exposures to employee illnesses; frequently updated written standards for employee health assessments based upon medical advances and new regulations; health materials provided to employees on myriad topics; and the use of automatic defibrillators.[10] In addition, Dow utilizes community and expert input on safety, health, and environmental issues. The "Off the Job Safety Process" was a joint program implemented by Dow Health Services and Job Safety in 2001 to improve safety awareness and safety-related behaviors both on and off the job. The program incorporates an annual plan, data collection, resource planning, and program evaluation activities to improve safety awareness.[11] Dow continues to become involved in the development of both government and community safety and health regulations. In 2003, The Dow Chemical Company and The Occupational Safety and Health Administration (OSHA) formed an alliance to foster more healthful and safe workplaces by sharing guidance and information to assist U.S. employers in protecting employee health and safety in areas such as ergonomics and process safety management. The alliance seeks to help U.S. employers by providing guidance in the development, implementation, and improvement of employee health and safety programs.[12]

Dow has achieved a steady decline in the rate of reportable accidents (incidents per 200,000 work hours) from 2.57 in 1995 to 0.05 in 2004.[13] Participation in health assessments and health promotion programs are believed to be major contributing factors to this downward trend in injuries. Strong leadership is the key to building a culture of safety at Dow, including accountability and ownership over outcomes at all levels of the organization. As such, management's future career opportunities, annual bonuses, and yearly performance ratings are all intricately linked to environmental health and safety performance.[14]

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Federal Express

Federal Express (FedEx), with approximately 275,000 employees worldwide, provides international delivery and document production services.[1] FedEx was the 2002 winner of the C. Everett Koop Award for its outstanding health risk and cost reduction program. FedEx works in conjunction with the International Fitness Club Network (IFCN) to provide employees with access to fitness facilities in cases where onsite facilities are not available. IFCN provides services to about 140,000 members of the FedEx corporation worldwide. In 2002, Ms. Bridget Zech, senior vice president of IFCN, was awarded the FedEx "Quest for Quality" Award for excellence in vendor services, assisting FedEx in creating a healthier workforce.[2]

According to the C. Everett Koop Award Web site, FedEx addresses concerns about employee safety through its "Safety Above All" initiative program. This plan aims to increase recorded data of on-the-job injuries, implement teams to review safety structures, adequately train employees, create safety goals and provide managers with bonus incentives and awards for maintaining the safest workplaces. Since the program's inception in 1996, FedEx has realized a 47% decrease in the number of workplace injuries, despite an increase in the overall number of employees.[3]

FedEx has also worked in conjunction with the CIGNA corporation to develop customized health-care plans for its employees. Employees have the option of joining either the "FedEx Advantage" or the "FedEx Premiere" plan.[4] CIGNA also operates two programs with FedEx, "CIGNA Well Aware" and "CIGNA Healthcare Healthy Rewards." The "CIGNA Well Aware" program targets certain conditions, such as lower back pain, diabetes, asthma, and cardiac care. Patients, identified through claims data or recommended by their primary care provider, are kept informed via telephone hotlines, newsletters, and reminders to receive follow-up testing. "CIGNA Healthcare Healthy Rewards" provides FedEx employees with the opportunity to take advantage of products and services otherwise not offered by health-care plan.[5]

FedEx recently teamed with Thomson Reuters (formerly Medstat) to predict future time away from work and decreased productivity using regression models to determine the demographics of at-risk employees. The study utilized disability claims, workers' compensation, and other data from 2005. Results indicated that the workers most likely to be at risk for lost productivity were younger, less experienced, passed fewer training courses, and had a higher number of previous injuries than those not at risk. This information will assist FedEx in designing an intervention to target the at-risk population.[6]

Promoting health outside the workplace setting is a point of interest for FedEx. One example of this is FedEx's support of National Men's Health Week, the national campaign to promote health awareness and increase screening and detection for men's health issues.[7]

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GE Energy

GE Energy, a component of the General Electric Corporation since 1901, supplies and generates traditional power sources such as gas, steam, and oil, while also creating "renewable" power sources including wind, solar, and biomass (natural gases).[1] According to its corporate Fact Sheet, GE Energy has approximately 36,000 employees operating in 100 countries worldwide and generated revenue in 2006 reaching $19.1 billion.[2] In addition, in 2005 they launched "ecomagination," a campaign that aims to produce energy through ecologically safe means, mainly by reducing facility emissions.[3]

GE Energy employees can participate in "Health By Numbers 0-5-10-25," a corporation-wide program established in 2001.[4,5] The initiative's claim is that these numbers target the "most important" aspects of healthy living, with each number representing a different health goal for employees to achieve: "0" refers to the reduction and elimination of tobacco use; "5" signifies eating 5 servings of fruits and vegetables per day; "10" encourages employees to walk 10,000 steps per day (or to do 30 minutes of exercise); and "25" represents the target Body Mass Index (BMI). General Electric's Web site has information for any individual interested in reaching and maintaining these numbers. For each section, GE provides links to resources, as well as information and tips on how individuals can achieve these goals. For example, the "25 Body Mass Index" tab provides information on how to read nutrition labels and how to make healthy choices at common fast food restaurants.[6]

According to its Web site, GE employees have the added benefit of enrolling in an online "Health by Numbers" challenge that allows participants to monitor and track exercise progress and healthy eating habits. The Web site offers motivation by allowing users to compare personal progress to other participants.[7] The National Business Group on Health (NBGH), which acknowledged GE Energy as a "Best Employer Gold Winner" in 2005, reports that the program is available in seven languages and at all GE Energy sites.[8] Dr. David Pratt, director of health services and medical operations at GE Energy, recently presented a workshop to the HERO Forum for Employee Management Solutions describing the components of the "Health by Numbers" challenge. According to Pratt, this intervention includes personalized emails and coaching, Web chats, and encourages participants to join fitness teams within the organization. Pratt also noted that analyses of the program revealed statistically significant improvements in employee health among program participants.[9]

In a recent presentation given by Dr. Donna Tomlinson, Health Promotions Manager at GE, and Tiana Howland, cardiovascular disease prevention specialist and health coach for community care physicians, GE Energy' focus on cardiac risk assessment and diabetes prevention was made clear. The company's Cardiovascular Risk Assessment (CRA) comprises 11 questions, including height and weight, lipid and glucose levels, and blood pressure. The target population for the intervention has both high-risk and moderate-risk criteria based on certain physiologic results, such as cholesterol and hypertension. According to this presentation, the average 5- and 10-year risk change for a primary cardiac event between time 1 and time 2 were both significant, and 24.8 events were prevented with the GE Energy employee population through CRA implementation. Additionally, they reported that four events are averted per 1,000 employees screened. Considering costs for a cardiac event average around $40,000, GE Energy calculated a total savings of $992,000 after CRA implementation efforts. Overall, this demonstrates that it costs only $8,500 to prevent a single cardiac episode. While the benefits of the CRA are undeniable, GE Energy does acknowledge that program implementation is "a major investment from businesses."[10]

The diabetes plan at GE Energy, which works in collaboration with the Centers for Disease Control and Prevention (CDC) and NBGH, focuses on nutritional management and building an underlying knowledge of the effects of saturated fats. According to the aforementioned presentation, a pilot program was launched at GE Energy's Houston site, which enrolled approximately 24 employees. Additionally, GE Energy has plans to offer this program at locations

in Schenectady, Bangor, and Minden. GE Energy indicates that pilot study participants reduced their total cholesterol, blood pressure, triglycerides, and glucose levels significantly from their measured baseline. Program participation is initiated with a questionnaire to establish baseline characteristics, which is followed by a 6-month intervention and counseling, and culminates with another screening. In comparison to the CRA, nurses are the main resource in the nutritional management program, and contribute to most of the operational costs of the program.[11]

GE Energy also is a member of the Voluntary Protection Programs (VPP) with the Occupational Safety and Health Administration (OSHA). Began as a Federal program in 1998, VPP is a recognition of excellence in upholding the safety and health management of employees at worksites. Companies receive either "Star" or "Merit" designation for participating.[12] The main goal is to ensure healthy and safe working conditions for employees. VPP recognition is designated by site; GE Energy has six VPP sites, all of which have a "star" designation.[13] The research literature suggests that aside from ensuring equipment safety for employees, there is limited, if any, integration of health promotion efforts and safety at GE Energy.

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GlaxoSmithKline

GlaxoSmithKline (GSK) is a research-based pharmaceutical company headquartered in England, employing more than 100,000 people in more than 116 countries, including the United States[1] GSK, which claims to have 7% of the world's market in pharmaceuticals, develops medicine for six areas of health—asthma, virus control, infections, diabetes, mental and digestive disorders. In addition, it produces vaccines, over-the-counter medicines, smoking cessation products, dental care products, and nutritional drinks, while also conducting research and developing treatments for cancer.[2] In the United States, GSK employs approximately 24,000 people in Pharmaceutical Operations, Consumer Products, Research and Development, and Manufacturing sites scattered across Pennsylvania, North Carolina, Missouri, Tennessee, New Jersey, and South Carolina.[3]

In 1997, GSK implemented "Contract for Health and Wellness," a health promotion program for its employees targeting smoking, nutrition, physical activity, stress, depression, and preventive care measures. Employees sign contracts when enrolling in the program in an effort to increase commitment to the program. The goals of the program are to promote health and wellness, encourage employees to lead healthier lifestyles, to reduce the economic burden of health-care costs, and increase workplace productivity. Employees first fill out a self-assessment to determine what step in the "Stages of Change Model" they are in, and then choose to participate in programs that they believe they can commit to for 1 year. GSK conducts onsite seminars and programs that help participants lead healthier lives. Employees earn points based on how often they attend program seminars and for incorporating suggested behavior changes. These points are converted into financial incentives, which average approximately $50.[4]

Gregg Stave, Lamont Muchmore, and Harold Gardner conducted a 4-year analysis using GSK data from 1996–2000 to determine the financial outcomes of the "Contract for Health and Wellness" program. Focusing on a group of 6049 employees, the study examined the impact on health behaviors and on integrated health benefits use of this continuously employed population. Total benefits costs were examined for participants and nonparticipants, and the annual savings associated with the program were $613 per participant. Reductions in disability costs accounted for the majority of these savings. The analysis also examined the relationship between employees who enrolled in the Contract for Health and Wellness in three consecutive years (1998 to 2000) and total health-related benefits cost. Here, the average annual estimated savings were $777 per employee and the total savings associated with this group of 1275 employees were almost $1 million annually.[5]

GSK works with numerous vendors to provide wellness-related initiatives to its employees. For example, L&T Health assists GSK in incorporating fitness and wellness into its program design.[6] In conjunction with L&T Health, ICTraining, which creates computer programs for fitness data, is also used by GSK. These programs assist employers in compiling statistics on participant progress, and in creating calendars to schedule trainers and participants all in one location. Libby Vaughn, the Personal Trainer Coordinator for GSK through L&T Health, has applauded the use of ICTraining at GSK sites, commenting that through this program less time is spent trying to manage all of its data.[7]

According to GSK's Web site, safety measures implemented by GSK include the GlaxoSmithKline Health Standards, developed in 2001. Compliance with these standards is audited by a global program and focus is placed on musculoskeletal conditions, mental health, and exposure to chemical agents. To ensure these safety measures are adhered to, GSK created two teams: EHS and Employee Health Management (EHM).[8]

In a case study conducted by the International Business Leaders Forum, EHM's focus on mental health is shown at GSK through organizational "team" assessments. "Teams" of employees are composed of individuals who work together in a department or area and can fill out an online assessment of their working environment. These assessments do not link to any specific individual employee, though EHM

uses these online assessments to work with the team in creating effective improvements and solutions to issues related to relationships, management, and career development. EHM is also involved in program assistance, ensuring participants are interested in the program and develop ownership of the program.[9]

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IBM

Headquartered in Armonk, New York, International Business Machines Corporation (IBM) is a global leader in the invention, development, and manufacture of advanced computer systems, software, information technologies, microelectronics, and storage systems. With annual revenues of $91.4 billion, the company employs more than 355,766 individuals across the globe.[1]

Since the company instituted its first formal workplace safety policy in 1967, IBM has established global standards for employee well-being and safety. Although these standards are universal across both domestic and international IBM sites, flexibility exists to allow for efficient implementation in diverse work environments, cultures, and settings. An example of the implementation of global standards is the establishment of IBM's Well-Being and Management System (WBMS), launched in 1999 by Global Well-being Services and Health Benefits. This global management system ensures the compliance, planning, measurement, and improvement of industrial hygiene, ergonomics, safety, medical, wellness, and preventive benefit initiatives across all IBM business units. Through the WBMS both worksite managers and executive officials are informed of employee health and safety goals and initiatives, as well as the necessary corrective or preventive actions.[2]

Safety compliance and the workplace environment, from construction and operations to the design of manufacturing tools, are assessed regularly by qualified industrial hygienists, safety engineers, and occupational physicians and nurses.[3] When an injury occurs, the primary focus is to restore the employee's health. Efforts are taken to support the employee during time off from work through resources such as EAPs, condition/disability management services with occupational health nurses, and workers' compensation benefits. Resources are also focused on the prevention of further occurrence of injury. Accident and illness prevention programs at the worksite focus on protective equipment and safety training, proper lighting and ergonomic efficiency. EAP helps employees manage work-life issues, marriage and family problems, and stress through counseling and referral services. IBM's Care Advantage program offers employees case and condition management services for more complex injuries and chronic diseases such as diabetes, asthma, depression, and congestive heart failure.[4] Absence and disability issues are managed through effective partnerships with the WBMS, Case Management, Benefit Design, Disease Management, and Care Advantage/Case Management programs. The overall focus of IBM's well-being initiatives reflects their dedication to integration.[5]

IBM has also instituted a driver safety training program among company fleet drivers, which has significantly reduced motor vehicle accidents, the severity of injuries and related workers' compensation costs. Safety initiatives have received the Occupational Safety and Health Administration's (OSHA) recognition as a Voluntary Protection Program (VPP) site. In terms of larger scale public health prevention efforts, IBM has developed a crisis management emergency planning team to respond to public health threats such as terrorism or communicable disease epidemics through employee education and a worldwide database for threat analysis, assessment, and communication.[6]

IBM's health promotion initiatives focus on health risk reduction and maintaining the low-risk status of those employees already realizing low risks for injury and illness. Primary prevention programs focus on physical fitness, nutrition, ergonomics, and injury and illness prevention, while secondary prevention programs focus on the condition and case management of injury or chronic illness.[7] IBM partners with the University of Michigan Health Management Research Center and MediFit—a national health promotion vendor—to administer and evaluate the results of the "Wellness for Life" Employee Health Risk Appraisal profile.[8] Express Wellness Onsite, meanwhile, is an U.S.-based program offered at selected sites that provides biometric and health screenings (i.e., cholesterol, blood pressure, and bone density screenings) in

addition to employee health coaching and goal setting.

Safety and well-being initiatives are extended to all employees, including client contractors and at-home work locations through interactive technologies; ergonomic training and self-assessment; and driving and travel safety initiatives. Online health promotion initiatives include a Virtual Fitness Center (VFC) that is accessible 24 hours per day, 7 days per week, which enables employees to set physical fitness goals and track activities. The Health and Wellness Companion, an interactive health information tool, assists employees in evaluating health risks and finding information on myriad health topics. As an incentive to engage in healthy living, IBM offers employees a "Healthy Living Rebate" in the amount of $150 annually for those employees who participate in smoking cessation programs or regular physical activity by tracking their performance through the VFC.[9]

In addition, IBM periodically surveys employees to assess perceptions of protection against workplace safety and health hazards.[10] IBM won the 2002 Corporate Health Achievement Award based upon its exemplary program for the use of information technology to disseminate health promotion information, toxicology assessments, and case management of environmental and occupational injuries.[11] IBM collaborates with The Leapfrog Group, The National Business Group on Health, and The Integrated Benefits Institute to engage employees in health-care quality and safety issues.[12]

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International Truck and Engine

International Truck and Engine Corporation, a division of Navistar International Corporation, has been a leading U.S. manufacturer of trucks, engines, school buses, and automotive parts for more than 100 years. With 26 locations throughout the United States, International Truck and Engine currently employs more than 14,500 individuals.[1]

Under the direction of former President and CEO John Horne, International Truck and Engine sought to achieve the company vision of being the "best truck and engine company" through all available avenues, including by targeting the health and wellness of employees.[2] The planning of the Vital Lives program commenced in 1996, with the support of a 10-member Executive Wellness Council (EWC) made up of upper-level executives aimed at incorporating a health promotion program into the corporate culture at International Truck and Engine.[3] The EWC developed the initial vision for Vital Lives, and continues today to oversee how the program is functioning to meet the changing needs of employees.

The first HRA was available to employees in 1998, though only about 20% of workers participated.[4,5] The growing success of Vital Lives is evidenced by recent HRA participation rates, as 90% of nonunion workers took part in the 2004 online HRA. As an additional quantitative measure of workplace health and safety, a Health Promotion segment was added to the already existing annual Health & Safety audit in 2002. Each month, the Health, Safety, Security, and Productivity (HSSP) department conducts an eight metric audit, measuring: health-care cost, short-term disability, long-term disability, absenteeism, workers' compensation, incident frequency rate, lost-time case rate, and audit remainder. These metrics are compared against wellness program participation, providing a direct measure of employee health in relation to safety and productivity.[6]

To further define and promote Vital Lives, the EWC launched its own set of values to support the program and guide its evolution. These values, aligned with the company's overall Bold Goal vision, support the corporate policy for employees to "Be Smart, Be Healthy, Be Safe, and Be Responsible." Recently, monetary incentives have been established for Vital Lives participants, with an offering of a $50 reduction in monthly health-care premiums for workers who are committed to smoking abstinence through participation in smoking cessation programs and the creation of smoke-free work environments. Financial rewards for healthy lifestyles increased in 2005, with a $200 reward upon successful completion of the online HRA and the corresponding lifestyle modifications.[7]

Vital Lives is currently directed by Bill Bunn, Vice President of HSSP at International Truck and Engine. As a decentralized health and wellness program, Vital Lives is operated at the local-level by volunteer union and nonunion employees at each of the 26 company sites. While the basic health and safety initiatives are developed by the EWC, the differing sites are able to create customized programs to fit the needs and interests of employees. For example, sites with employees who travel frequently offer pre-travel medical screenings and vaccinations, as well as a "travel kit" containing first aid and medical supplies, travel safety information, and exercise bands to encourage fitness while traveling. To coordinate the efforts of each local team, the Vital Lives annual summit is held in order to set goals for the upcoming year and share information about both successes and failures to assist other sites in developing their programs. Similarly, both monthly conference calls and the Vital Lives team resources Web site provide team members with resources to aid in program implementation and development. [8]

A driving focus for International Truck and Engine is the encouragement of employee engagement in the Vital Lives program. By offering support and education, as well as financial incentives, the company seeks to get workers interested in improving their own health for their own well-being and the good of the company. Rather than tackling only issues related to high-risk individuals, Vital

Lives offers preventive care advice for those at lower risk.

International Truck and Engine has embarked on numerous health and wellness initiatives, including the medical self-care program, disease management programs, the online HRA, and financial rewards based on participation. The self-care program provides Healthwise Handbooks and other educational materials to all employees to assist workers and their families in better utilizing the health-care system. Retrospective studies conducted in 2000, 2002, and 2004 have indicated a 5-year estimated net savings of $12.1 million dollars after the initial investment of only $1.2 million. These cost savings are considerable: the company documents a return on investment of $9.70 for every one dollar invested.[9] Approximately 12% of the employee population participated on one or more of the currently offered corporate disease management programs targeted at asthma, peptic ulcer disease, diabetes, heart failure, chronic obstructive pulmonary disease, and coronary artery disease. Individual sites also offer other programs aimed at depression, musculoskeletal and cardiovascular conditions, obesity, allergies, skin cancer, and alcohol abuse.

Allergens have recently been studied as a possible cause of lower productivity rates and increased absenteeism among International Truck and Engine workers.[10,11] Allergens affecting company employees include those caused by local flora, as well as resulting from workplace byproducts. Results of these studies indicate that persons suffering from allergies indeed are at a higher risk for accidents, causing the company to incorporate allergy awareness campaigns into the Vital Lives program.

The online HRA offers employees assistance in appraising current health status to alert participants to possible health risks and early preventive care techniques. Other programs, such as Trucking Across North America (TANA) and the health club subsidy, are aimed at encouraging increased levels of employee activity. TANA is a 13-week competition where teams of 5 to 10 employees "walk" to every International Truck and Engine worksite by logging exercise rates. The competition takes place at the site- and company-wide-level, with prizes being offered along the way. Similarly, the health club subsidy program provides employees in worksites in Indianapolis, IN, Melrose Park, IL, and Springfield, OH access to onsite fitness centers for a small membership fee of only $5 per month. Employees at other locations are offered a subsidy of up to $30 per month in reimbursement for health club fees.[12]

Employees at International Truck and Engine will continue to have access to the benefits of Vital Lives well into the future, with the company striving to achieve 100% participation levels. It is estimated that by attaining the maximum involvement, International Truck and Engine will realize more than $19 million in health-care savings per year.[13]

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Johnson & Johnson

Since 1886, Johnson & Johnson has been a premier manufacturer of products and devices related to health care, from bandages and medical dressings to pain relief products. Today, the company employs more than 121,000 people in 57 countries through more than 250 operating companies.

Johnson & Johnson has provided employees with the benefits of a corporate wellness program since 1978, first with the development of LIVE FOR LIFE®, then the 1995 implementation of the Health & Wellness Program (H&W), and most recently with the Healthy People 2005 Initiative.[1,2] According to a 2002 study, more than 90% of the 40,000 U.S.-based Johnson & Johnson employees were active participates in the H&W Program.[3] The program has integrated aspects of health and safety into the corporate culture at Johnson & Johnson, by providing numerous educational opportunities, health activities, and incentives for participation. The benefits of the H&W Program at Johnson & Johnson have been recognized on numerous occasions, as the corporation received the 2005 Robert W. Campbell Award from the National Safety Council and the 2001 C. Everett Koop National Health Award.[4] Similarly, both the health and economic outcomes of Johnson & Johnson's health promotion program have been demonstrated in numerous peer-reviewed articles.

The LIVE FOR LIFE® program began at Johnson & Johnson in 1978 under the direction of Jim Burke, who believed that rising health-care costs could be dispelled by promoting overall employee health and positive lifestyle decision making. The early program operated with two main goals: (1) to provide educational materials and access to behavior modification services to all employees, and (2) to offer onsite programs to help diminish overall health-care costs.[5] The positive outcomes related to the program began to surface immediately—Johnson & Johnson worksites that had implemented LIVE FOR LIFE® had 18% lower absenteeism rates and one-third the medical expenses as their counterparts without access to LIVE FOR LIFE®. These early results prompted the program to be implemented at 22 locations by 1986.[6]

Since 1995, the H & W Program has operated under a "shared services" concept through the integration of employee health, wellness, assistance, disability management, and occupational medicine programs.[7] The H&W Program has partnered with Johnson & Johnson Health Care Systems to oversee the Insight® Health Risk Appraisal survey and the high-risk intervention program Pathways to Change®, as well as other components of the program aimed to improve employee health.[8] Studies have demonstrated the impact of the H&W Program on health-care costs, with program participation resulting in a $224.66 per employee per year cost savings.[9] The effects of involvement have proven most notable after year three of program initiation, as measured by employee health-care utilization rates.

Johnson & Johnson continues to reformulate its H&W Program today, with the recent addition of the Healthy People 2005 initiative, a reformulation of the national Healthy People 2010 program being coordinated by the U.S. Department of Health and Human Services. The goal of this component is to address modifiable health and safety risks to improve the overall health of employees while also further promoting a corporate culture revolving around wellness. Healthy People 2005 gives employees and their families access to an expanded set of services, including TotalHealth® lifestyle counseling, work/life services through LifeWorks®, and stress management classes. The main objectives of this newest initiative include smoking cessation, reduced blood pressure and cholesterol, and increased activity rates among employees.[10]

Since the origination of LIVE FOR LIFE®, a primary goal of Johnson & Johnson has been to maximize employee safety in the workplace. Numerous awareness campaigns have been launched to address the safety issues faced daily by employees. Workers in all realms of the company have been evaluated for their ergonomic efficiency through the Computer Workstation Ergonomics Job Analyzer tool, which identifies employees at risk for pain because of repetitive motion injury or poor workstation setup.[11] JOBFIT, an awareness campaign targeted

at preventing musculoskeletal disorders through ergonomic training, initiated in Puerto Rico, reduced the number of lost workday cases and recorded injuries to zero at 6 of 7 worksites in 2001.[12]

The goal of the Safe Decisions for Life awareness campaign, another program targeted to reduce employee accident rates, is to decrease hand injuries and injuries caused by falls in the workplace.[13] Meanwhile, laboratory safety has been encouraged through the Safe Science program, which ensures that all worksites abide by a uniform lab inspection checklist to maintain a safe environment.[14] As many Johnson & Johnson employees must drive a vehicle as a part of their expected workday, the SAFE Fleet program has been developed to give tips for safer driving and provide education on proper handling techniques. It has been estimated that since the inception of the SAFE Fleet program, an estimated 6,700 accidents, 800 injuries, and 13,500 days away from work due to injury have been prevented.[15] In light of the machinery many Johnson & Johnson employees must work with daily to complete their duties, the company has created a "Beyond Compliance" motto, in which all machinery must exceed national safety recommendations in order to assure employees remain safe in the workplace. Thus, the Zero Access™ machine safeguarding program has seven safety standards that all employees must comply to.[16]

As a means to encourage employee participation, Johnson & Johnson offers financial incentives to workers who actively take part in H&W Program offerings. For example, employees are offered reductions of up to $500 on health-care coverage for completing the Insight® Health Risk Appraisal survey and, if necessary, being involved in the high-risk intervention program Pathways to Change®.[17]

Through the H&W Program, Johnson & Johnson encourages employees to play an active role in their health, giving them first hand access to educational materials, fitness clubs, and health screenings to battle both current health-care issues and future risks. Johnson & Johnson continues to reevaluate the H&W Program each year to promote healthy lifestyles while also meeting the changing needs of its workforce; as their business credo states, "we are responsible to our employees, the men and women who work with us throughout the world."[18]

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NASA

Established in 1958, the National Aeronautics and Space Administration (NASA) conducts scientific and aeronautical research projects through space exploration programs and satellite endeavors. Well known projects include the development and maintenance of the International Space Station, space shuttle missions, robotic explorations of the solar system, and the advancements in space exploration vehicles and technology.[1]

Worksite wellness initiatives have a long history at NASA: in 1972 NASA commissioned the Durbeck study, which later confirmed the existence of a relationship between worksite exercise programs and improved health. Within 5 years, NASA incorporated nutrition promotion programs into its employee benefits package. From 1990 to 2000, the agency designed and implemented a health and wellness agenda designed to make workers meet nationwide Healthy People 2000 goals. These efforts culminated with the institution of the NASA Health Promotion and Wellness Team, designed to create a standardized wellness program across all NASA locations.[2] In addition to onsite health promotion activities, employees have access to educational materials online.[3]

The Office of the Chief Health and Medical Officer (OCHMO) oversees the health and safety of all NASA employees, setting regulations and ensuring that all locations are fully compliant, while the wellness program itself remains decentralized and specific to each worksite. The fiscal year 2002 budget for full administration of the wellness program across all NASA locations was just more than $45 million. More than 400 health professionals currently implement the program at the 14 worksites. To ensure communications between the OCHMO and each location, the program teams interact through an annual occupational health conference, an annual health and safety meeting, and an occupational health Web site where program materials can be accessed and disseminated. Each site's program is unique, offering benefits that include preventive care information, nutritional advice, fitness centers, onsite medical and dental clinics, and stress management courses.[4]

All NASA employees have access to the main Occupational Health Web site, which provides materials regarding occupational health, preventive health measures, physical fitness, and specifics regarding each NASA location's onsite facilities. The Kennedy Space Center, Johnson Space Center (JSC), and Marshall Space Flight Center all offer its employees additional Web sites with information specific to the location. JSC, for example, runs its own wellness program, Exploration Wellness. This program was created in partnership with onsite contracting organizations to provide health and safety information to the entire JSC team. The entire team has access to behavior change programs targeted at disease management and improved fitness, HRAs, participation incentives, and the Starport Fitness Center. All resources provided by the Exploration Wellness program are available to NASA employees and to onsite contractors working for organizations that contribute operational funds.[5]

Because of the industrial nature of many NASA jobs, the encouragement of industrial hygiene is a key aspect of its occupational health program. Each location has a Hazardous Material Program, designed to identify possible areas of exposure to reduce risk. All employees engaged in tasks where contact with hazardous materials may become an issue are required to take part in extensive training sessions and participate in annual safety inspections. Similarly, the NASA Safety Training Center in Houston develops and disseminates health- and safety-related courses for employees nationwide. The NASA Ergonomics Program is proactively targeting ergonomic safety by making educational materials available on the wellness program Web site and through assessments of engineering controls and operations. At least one worksite also provides employees with onsite physical therapy and rehabilitation services.[6]

Despite the size and provisions of the wellness program at NASA, the agency still feels that the program has yet to provide an integrated approach to promoting employee health *and* safety.[7] For example, health awareness is promoted by a separate team than that providing information related to safety.

This is exacerbated by the divide between services offered to NASA employees versus those services provided to contractors. According to published materials, accessibility to communications about the program tend to vary across sites; some locations offer little information while others tend to either send too many communications or bury invitations within large, company-wide distributions.

Plans for upcoming changes to the health programs sponsored by NASA were recently discussed at the March 2007 meeting of the Health Promotion and Wellness Committee. Here, members discussed the current challenges being faced by NASA employees, and also developed a new agenda and focus for the program. In the future, the program will place an increased emphasis on health management counseling to reduce cardiovascular risk and the occurrence of co-morbidities with diabetes. Also in development are programs targeted at colon cancer, sleep awareness, tobacco cessation, and a ban on smoking at all NASA campuses.[8]

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Perdue Farms

Perdue Farms, headquartered in Salisbury, Maryland, is the third-largest poultry company in the United States[1] With annual sales in excess of $3.4 billion, Perdue employs approximately 22,000 individuals and provides agricultural and food products and services to customers in more than 50 countries.[1,2]

Perdue's Health Improvement Program is a voluntary program, provided at no cost to employees, designed to target modifiable health risk factors such as blood pressure, physical activity, body mass index (BMI), cholesterol, and tobacco use. The program also aims to intervene in high health risk areas that represent high dollar expenditures.[3] The three main objectives of the Health Improvement Program are to (1) eliminate lifestyle risk factors; (2) systematically manage controllable disease; and (3) establish an environment of health. To initiate program participation, employees complete a health risk appraisal and biometric screening, and are then provided with a "Personal Plan for Health" based upon identified health risks.[4] Employees work with Perdue's onsite health professionals, which includes nurses and health promotion specialists, that provide health coaching and channel employees to behavior modification programs and initiatives such as healthy food options in onsite cafeterias and walking paths. Onsite medical clinics provide preventive screenings and access to both primary and specialty care services that attempt to address health issues at the earliest, least costly stage. Evaluation results of the program report statistically significant reductions in weight, blood pressure, tobacco use; increases in employee physical activity levels; and direct medical cost savings of approximately $161 per employee.[5]

Perdue launched its ergonomic program in 1991, and since has expanded the program to all its corporate plants.[6] Ergonomic awareness begins at pre-employment, when occupational nurses review musculoskeletal disorders, such as carpal tunnel syndrome and associated symptoms with employees. Perdue plants follow the National Broiler Council's medical ergonomic training program, which emphasizes participation in isometric exercises at the start of every shift. The companywide Error Cause Removal (ERC) program mandates management response to suggestions from associates regarding ergonomic concerns. Perdue Farms stresses that it values employee participation and insight into safety issues, and that ergonomic concerns are addressed monthly at team management meetings.[7]Associates are included in safety committees that perform safety inspections at the start of every shift and meet regularly to discuss safety concerns. Associates are also empowered to halt production if they observe conditions that may be dangerous.[8]

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Pfizer

Pfizer, Inc., headquartered in New York City, is the world's largest pharmaceutical manufacturing and research organization in human and animal health, developing and manufacturing numerous pharmaceutical and consumer health products. Pfizer employs nearly 100,000 people globally, including 12,000 medical researchers, and has operations in more than 180 countries.[1] With an annual revenue of $48.4 billion in 2006, Pfizer conducts an estimated 15% of the world's biomedical research.[2]

Pfizer Health Solutions, Inc. a wholly-owned care management subsidiary of Pfizer, Inc. located in Santa Monica, CA, administers Pfizer's employee health management program, "Healthy Directions." Healthy Directions has been developed to improve the health of Pfizer colleagues and their families by encouraging individuals to take an active role in their health by providing tools, resources, and education. The Healthy Directions program includes health information via a personalized online portal, annual health risk assessments, access to a continuously operating nurse/care advocate information hotline, telephonic health coaching, and numerous onsite programs and events. The Healthy Directions portal is a personalized, confidential Web site based upon preferences and responses to the health risk assessment. The portal provides self-service health resources, information, and health improvement programs. Telephonic disease management programs, which offers one-on-one support, focuses on the self-management of chronic conditions such as asthma, lower back pain, depression, diabetes, and coronary artery disease. Telephonic risk management programs, meanwhile, provide one-on-one lifestyle coaching covering topics such as weight loss, fitness, tobacco use, stress, and high cholesterol. Onsite programs include biometric health screenings, health fairs, fitness centers, walking programs, and immediate access to health coaches. Colleague participation in Healthy Directions is driven by management support and encouragement, as well as by incentives ranging from $100 gift cards to health improvement-related raffle prizes to discounts on health benefit premiums. In 2006, Pfizer offered a 20% discount on health benefit premiums to colleagues who completed a health risk assessment. In addition, Pfizer's health benefits provide 100% coverage for preventive care exams and preventive prescription drugs.[3]

Pfizer partners with a number of organizations to administer the Healthy Directions program. WebMD assists Pfizer with the management and administration of health risk assessments, personal medical data, and the personalized online health portal. Pfizer partners with Matria Healthcare and Gordian Health Solutions, Inc. to improve employee health status by administering health coaching and disease management services. Matria Healthcare also provides access to a 24-hour nurse hotline, and forms a cooperative alliance with Mercer and Ingenix to manage data via a data warehouse, conduct analyses, and perform evaluation activities.[4]

Pfizer's Occupational Medical Support Program aims to prevent and reduce the severity of work-related injuries and illnesses at large offices, research and development locations, manufacturing sites, and large logistic facilities. Medical questionnaires are used to monitor the health of employees working with possible hazardous processes and materials. Similarly, injury and illness data are used plan future health and safety efforts, as Pfizer applies scientific risk assessment technologies to prevent illness and injury during the manufacture, transport, and disposal/use of pharmaceutical chemicals and products.[5,6] In terms of process safety and the prevention of accidental chemical release, fire, or explosion, research/development and manufacturing locations maintain a management system that oversees process and equipment design, emergency preparedness, training programs for colleagues and contractors, and hazardous material handling and storage practices.[7] Pfizer has also recently instituted safe driver and defensive driver training programs for its sales force, and only purchases vehicles that have met high crash test safety and fuel efficiency ratings.[8] In office locations, Pfizer has developed fire safety programs to ensure safe evacuation plans, regular building inspections for fire hazards, and online fire safety training. In addition, Web-based

ergonomic training programs, training modules, and handbooks are available to all office-based locations.[9]

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Pioneer Hi-Bred

Pioneer Hi-Bred International Inc. (Pioneer), a DuPont Company, is headquartered in Johnston, Iowa, and employs nearly 6,500 individuals worldwide. Pioneer markets and sells improved or hybrid varieties of sunflower, canola, rice, soybean, alfalfa, wheat, grain additives, sorghum, and corn globally through numerous subsidiaries, independent dealers, sales representatives, and joint ventures in 70 countries. Pioneer is also the producer of hybrid corn seed.[1] Recognized as a Platinum Gold Well Workplace in 2004 from the Wellness Councils of America, Pioneer Hi-Bred offers onsite health and wellness programs, ergonomic workstations, and safety education to employees.[2]

Pioneer's health management strategy is to keep low-risk populations at low risk by maintaining employee access to health and safety resources and addressing a variety of health areas including musculoskeletal injuries, depression, stress, and physical activity. For high-risk individuals, efforts aim to support lifestyle change. Health promotion initiatives include, but are not limited to: medical self-care and consumer education; high risk management for cardiovascular disease, asthma, and diabetes; a bimonthly health newsletter; financial incentives for smoking cessation and weight loss; a nurse hotline; healthy choices in vending machines and cafeterias; preventive exam reminders; group exercise classes; health club reimbursement; CPR/First Aid/AED training; and nutritional counseling. Pioneer also offers a comprehensive health screening to all employees and their spouses, which includes health risk assessments and biometric screenings including body mass index (BMI), a complete blood profile, and body composition testing. EAPs offer employees counseling and resources for stress management, depression, and substance abuse. Pioneer partners with Health Fitness Corporation, a national health promotion vendor, to manage the daily operations and evaluation of its 3,000 square foot fitness facility at company headquarters.[3]

An integrated approach is taken within the organization to address health and safety concerns. From 2002 to 2005, Preventative Health Services determined a need for and implemented specific interventions to address physical activity, back health, and musculoskeletal injury, specifically focusing on remote locations throughout the United States Initiatives included the development of a WorkFit program to provide an affordable fitness program and activities comparable to the main fitness center at the Johnston location. WorkFit programs currently operate under a fee-per-visit arrangement. In addition, Wellness and Health Promotion staff partnered with Safety and Risk Management efforts to provide "best practice" standards and integrate activities to establish proper lifting techniques and back care, as well as stretching and injury prevention training programs. Risk and Supply Management also ensures that stretch break training is incorporated into the daily work routines for all plant employees.[4] Pioneer Hi-Bred's employee safety initiatives have been recognized by the Occupational Health and Safety Administration's Voluntary Protection Program (VPP) for achieving injury and illness rates more than 50% below industry average.[5]

Pioneer has developed a business case to support their health and safety initiatives by collecting data to demonstrate the relationship between regular physical activity and employee health-care claims, prescription drug use, health risk trends, disability, and workers' compensation injury costs. Sources of data include health screenings and biometric data; fitness center participation and satisfaction data; health-care claims; preventive screening utilization; disease management outcomes; human resource metrics; and workers' compensation and safety metrics, including workers' compensation claims and costs, lost workdays, reportable injuries and accidents, and short-term and long-term disability cases and costs.[6]

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Pitney Bowes, Inc.

Best known in its earliest days as a postage meter company, Pitney Bowes, Inc. has expanded its services during the past 87 years to provide a comprehensive suite of mailstream hardware, software, services, and solutions. Pitney Bowes serves more than 2 million businesses in over 130 countries by managing the flow of their mail, packages, and documents to improve communication. Headquartered in Stamford, Connecticut, Pitney Bowes employs 35,000 individuals worldwide, with 25,000 located in the United States, and has $5.7 billion annual revenue.[1,2] Introduced in the 1950's, Pitney Bowes was one of the first companies in the United States to establish a wellness initiative for its employees.[3]

In response to an analysis of 1991 medical expenditures projecting that, if action was not taken, health-care costs would exceed corporate profits by the year 2000, Pitney Bowes launched an integrated health-care strategy, Health Care University (HCU), under its Medical/Wellness program umbrella to optimize health and productivity among employees. HCU, piloted in 1993 with approximately 5,000 Pitney Bowes employees, was developed to bridge the gap from past benefits practices to a more integrated, multi-dimensional health-care management approach. Health Care University hinges on three cornerstones: (1) educating health-care consumers; (2) increasing consumer efficiency in utilization and purchasing practices; and (3) providing the employer with internal and external support for program design. The program's predominate goals included a 0% cost increase through 1997; measuring program impact; enhancing benefits and health outcomes; and rewarding healthy behaviors. These goals have been addressed through a focus on demand management, disability management, and disease management/prevention.[4]

Health Care University program components include: onsite medical and fitness facilities; health screenings and vaccinations; educational seminars on various health issues; ergonomic evaluations; an EAP; self-care education; and nutrition counseling. In 1996, Pitney Bowes received the C. Everett Koop National Health Award for its promotion of employee health. As the Koop Web site describes in its evaluation of the award-winning worksite program, Health Care University is offered onsite to maximize employee convenience, and provides incentives for employee participation in the form of credits, with those earning 6 credits over the course of a year receiving $25 towards a future benefit purchase. Analyses of the impact of Health Care University revealed an estimated net cost savings of $158 per participant per year, with overall improvements in health status, absenteeism, and productivity.[5]

Based on the initial results of Health Care University implementation, Pitney Bowes launched an expanded version of its wellness initiative in 1994, the "Power of 2—Pitney Bowes and You." With similar goals to the piloted Health Care University program described above, "Power of 2" focuses specifically on the effects of employer/employee dynamics on health and well-being. The four main elements of the program are (1) onsite medical service access/integration, (2) disease management, (3) disability management, and (4) Health Care University.

After evaluating the impact of its onsite medical services on health-care costs and health outcomes, Pitney Bowes made onsite medical clinics participating partners of their health-care network in 1998. They also added certain medical specialties (e.g., dermatology) to their current offerings and began providing disease management through their clinics, including a newly designed diabetes management program for employees, dependents, and retirees. Pitney Bowes' Disability Assistance Department, with a focus on early intervention and the "whole person," administered short- and long-term disability and workers' compensation plans. Analysis of the "Power of 2" initiative revealed that participation in the program improved employees' health risk profiles, reduced cardiovascular costs, and increased cancer screening awareness. Use of the onsite medical clinics lowered health-care costs, absenteeism, and disability leave. For example, compared with men aged 35–49 with no chronic disease who used community-based services exclusively as their primary care providers, men who used the onsite clinics exclusively as their primary care providers had 33% lower health-care charges,

utilized fewer and less expensive laboratory tests and prescription medicines, and had half as many nondisability related absences.[6]

The Diabetes Management program, meanwhile, improved screening outcomes and realized self-reported behavior changes related to diabetes and other health issues (e.g., diet, exercise). In the span of two years, the Disability Management program reduced the duration (by 16 days) and cost (by 14%) of conditions most likely to result in disability leave, and indicated the need for a better maternity management model, which was then implemented. Overall, the "Power of 2" demonstrated an estimated $371 adjusted annual difference between participants and nonparticipants, reflecting a 4.2 to 1 cost savings for the program. In 1998, Pitney Bowes was again awarded the C. Everett Koop Award, this time for the "Power of 2" program.[7]

Pitney Bowes has received a number of other awards for its health improvement programs, including the 2002 IHPM Corporate Health & Productivity Award. Pitney Bowes continues to assess and modify its existing programs and create new programs as employer/employee needs and technologies evolve. For example, when results of the 2002–2003 Health Risk Appraisal completed by Pitney Bowes employees indicated that employees were generally overweight, had poor diets, and were physically inactive, Pitney Bowes partnered with CHD Meridian Healthcare to develop and implement a new health improvement program, "Count Your Way to Health," a Web-based health awareness and health promotion tool introduced in 2006 as part of Health Care University. The program asks employees to answer questions three times per year regarding tobacco use, diet, body mass index, physical activity level, and seatbelt and helmet use. As with many of Health Care University's programs, employees showing improvements in these domains earn credits towards their benefits program.[8,9] "Count Your Way to Health" appears to be a step toward integrating Pitney Bowes' health promotion initiative with elements of their occupational safety, health, and loss prevention efforts (e.g., accident prevention conferences, manufacturing ergonomics, back injury prevention, stretching breaks, etc.).[10] Currently, the company also faces the challenge of extending its health improvement program to the 14,000 Pitney Bowes employees in the United States who do not work at a Pitney Bowes site, many of whom may be at particularly high-risk.[11]

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Procter & Gamble

Procter & Gamble (P&G), a Cincinnati, Ohio-based company with more than 130,000 employees, manufactures more than 300 household consumer products ranging from laundry and dishwashing soaps to small appliances to cosmetics. When Leslie M. Yee became the corporate medical director in April 1994, he came up with five new company-wide medical priorities, two relating directly to employee health. The first aims to protect employees by ensuring all illnesses or accidents are treated in a timely manner, while the second seeks to improve overall employee health and performance.[1]

P&G employees have had access to the Health Check worksite wellness program for more than 15 years. Program participation includes the completion of a health profile questionnaire (HPQ), administered by Johnson & Johnson Health Care Systems, which asks employees about their medical history, exercise and nutrition routines, use of alcohol and cigarettes, and general well-being. The HPQ also serves as a biometric evaluation, documenting weight, height, blood pressure, and other measures of general health. Analysis of the HPQ provides employees with individualized reports to alert workers to the specific health risks they face. The company provides one-on-one counseling for program participants to learn how to better manage their health and how lifestyle behavior modifications can positively reduce their health risks. After completing the HPQ, employees are offered further health promotion services through onsite fitness and aerobic programs both during and after work, weight management programs, smoking cessation assistance, annual mammography and other health screenings, and educations materials regarding numerous health categories. Participation in many of these programs is encouraged through incentives.[2]

A 1998 study of the impact of Health Check on the Cincinnati P&G employee population found that the health-care costs of program participants were 29% lower than that of nonparticipants. This study also found that health-care costs declined through the duration of the study, with the majority of reductions becoming evident in year 3 of participation.[3]

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Texas Instruments

Headquartered in Dallas, Texas, Texas Instruments (TI) provides digital signal processing and analog technologies that help businesses communicate. In addition to their focus on semiconductor solutions for wireless and broadband access, TI is also a provider of educational technology. With approximately 31,000 employees located in more than 25 countries around the world, the 75-year-old company reports 2006 annual revenues reaching $14.3 billion.[1]

As part of their corporate social responsibility initiative, TI has developed programs targeted at both environmental health and safety and at employee health and well-being. Texas Instruments' Environmental, Safety, and Health Excellence Programs have established long-term goals of "zero wasted resources, zero injuries and zero illnesses." To achieve the first objective, TI has developed programs focusing on recycling, clean air, energy and water conservation, and reducing lead and other hazardous materials. The second and third objectives prompted the 2001 launch of TI's ergonomics program, including evaluations and facilities improvements, for which *Occupational Hazards* magazine recognized TI as a "Safest Workplace in America." TI reports holding the top ranking in the industry in 2004 for having the fewest injury/illness cases and the lowest lost/restricted day case rate.

TI's wellness programs, offered through its "Live Healthy Wellness Program," are available to employees and their dependents. Launched in 2005 in North Texas, program components include nutrition counseling from registered dieticians; healthy vending machine and cafeteria options; onsite walking clubs ("Walk This Way"); fitness centers ("Texins Activity Centers"); weight management ("Live for Life"); preventive screenings and immunizations; an EAP; safety courses, training, and workplace protective equipment; and tobacco cessation materials and encouragement. TI's weight management and walking programs are offered through Health Fitness Corp, the vendor who also manages their fitness centers. TI also has partnerships with vending and cafeteria suppliers and the Occupational Health Nurse Consultant. In addition to its Health Lifestyles programs, TI offers a Live Healthy Program, an online assessment tool and wellness program, "LiveHealthyAtTI.com," that identifies potential health risks and offers suggestions for modifications.[2,3,4,5] Onsite registered nurses provide information and assistance with disease and disability management, occupational health management, and healthy lifestyles. Employees may choose from several types of health plans (e.g., HMO, PPO) that cover many of the wellness programs, and they can participate in a "Build Your Own" option to tailor their PPO to their individual needs.[6]

TI has received a number of awards and recognitions for its health and safety programs. For example, TI earned the 1998 C. Everett Koop National Health Award for excellence in health risk reduction and cost reduction programs for its Health Excellence—Personal Health Management initiative.[7] More recently, TI was awarded the *Dallas Business Journal's* 2005 Healthcare Heroes Award and also earned the 2005 and 2006 National Business Group on Health's Institute on The Costs and Health Effects of Obesity Award for Best Employers for Healthy Lifestyles.[8]

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UAW-General Motors

General Motors (GM) is a global leader in the automobile industry. The GM Web site claims that it is currently the world's largest automobile maker, and that it has been the global sales leader for 76 years. Headquartered in Detroit, Michigan, 9.1 million GM branded cars were sold in 2006, with the company employing around 284,000 people worldwide.[1] The International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW) is a union comprising employees from multinational corporations, small businesses, local and state governments, and colleges and universities. Its membership totals 1,140,000 active and retired members, and is also headquartered in Detroit.[2] According to a 2005 press release discussing the renewed partnership between GM and UAW, their combined health promotion efforts affect more than 750,000 GM employees, dependents, and retirees.[3]

According to their Web site, "Health and safety at work—and at home—is a number one UAW-GM priority."[4] Since 1996, UAW-GM has operated a worksite health promotion program called LifeSteps, which enrolls both active and retired employees and dependents. The core program includes a Health Risk Appraisal (HRA), the LifeSteps Personal Health Advisor®, the quarterly newsletter, feelin' good, and a health book with relevant topics and information on typical complaints or conditions. The LifeSteps Personal Health Advisor is a telephone hotline where nurses provide callers with guidance based on their medical records, and can also provide counseling as needed on conditions and treatment. In addition, callers can access a tape recorded repository of information on about 400 health conditions.[5]

On the LifeSteps Web site, employees can gain access to the HRA; a dashboard that provides participants with the latest health news tailored specifically to their needs; a "fitness manager" that helps participants track and maintain exercise regimens; and personalized advice that includes information about potential prescription interactions.[6] The LifeSteps Web site also has a tab for employee safety—encompassing home, work, travel, holiday, children, and first aid. The workplace safety section has articles on several conditions, such as occupational asthma, depression in women, and lower back pain. These articles provide links to other articles on the LifeSteps Web site regarding workplace safety and external information sources.[7] UAW-GM has teamed with GlobalFit, a national network provider of employee fitness benefits, to increase the content of the LifeSteps program. GlobalFit offers UAW-GM employees up to a 60% discounts on noncontractual fitness club memberships with lenient cancellation policies and options to freeze or hold membership.[8]

In terms of safety, the UAW-GM Center for Human Resources provides information on ergonomics, fall hazards, safety training, and documentation forms. In the ergonomics section of the Web site, employees have the opportunity to be candid about their working environment and fill out a Cumulative Trauma Disorders survey. Information garnered from completed surveys can lead to changes in the workplace.[9] In addition, the GM Web site claims that the program had led to an increase in machine safety and decrease risk of machine-related injuries to employees.[10]

According to the GM Web site, one of their safety programs, called "Safe Driving," aims to educate and promote safe driving both onsite and in the community. The company boasts that the program has had a dramatic impact on increasing national seat belt usage in 2005 to 82%.[11]

UAW-GM was a 2004 C. Everett Koop Award Winner for the LifeSteps Health Promotion program. The University of Michigan Health Management Research Center partnered with UAW-GM, acting as a third-party evaluator of the LifeSteps program. According to the C. Everett Koop Award Web site, after 5 years LifeSteps had an overall risk reduction of 13.4%, with a 3.7 to one savings-to-cost ratio in the United States. There were approximately 356,833 participants in the study, marking a 34% participation rate among the UAW-GM population. Participants showed the highest risk reduction through increased seat belt use (50%), followed by stress reduction (20.9%). The review also found that UAW-GM realized a savings of $97

per participant, and a disability reduction cost of $240 per participant per year.[12]

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Union Pacific Railroad

Union Pacific Railroad is the largest railroad in North America, with approximately 33,000 route miles operating in 23 states across the western two-thirds of the U.S. Union Pacific employs in excess of 48,000 workers to serve the organization's mission of providing freight transportation services.[1]

Union Pacific Railroad is a multi-winner of the C. Everett Koop National Health Award (1994, 1997, 2001, 2005), because of their leading health management programs and initiatives, which are considered "best practices" within industry. The organization has also been recognized with numerous other accolades, including the Well Workplace Gold and Platinum Level Awards and the Corporate Health and Productivity Management Award. Additional recognitions include the Corporate Health Achievement Award provided by the American College of Occupational and Environmental Medicine (ACOEM), Innovation in Prevention by the U.S. Department of Health and Human Services, and the Best Employers for Healthy Lifestyles Platinum Award by the National Business Group on Health.[2] Union Pacific states that the key to their success has been through increasing participation in its health, safety, and productivity initiatives; by removing barriers; garnering senior management support; and persuading local management to promote health initiatives.[3]

Health promotion activities have continually evolved at Union Pacific and the organization strives to improve workplace health promotion and safety programs on a continual basis. The organization indicates that they aspire to be the healthiest company in America.[4] Within Union Pacific's initiatives, the focus has been on integrating safety and health promotion. Safety is a critical component of Union Pacific's operations and significant importance is placed on workplace safety and injury prevention. Union Pacific was able to evaluate safety and health data to determine that health status, tobacco use, stress and weight were predictive of safety incidents.[5] This process established the foundation for collaboration between workplace health promotion and safety.

Health promotion activities within Union Pacific date back to 1987, when the CEO of the organization gave the directive to build a fitness center at the corporate headquarters.[6] Since that time, the organization's initiatives have moved quickly and progressed to include integrated programs focused on workplace health promotion and injury prevention. Initiatives have included programs such as Project HealthTrack; an alcohol awareness program entitled By the Numbers: 0-1-2-4; the Alertness Management Program, with a focus on fatigue management; Butt Out and Breathe, a smoking cessation program; TED, which is the training and education program for diabetes; and RDN, Reduce Diabetes Now.[7]

Union Pacific targets all aspects of employee lifestyle to decrease worksite injury, increase employee presenteeism, and promote overall worker health. To specifically target increased on-the-job safety, employees participate in quality safety meetings, where safety captains present information on proper safety techniques and procedures, as well as lead discussions on how exercise and nutrition can lessen the chances of injury. In conjunction with quality safety meetings, occupational health nurses are available at all field locations to provide health-related examinations, respond to onsite injury, and assist employees in reaching annual health care and nutrition goals.[8]

Through Project HealthTrack, Union Pacific emphasizes how improved employee health can benefit on-the-job productivity and safety. Smoking cessation has been greatly encouraged with more restrictive smoking policies, with the company providing Zyban and other nicotine suppressants free-of-charge to all employees, and by making it company policy to only employ nonsmokers in regions where it is legal to do so. To increase safety for both consumers and employees, Union Pacific offers telephone counseling and educational materials to reduce depression and insomnia rates for workers, both of which have been cited as causes of workplace accidents. Similarly, the Health Index, a measure of employee health and safety, encourages

work units to promote their own health and the health of their co-workers.[9]

Physical fitness and nutritional awareness is heavily emphasized for all Union Pacific employees, as everyone is provided with a gym membership free-of-charge. Employees in the Omaha headquarters building are offered access to the health and fitness center, a 20,000 square foot exercise facility that features areas for weight training, stretching, group exercise, training rooms for fitness and health consultations, and a library featuring books and videos on health promotion. For those not employed in the Omaha region, there are more than 575 facilities nationwide that Union Pacific employees can access free-of-charge through a partnership with System Health Facility. In addition, efforts have been made to equip rail cars with fitness equipment to increase participation rates and remove barriers to access.[10]

The dedication to promoting nutrition is evidenced in choices provided at the corporate dining center, modified recipes to reduce calories and fat, nutrition labeling, and with vending, as the organization provides a minimum of 30% healthy options in its vending machines. The combination of preventive education and emphasis on improved fitness and nutrition have culminated in a 15% reduction in reported workplace injuries and a 21% reduction in lost workdays in 2004.[11]

A consumer-driven health-care plan (CDHP) with a reimbursement account is available to employees, which provides incentives to workers participating in health promotion activities. Rewards include $100 for completing a wellness assessment and $100 if an employee either remains a nonsmoker or successfully participates in one of the many smoking cessation programs offered by Union Pacific. Similarly, 100% of the costs related to preventive care are financed by the company, and employees can utilize a 24-hour nurse hotline, the healthy baby program, multiple disease management programs, and receive care through a transplant management center at no cost.[12]

Union Pacific will continue to evolve their workplace health promotion and safety programs to meet the changing needs of employees. The organization is at the beginning stage of a team-based intervention focused on reducing worker depression with hopes to improve worker health and to prevent worker injury. In the near future, the organization plans to further enhance their nutrition programs by requiring a minimum of 50% of all food products available on company property or at Union Pacific events be low calorie or reduced fat options.[13]

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USAA

USAA is a financial services company geared towards providing financial planning resources; home, life, and health insurance; and investment and banking services to active and retired members of the U.S. armed forces and their families. Headquartered in San Antonio, Texas, USAA employs approximately 22,000 people in six U.S. locations.

The Take Care of your Health© employee wellness program was first launched at USAA in 2003. Since its introduction, more than 14,800 employees have participated by completing wellness assessments, attending health-focused discussion forums, and having preventive health exams.[1] After only 2 years of program implementation, overall employee participation has increased to 68.5%.[2] While active employees are the primary target for the wellness program, many of Take Care of your Health© services are also made available to the spouses and children of workers.[3] The success of USAA's program is already evident—they received the 2005 California Fit Business Award and given the 2006 C. Everett Koop National Health Award.

USAA's risk-based prevention wellness program has three main foci:

- Workplace Intervention—Designed to address worker safety through Worker's Compensation, leave, and disability management.
- Population Intervention—Centered on creating a corporate wellness culture by promoting exercise, healthy eating, preventive care exams, and smoking cessation.
- Individual Intervention—Targeted to improve the health of high-risk/high-cost employees through wellness counseling and improved disease and prescription management.[4]

For USAA, the majority of worksite injury is caused by repetitive motion. To confront this, USAA has developed an onsite Intranet Web site, the Ergonomic Information Page, where employees answer surveys about their workstation and are later paired with a specialist who will instruct them on how to reduce the potential of future injury.[5]

To construct a wellness culture for USAA employees, the company offers onsite fitness centers at all six locations, as well as cafeterias with healthier options that are priced lower than their traditional counterparts.[6] To further encourage employees to utilize the fitness centers, workers are offered membership at a 50% reduced rate if they visit more than twice per week. Similarly, in an effort to curb smoking, employees are offered smoking cessation drugs free of charge, and all campuses maintain a smoke-free policy. To promote the use of preventive services, all medical plan participants have up to $350 per year to spend toward such care and other wellness-related costs.[7]

The financial impact of program participation has already been demonstrated to USAA: statistically significant increases in worksite productivity are observable and the decrease in employee absences is projected to save more than $105 million over the next three years.[8] In the future, USAA plans to increase the wellness program's focus on improving the health of workers categorized as high-risk by the annual health assessment, as this small group accumulates a disproportionate share of overall health-care costs each year.[9]

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The Economics of Integrating Injury and Illness Prevention and Health Promotion Programs

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Preface

This paper provides an economic analysis of the potential gains to taking an integrated approach to promoting health and safety in the workplace. The goal of the paper is to highlight the fact that many adverse health conditions have contributing factors that are occupational and some that are nonoccupational, and sometimes they can work together to exacerbate the likelihood of a bad outcome. The example used most in the paper is the combination of smoking and exposure to toxic or hazardous materials in the workplace. We tend to think of the former as nonoccupational and the latter as occupational, in the sense that exposure is governed chiefly by the decisions of workers or employers, respectively. But the existing evidence, including some presented in this paper, suggests that while either smoking or being exposed to hazardous materials at work on its own is bad for your health the combined effect is worse. We demonstrate that in the face of such health risks, the optimal investment in worker health will only be attained with an integrated approach that internalizes all the benefits to both parties.

In the paper we discuss the policy implications of these findings, which argue in favor of integrating occupational injury and illness programs with health promotion programs to have the biggest and most cost-effective impact on worker health. At the time of its original writing we argued that the chief motivating factor for this approach was the escalating cost of health care in the United States and the desire to find cost-effective methods of curtailing it, including the promotion of individual health. Since then, this issue has become even more pressing. First, the cost of health care has continued to grow since 2005. Current estimates suggest that by 2020 health care will account for approximately one-fifth of U.S. gross domestic product.[1] Second, the recent adoption of the Patient Protection and Affordable Care Act (PPACA) has introduced a number of profound changes that have the potential to dramatically reshape the U.S. health-care system.

As the health-care system evolves in the face of these reforms, so too do the potential benefits and challenges of integrating injury and illness prevention and health promotion. Although the ultimate fate of the individual insurance mandate in PPACA is unclear at the time of this writing—given that it is currently under review in the courts—if implemented in its present form it will significantly increase health insurance coverage in the general population. However, there is uncertainty about how much of that increase will come from the employer-provided coverage as opposed to an expansion in public coverage. If employer-provided coverage expands, this could increase the incentives of employers to invest in health promotion. But there is concern that the effect of PPACA will actually be to crowd out private insurance and result in an overall decline in employer-provided coverage. This will reduce the incentives of employers to promote worker health, and it will make it more difficult to coordinate health promotion with injury and illness prevention.

If employers lack incentives to invest in health promotion, it could exacerbate the externality problem described in the paper. That is, if more workers are covered by government-provided health insurance, then any lack of efficiency that results from a failure to integrate health promotion and injury and illness prevention will accrue to taxpayers rather than employers. This would mean that it would be insufficient to simply demonstrate the cost-effectiveness of an integrated approach and make a business case for

1 See Keehan, S. P., A. M. Sisko, et al. (2011). "National Health Spending Projections Through 2020: Economic Recovery And Reform Drive Faster Spending Growth." *Health Affairs* 30(8): 1594.

employers to adopt. Rather, some kind of public policy intervention would likely be required in order for integration to be successful.

Another trend that has arisen in recent years that could impact the integration of efforts to promote worker health is an increasing willingness of employers to directly reward workers for healthy behavior and penalize them for unhealthy behavior.[2] This is essentially a more direct form of influencing worker behavior and more closely mimics the contracting between employers and workers that we note could lead to the optimal investment in healthy behavior. But the optimal level of any such penalties will be determined in part by whether or not there are any spillover effects between occupational and nonoccupational health activities. That is, our results suggest that the optimal reward for quitting smoking would be higher for workers who were regularly exposed to hazardous materials at work. This would be true of any public program that was introduced to try to use financial incentives to directly influence health behavior by individuals.

We hope that the model presented in this paper provides a useful framework for combining empirical and theoretical analysis to evaluate the costs and benefits of integrating health promotion and injury and illness prevention programs. And while the potential benefits and challenges to integration change as the institutional environment of health care in the United States changes, we believe that the fundamental principles remain sound, and the model can be extended to represent whatever institutional framework emerges. Future work should endeavor to determine which combinations of health conditions represent the best targets for integration and exactly what form that integration should take to promote the optimal investment in worker health.

2 For example, see: http://www.forbes.com/2008/01/11/obesity-workplace-cdc-ent-hr-cx_kw_0110whartonobesity.html?partner=email or http://www.cleveland.com/nation/index.ssf/2009/10/health_surcharge_north_carolin.html (both accessed August 10, 2011).

Abstract

There is a growing interest in coordinating employer programs to promote health and reduce occupational injuries and illnesses. While efforts to study the effectiveness of both types of programs separately are methodologically challenging, most studies suggest that health promotion and injury and illness prevention activities can reduce the frequency and severity of negative health outcomes for workers. There is little evidence, however, on whether or not the effectiveness of interventions are enhanced by combining the two types of programs into a single all-encompassing effort by employers to improve worker health. This paper uses an economic model to explore whether or not a coordinated effort by employers would lead to superior health outcomes for workers. The model suggests that improved outcomes can result if there are "spillovers" from nonoccupational and occupational risk factors. In other words, if factors that influence individual health at home and work combine to influence health in a synergistic fashion, then there will be a gain to coordinating health promotion and injury and illness prevention programs. Using data from the Health and Retirement Study (HRS), we search for evidence of health spillovers for two important risk factors that are generally thought to jointly contribute to negative health consequences: smoking and exposure to harmful substances at work (e.g., asbestos). We confirm past evidence that these two factors do combine to worsen health outcomes beyond what would occur if individuals were exposed to either in isolation, but the evidence also suggests that other, unobserved factors likely contribute to the estimated spillovers.

Introduction

Rising health-care costs in recent years have intensified the interest of employers in promoting a healthy workforce. Data from the Bureau of Labor Statistics (BLS) show that in 2001, employer-provided health insurance, short and long-term disability programs, and workers' compensation at private industries in the United States combined to total almost $294 billion.[3] These costs have led employers to take steps to attempt to reduce adverse health outcomes both in and out of the workplace. Programs that are designed to reduce the onset of illnesses and injuries at work are generally referred to as *injury and illness prevention* programs, while programs targeting nonoccupational health conditions are known as *health promotion* programs. While a substantial amount of research has focused on evaluating the effectiveness of these programs in isolation, there has been too little attention given to the potential benefits from coordinating them.

Traditionally, there has been only modest overlap between research in the areas of occupational and nonoccupational health. The strong distinction between the two has been driven at least partly by their differing compensation mechanisms; individuals with occupational health conditions are usually eligible for workers' compensation benefits, whereas those with nonoccupational conditions are not. Workers' compensation is mandated in almost every state, and it provides income as well as medical benefits. Employers have covered health care and compensation for lost income for nonoccupational conditions optionally, without integration with workers' compensation. In practice, the distinction has been so strong that it has even helped spawn the subcategory of medicine referred to as occupational medicine.

Despite the historical reluctance to consider the two issues jointly, the changing nature of work and the workplace environment in the United States has begun to erode the justifications for keeping them separate. Over time, the prevalence of acute traumatic workplace injuries, most notably workplace fatalities, has fallen (Loomis, Bena and Bailer, 2003), leading to an increased focus on work-related chronic conditions, such as low back pain. It is considerably more difficult to determine the workplace causality of chronic conditions, which has helped to blur the distinction between occupational and nonoccupational injuries. In addition, the increasing use of off-site contractors and telecommuting also complicates the ability to pinpoint the work-relatedness of any given health condition (Smith, 2003).

As the distinction between occupational and nonoccupational health fades, it becomes natural to think about the impact of workplace and employer interventions on *all* health conditions, and to think about the impact on employer costs for all mandated or employer-sponsored health programs. In particular, it raises the question of whether or not the integration of injury and illness prevention and health promotion programs will lead to improved

3 This figure is based on the authors' calculations using data from the U.S. Department of Labor, Bureau of Labor Statistics (BLS), Employer Costs for Employee Compensation. See www.bls.gov for more information. The BLS reports these individual cost components as hourly rates. We estimated the total cost by computing the total hourly cost, and then multiplying by the total number of work-hours (assuming individuals work 50 weeks a year).

outcomes for workers and employers. In this paper we analyze the relationship between health promotion and injury and illness prevention using an economic framework. In particular, we discuss the concept of synergies, or "spillovers," between efforts to reduce health risks for both occupational and nonoccupational conditions.

Our paper also discusses how the relationship between occupational and nonoccupational health risks, and the impact of efforts to curb them, could be measured empirically. We use the HRS to provide a simple example of some evidence on the relationships between occupational and nonoccupational health risks. We focus in particular on the combined impact of smoking and exposure to harmful chemicals or substances at the workplace on the onset of an adverse health condition. This analysis allows us to document the extent to which we observe health-related spillovers for two important public health concerns that are generally thought to contribute to each other's negative health consequences.

We proceed as follows. In Section 2, we discuss past work on the impact of injury and illness prevention and health promotion programs. In Section 3, we model the conceptual relationship between health promotion and injury and illness prevention programs. Our discussion draws distinctions between the potential individual and combined impacts of interventions targeting health "inputs" (i.e., risk factors) on health outcomes (e.g., the onset of disease or disability), as well as the potential impact on program costs. Section 4 describes our empirical analysis. Finally, we conclude with a discussion of the implications of our paper for future research on injury and illness prevention and health promotion.

What Do We Know About Injury and Illness Prevention and Health Promotion Programs?

In this section we briefly review the empirical literature on the effectiveness of health promotion and injury and illness prevention activities. If these programs are not able to improve health outcomes in isolation, it is doubtful that there will be any substantial gains to coordination. There has been a substantial amount of work dedicated to both areas, with several thorough reviews of the literature. Rather than duplicate this work, we simply highlight some of the broad themes, and direct the interested reader to these reviews for further study.

Health promotion programs usually target personal health habits, or activities taken by individuals that impact their health. Aldana (2001) categorizes the major health risks that have been studied in the literature into 10 primary categories: tobacco use, body mass index (BMI) and obesity, cholesterol, hypertension, stress, diet, alcohol abuse, seat belt use, fitness or physical activity, and multiple risk factors.[4] These are similar to the set of risks studied in Anderson et al. (2000), who found that modifiable risks accounted for 25% of total expenditures for health care (although what they find is the most costly factor, stress, is not considered in the studies reviewed by Aldana). Some of these risks are direct measures of health habits, while others are probably best thought of as proxies for the actual habits of interest. For example, tobacco use is a direct measure of smoking behavior, but obesity is probably better thought of as a measure of some combination of caloric intake and physical activity (and in some cases genetics).

Health promotion programs attempt to induce workers to modify these behaviors to reduce the onset of negative health consequences. There are many interventions that might be part in a health promotion program. Employers might try to educate workers on the dangers of smoking. They might remove vending machines in an effort to improve workers' nutritional habits. Regardless of the type of intervention used in a health promotion program, ultimately the decision is up to workers; employers can typically only influence health habits by altering workers' incentives.

In contrast, most injury and illness prevention programs involve a more direct intervention by employers. Instead of convincing workers to modify risky behavior, employers usually modify the workplace environment to directly reduce the risk of injury. Zwerling et al. (1997) describe four major categories of interventions: engineering, administrative, personal and multiple interventions. Engineering interventions represent changes to the physical environment in which individuals work in an attempt to reduce the risk of negative health outcomes. Administrative interventions involve modifications to employer-mandated policies or procedures that may have an impact on workplace safety. Personal interventions attempt to reduce adverse health outcomes for workers with education and training, and are the most similar to health promotion activities.

4 Aldana does not specifically include studies about tobacco use in his review, though he does acknowledge it as an important risk factor.

The final category, multiple interventions, deals with programs that try any combination of these approaches.

The scientific literature on health promotion and injury and illness prevention programs typically attempts to measure the effectiveness of programs by measuring their impact on some health outcome, such as the onset of a particular disease or injury, or some cost measure, such as medical care expenditures. These latter measures are important because they speak to the cost-effectiveness of the programs, that is, the extent to which the value of any improvement in outcomes resulting from the program exceeds the cost of implementing it. Given that employers bear the cost of these programs, this raises an important question: What are the benefits to employers of investing in worker health?

One explanation for the prevalence of employer efforts to promote health could be that employers are altruistic, and they care about the well-being of their workers. Another is that they are required to do so, through government regulations such as the Occupational Safety and Health Act. Additionally, there is a more traditional economic argument suggesting that some positive level of investment in worker health is profit maximizing for employers. The impact of occupational injuries and illnesses for employer costs is fairly straightforward, as employers are liable for medical and indemnity costs through workers' compensation. Leigh et al. (1997) estimate an annual direct cost to employers of approximately $65 billion for occupational injuries and illnesses. With regard to nonoccupational health conditions, the most obvious explanation for the prevalence of health promotion programs is the widespread existence of employer-provided health insurance. Rising medical costs for workers contribute substantially to employer costs, raising the incentives of employers to encourage preventative measures by workers.[5]

In addition to the direct financial incentives from higher labor costs, poor health could also have a negative effect on the productivity of workers. For example, Stewart et al. (2003) estimated that common pain conditions were responsible for reduced performance, costing employers $61.2 billion per year. Likewise, Berger et al. (2003) estimate that 5 to 10 percent of the "effective" workforce is lost because of health problems. If poor health makes workers less productive, and if employers are unable to replace unhealthy workers with healthy ones at no cost (or unhealthy trained workers with healthy untrained workers), then employers will also obtain some benefit from reducing poor health among workers. In an attempt to account for these indirect benefits, some studies of health promotion programs also evaluate the impact on employee absenteeism (Aldana, 2001). Nevertheless, evaluations of health interventions by employers rarely measure such costs as retraining and search costs.

In general, the literature tends to find that both injury and illness prevention and health promotion programs are able to reduce health risks and improve outcomes for individuals. The four studies cited by Aldana (2001) that use randomized study designs, Fries et al. (1993), Leigh et al. (1998), Fries et al. (1994) and Bly et al. (1986), all report significant decreases in the utilization of health care for those treated with health promotion interventions. All but Bly et al. (1986) report a reduction in medical costs among the treated group. Many studies using nonexperimental or quasiexperimental designs also report significant reduction in health expenditures. However, most studies place little emphasis on the actual cost effectiveness of the programs. The studies are limited both in the measures of cost, and in the measures of benefits to employers and even to workers. Additionally, the literature suffers from too little focus on the representativeness of the study populations being considered and the long-term impact on outcomes for employers and workers (Bull et al., 2003).

Similar results, and problems, exist for the literature on injury and illness prevention programs. Zwerling et al. (1997) list a number of studies that report improved injury and illness outcomes resulting

5 An important question here is whether these costs are ultimately passed on to workers, in the form of lower wages. For example, Krueger and Burton (1990) and Gruber and Krueger (1991) find that costs from workers compensation are mostly offset by lower wages. If these costs are perfectly passed on to workers, it should reduce the financial incentives for health promotion and injury prevention activities by employers.

from different forms of interventions. However, the overall literature on injury and illness prevention appears rather limited, with relatively few scientifically designed studies (c.f., Dannenberg and Fowler, 1998; Hulshof et al., 1999). Thus, while work does exist documenting positive effects of injury and illness prevention programs, far more work is needed to establish the cost effectiveness of such programs.

Given some of the difficulties in establishing the effectiveness of health promotion and injury and illness prevention programs in isolation, it is perhaps unsurprising that there exists little work considering the two together. Economists have begun to consider the question of how both occupational and nonoccupational factors combine to influence health more broadly, however. In the remainder of this paper, we discuss how the application of theoretical and empirical economic tools can contribute to our understanding of the cost effectiveness of health promotion and injury and illness prevention activities.

A Model of Occupational and Nonoccupational Injury and Illness Prevention

In this section, we describe an economic model of how health promotion and injury and illness prevention may jointly affect health. This allows us to formalize the conditions under which the coordination of health promotion and injury and illness prevention programs will improve outcomes for employers and workers. The technical details of the model and the derivation of the results are presented in the appendix, and here we simply describe the analysis and provide the intuition behind the results.

As is the case with any model, it is necessary to simplify our analysis and consider only a few broad concepts. With respect to outcomes, we focus our discussion on health shocks to individuals. In occupational terms, these could be the onset of a workplace injury or illness, which could be fatal or nonfatal.[6] A nonoccupational health shock could represent a fatal injury or illness, or the onset of some morbidity or work disability. For our purposes, the only relevant distinction between occupational and nonoccupational is in describing the risk factors, not in describing the actual health outcomes.

In terms of inputs to individual health, we simplify the analysis by separating nonoccupational inputs by individuals from occupational inputs by employers. In other words, we assume that individuals can only directly affect their own health through their actions away from work, while employers only directly affect worker health through the workplace environment. This is clearly an abstraction; as we stated earlier, it is becoming increasingly difficult to distinguish individual behavior at and away from work. Nevertheless, this formulation allows us to consider how both home and workplace conditions combine to influence individual health.

The standard economic model for studying how health evolves over an individual's life is due to Grossman (1972), and it formulates health as an investment good. Two recent economic applications have adapted the health investment model to incorporate the relationship between health and work. Case and Deaton (2003) studied how "backbreaking" work in low-income jobs impacts the rate of health depreciation over time. Lakdawalla and Philipson (2004) focus on how the level of physical activity at work affects one important aspect of health—weight. Although both of these studies, and the Grossman model in general, emphasize a "smooth" lifetime model of health, our focus is different. We focus on how individual health habits and the work environment combine to affect what are essentially discrete shocks to health, in the form of the onset of a disabling injury or illness. For simplicity, we ignore direct investment in the *level* of health by individuals and focus only on individual and employer efforts to prevent or limit negative health shocks. In this specification, both individuals and employers can

6 While a chronic condition might take years to develop, we can think of the "health shock" as being the point at which the condition becomes disabling.

influence the likelihood of adverse health shocks, but neither is able to rule them out completely.

Perhaps the most important part of the model is specifying how individuals and employers choose to make decisions about the level of investment in health. First consider the case of individuals. Following standard economic practice, we assume that individuals are motivated to maximize a "utility function" that is increasing in both consumption of goods and health subject to a budget constraint. Thus, individuals are limited in the amount they can "spend" on investments in health.[7] Economic theory predicts that individuals will balance investment in their health with the cost in terms of consumption of other goods, based on how they perceive the value of each. As long as future health and utility are unambiguously increasing in current period investments to stave off future health shocks, economic theory holds that individuals will invest in their health until the expected marginal value of the increase in future utility equals its cost. In other words, individuals invest in protecting themselves until the gain in higher expected health is outweighed by the cost of more investment.

Now consider the decision of employers to invest in worker health. Again following standard economic practice, we assumed that employers are motivated to maximize profits for shareholders. This ignores other potential explanations for the existence of health promotion programs, such as employer altruism. In this sense, it is important to emphasize that we are searching for justifications of integrated health promotion and injury and illness prevention programs on the grounds of economic efficiency. We do not pretend that these are the only grounds for implementing such programs; they simply represent one aspect of the problem.

To study the incentives of employers to invest in worker health, we use a standard profit function in which profits are equal to revenue minus costs. In this model, labor costs include wages paid as well as the costs of investing in worker health. An important feature of the model is that profits are strictly increasing in health. As with the case of individuals, we assume that employers make current period investments that only affect future health shocks. We also assume that employers must choose some fraction of current period profits to devote to future reductions in health shocks and some fraction to give to shareholders. With all of these assumptions we obtain a result for employer investment that is analogous to the case of individuals. Employers will invest in health until the expected increase in next period surplus equals the marginal cost of investment.

The distinguishing feature of our model is that it incorporates formally a direct incentive for both individuals and employers to invest in the health of individuals. Past studies have tended more to focus on employer investments in occupational safety only through the demand for it by workers.[8] What we have not yet discussed is how the model can be useful for thinking about the benefits of *coordinating* employer and individual efforts to promote health. By focusing on simply employer investments in safety through the workplace environment, we have adhered to the traditional focus on occupational safety. But suppose that employers also had the ability to influence individual health habits through a health promotion program, or that the government impose regulations affecting the healthiness of the workplace on the behalf of workers. Would there be gains to such policies?

It is a straightforward matter to show that the primary gains from a health promotion program in this setting are to reduce the cost of *information asymmetries* between individuals and employers about investments in health. Information asymmetries can arise because individual investments in alleviating health shocks affect the welfare of shareholders (through its impact on productivity, for instance), but in most cases the employer cannot verify the exact level of investment taken by workers. For example, it is difficult for employers to monitor the nutritional habits of individual

7 For modeling purposes we represent the costs of individual investment with a fixed monetary price, though our results would be unchanged if we incorporated a more realistic specification in which the price of investment took the form of time or effort.

8 See, for example, Diamond (1977) or Rea (1981). Viscusi (1979) is, to our knowledge, the first to acknowledge that workplace injuries could lead to uncertain and reduced production for employers.

workers. Alternatively, information asymmetries can arise if individuals underestimate the effect of employer investments in health. If either party is imperfectly informed about the investments in health by the other, this will prevent them from optimally negotiating the level of investment in the contractual agreement.[9]

When either party maximizes investment without considering the impact on the other's welfare, it will lead to sub-optimal levels of investment in health. The intuition for this result, derived formally in the appendix, is that the total social value comes from jointly maximizing both the welfare of shareholders and the welfare of workers. If workers only invest in health promotion without considering the welfare of shareholders, while firms only invest in injury reduction without considering the utility of workers, inadequate investment will result.

In many ways, the Occupational Safety and Health Act can be seen as addressing one half of this problem. Suppose workers do not perceive the benefits of employer health investments; they will not demand high levels of safety from employers. If employers are not given the incentives to sufficiently consider the benefits of their investments in workplace safety for their employees, then they will provide too little safety. Thus, by regulating a higher level of occupational safety, presumably the optimal level, then regulatory interventions such as the Occupational Safety and Health Act can solve the problem of too little investment in safety by employers.

However, simply giving employers the incentives to invest more in workplace safety does not address the corresponding problem with worker health investments. Without further intervention, workers may not consider the potential gains to personal investment in health for employers, and hence will not invest the optimal amount in their own health. This is why health promotion programs are potentially important; employers may be able to use them to improve worker investments in health. Suppose we altered the model to give employers the ability to subsidize employee investments in health with a dollar transfer for every dollar invested by the worker. In such a scenario, employers would be willing to spend exactly up to the amount that generated the optimal level of personal investment in health.[10]

This discussion illustrates why employers may choose to adopt health promotion programs and why workers benefit from regulatory involvement in injury reduction (in both cases so that the gains to the other are considered when choosing their investment decision). However, it still leaves open the central question of this paper: whether or not there are gains to coordinating these interventions. In the model developed here, gains to coordination exist if there are *spillovers* between nonoccupational and occupational health investments in their effect on health.

Spillovers arise if nonoccupational heath investment makes investment in occupational health either more or less beneficial to employers (if, in the parlance of economics, the two are *complements* or *substitutes*, respectively). Spillovers in health investments create gains to coordinating health promotion and injury and illness prevention activities, because changes in the investment behavior of an individual will then lead to a different optimal level of investment by the employer. If these spillovers are not recognized, and individual and employer investment decisions are made independent of each other, we would not expect to obtain the optimal level of investment. This will be true even with well-designed interventions, if they are implemented separately.

There are a number of possible explanations as to why spillovers of this sort might exist. There may be

9 The problem of unobservable health and safety measures has long been recognized to cause problems in contractual arrangements with regards to both nonoccupational and occupational health. Arrow (1968) discusses the problem of unobservable personal health habits for health insurance. Diamond (1977) focuses on the issue of unobservable safety precautions by workers. Rea (1981) discusses the problems that arise when workers misperceive the impact of employer investments in health.

10 We note that the conclusion that there is underinvestment in health is by no means inconsistent with the observation that the United States pays too much for healthcare. The high amount spent on healthcare could indeed be a reflection of inappropriate investment in health promotion, as it may be more expensive to treat health conditions after they emerge than to invest in health activities and programs that prevent the problems from emerging. The investment in health that we are describing in this paper is of the activity and program flavor, rather than the treatment flavor.

physiological mechanisms that lead to a combined effect of occupational and nonoccupational risk factors that increase or lessen the impact of either on health. There could be psychological effects, whereby an effort to increase one's health in the workplace made them more committed to maintaining good habits at home. From an employer's perspective, there could be administrative effectiveness gains in terms of measuring outcomes or motivating participation. It is important to note, however, that the extent to which such spillovers exist could vary significantly among any of the important dimensions of the problem: namely, the specific types of health outcomes, risk factors, and interventions.

Estimating Spillovers in the Impact of Occupational and Nonoccupational Risk Factors on Health Outcomes

The question of how cost effective injury and illness prevention and health promotion programs are, either separately or jointly, remains largely unanswered. Actually determining cost effectiveness would take a large research effort that carefully selected measurable outcomes and inputs, as well as cost variables, and some form of randomization. This would likely require either a group of participating employers or at least one very large employer with many establishments over which to randomize. Additionally, given the length of time over which it may take some health conditions to develop, it would require a long time-path for the study to fully capture the benefits to employers and workers. Even with all of these elements, there are substantial challenges in measuring the true cost of any given health affliction to an individual.[11]

A large-scale examination of the costs and benefits of an integrated injury and illness prevention and health promotion program is beyond the scope of this paper. Instead, we study how personal and job-related health risks affect health shocks, both individually and jointly. While our analysis will be largely descriptive, given that we will not be able to distinguish whether the effects we measure are causal or selective in nature, we believe it will highlight some of the important issues that need to be considered when studying the role of modifiable job and personal risk factors on health.

Data and Methods

We use data on health status, personal health habits and job-related risks from the HRS. The HRS is a nationally representative panel sponsored by the National Institute of Aging and conducted by the Institute for Social Research at the University of Michigan. The study targeted individuals (and their spouses) aged 51–61 at the time of the first wave (1992), and was intended to provide information on health and retirement issues for the older community-dwelling population. Follow-up surveys were conducted biennially after 1992. The survey oversampled blacks and Hispanics, and includes weights that can be used to make it nationally representative for the 48 contiguous states.

As discussed above, there are numerous potential individual and work-related variables that could impact health. To focus our analysis, we consider a single personal health habit, smoking behavior, and a single job-related factor, the exposure to potentially harmful materials at work. These are useful for our purposes because both are clearly distinct in terms of their work relatedness, and both are well known to be associated with poor health. In addition, it is generally recognized that there may be spillovers in the two in terms of their impact on health; it has been argued that the health risks from exposure to asbestos are far more likely to manifest

11 One of the key problems is how to measure the noneconomic harm to an individual in dollar terms. Viscusi and Evans (1990) attempt to estimate these effects using survey data, but there remain challenges to measuring such effects in practice.

in smokers than in nonsmokers (U.S. Department of Health, Education and Welfare, 1979; U.S. Department of Health and Human Services, 2001).

The smoking variable that we utilize asks if an individual ever smoked cigarettes. This was asked in the initial wave, and follow-on questions were asked regarding current (at the time of the survey) smoking behavior. The exposure question was also asked in wave 1, and read as follows.

Individuals are sometimes exposed to dangerous chemicals or other hazards at work. Have you ever had to breathe any kinds of dusts, fumes, or vapors, or been exposed to organic solvents or pesticides at work?

If the individual responded affirmatively to this question, follow-up questions were asked regarding the nature and duration of the exposure.

We consider the impact of smoking and exposure to toxic chemicals on four potential health outcomes: respiratory disease (chronic lung disease, except asthma, such as chronic bronchitis or emphysema), cancer or a malignant tumor of any kind except skin cancer, heart disease (heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems), or arthritis (including rheumatism). We expect that both smoking and exposure to harmful substances could have an impact on the first three of these, particularly respiratory disease. Arthritis, on the other hand, is included as a robustness check. We expect that the risk of suffering arthritis because of either smoking or exposure to harmful chemicals should be small, given that neither is commonly recognized as a risk factor for arthritis. Therefore, any effect of smoking or exposure on arthritis that we observe should be due at least in part to correlation between these variables and unobserved variables indicating poor health status. Although this will not allow us to obtain causal estimates for the impact of smoking and exposure on health shocks, it will provide some insight as to whether selection appears to be prominent in our analysis.[12]

Results

Table 1 provides some summary statistics for the key variables used in our analysis. The summary statistics represent the characteristics of individuals in Wave 1 of the HRS. Most important for our analysis is to note that about 64 percent of individuals in our sample report ever smoking, while about 39 percent report ever being exposed to hazardous materials at work (about 27 percent report both). Almost 33 percent of individuals report being exposed to hazardous materials for more than 1 year.

12 All regression analyses account for the complex sampling design of the HRS using information on the survey weights, strata and primary sampling units as implemented in survey data estimation commands in Stata 7.0 (Stata Corporation, College Station, TX). The Huber/White nonparameteric correction is used to adjust standard errors for repeated observations on the same individuals.

Table 1. Summary Statistics

Variable	Mean	95% Confidence Interval
Age	55.6	[55.49, 55.63]
White	86.2%	[85.56, 86.75]
Female	52.4%	[51.30, 53.44]
Ever Smoked	63.90%	[62.91, 64.96]
Ever Exposed to Hazardous Substances	39.20%	[38.12, 40.30]
Smoked * Exposed	27.70%	[26.68, 28.68]
Exposure of Greater than 1 Year	32.70%	[31.68, 33.78]
Smoked * Long Exposure	23.20%	[22.25, 24.13]
Number of Observations: 9,771		

Notes: Number of observations represents the number of observations in Wave 1 of the HRS. The total number of observations in all waves in our data is 49,539. Note that some variables might have missing values, most notably the exposure to hazardous substances variable. Means and confidence intervals are calculated using weights reflecting the complex survey design of the HRS.

In Table 2 we illustrate the nature of the hazardous materials to which individuals report being exposed. The most common material was some form of chemical solvent, with the second most common being minerals and fumes other than asbestos (asbestos was the fifth-most common type of exposures). Note that individuals were allowed to report two forms of exposure, so we report the distribution of both exposure types in Table 2. For individuals exposed to hazardous materials, a separate question in the HRS indicates that approximately one-quarter felt that it had some adverse impact on their health.

Table 2. Types of Hazardous Materials Respondents Workers Report Being Exposed To

	First Category		Second Category	
	Number	Percent	Number	Percent
Solvents	832	29.4	477	33.73
Petroleum Products	202	7.1	121	8.56
Asbestos	293	10.3	68	4.8
Other Fumes and Dust	506	17.9	211	14.9
Biohazards (Incl. Wood and Paper)	191	6.7	65	4.6
Inorganic Materials (Incl. Acid)	199	7.0	143	10.1
Agricultural	296	10.4	124	8.8
Drugs and Explosives	20	0.7	9	0.6
Other	295	10.4	196	13.9
Total	2,834	100	1,414	100

Notes: There are 531 workers that do not report the type of exposure they faced. Workers are given the opportunity to list two types of materials to which they were exposed, and if they do this is reported above as the second exposure category.

In Figure 1 we examine the effect of exposure to hazardous materials on the prevalence of lung disease. For the figure, we use the response to the hazardous exposure question in Wave 1 and then examine the frequency of lung disease in all waves by current age (so we count individuals multiple times over different waves). The figure indicates a clear effect of reported exposure to hazardous materials on the reported prevalence of lung disease. The difference appears to be about a 4–5 percentage point increase in the frequency of lung disease for the exposed across all ages, with only a slightly higher gradient for the exposed category.

Figure 1. Frequency of Lung Disease by Age and Exposure Status

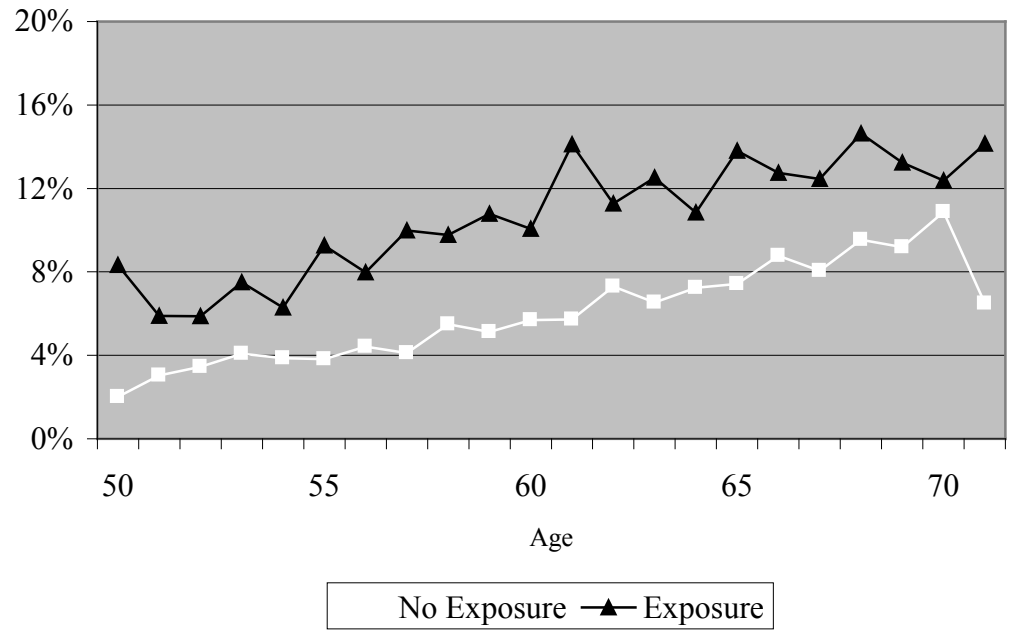
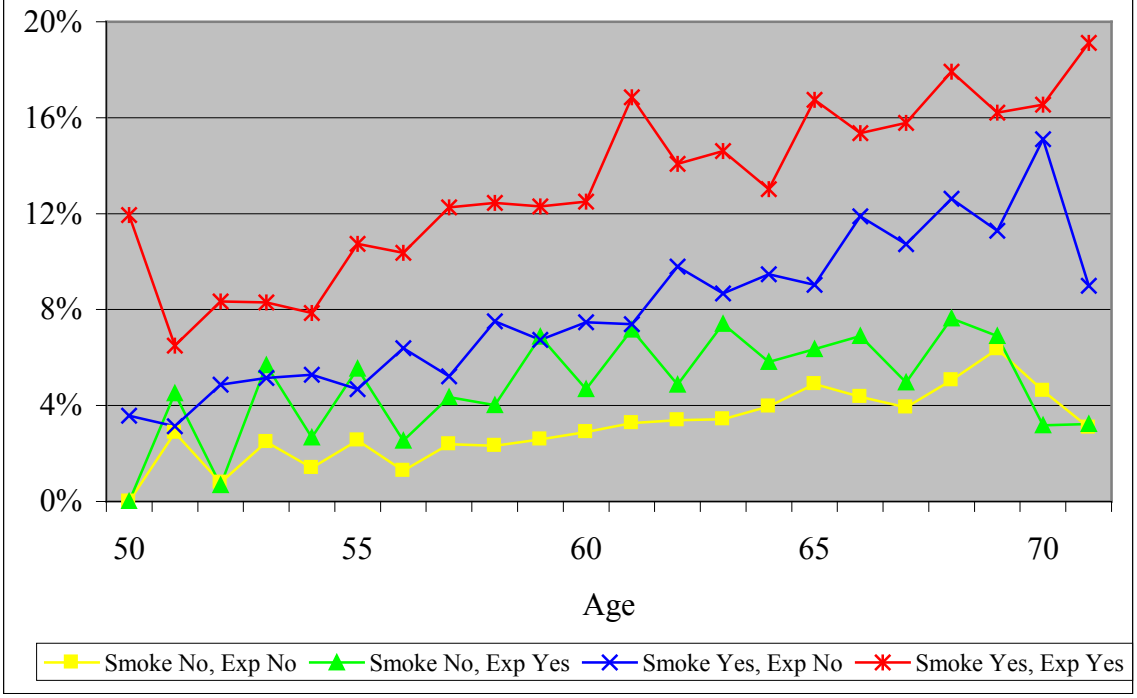


Figure 2 breaks down the data into four groups based on whether or not the individuals report ever smoking or ever being exposed to harmful materials. This allows us to examine the direct effect of our measures of individual and employer health risks, as well as the combined effect of the two. From the figure, we see that the combined effect is significant, indicating a propensity for lung disease of close to 10% in the early 50s and rising to nearly 20% at age 70. Both smoking and exposure appear to have an individual effect on lung disease, with the direct effect of smoking apparently larger.

Figure 2. Frequency of Lung Disease by Age and Exposure Status



Clearly, the danger of exposure to hazardous materials at work in terms of lung cancer appears worse for individuals who smoke. We now examine this relationship controlling for additional covariates (race, gender, education, and industry type), and examine the relationship for other health conditions. We do this with a series of estimated probit models, the results of which are reported in Table 3. The dependent variable in each of the probit models is whether an individual reported one of the four health conditions mentioned above (lung disease, cancer, heart disease or arthritis), either in the first wave or a later wave. We report results separately for any exposure to harmful chemicals, and for exposure that lasted longer than 1 year. We also report results with and without interaction terms between smoking and exposure.

Table 3. Impact of Smoking and Exposure to Harmful Substances on Health Shocks to Individuals

	Any Exposure		Exposure > 1 Year	
	I.	II.	III.	IV.
Lung Disease				
Exposed	0.2617	0.0736	0.2988	0.1397
	(6.28)**	(0.85)	(6.99)**	(1.57)
Ever Smoked	0.5087	0.4127	0.5100	0.4396
	(10.44)**	(6.62)**	(10.45)**	(7.32)**
Exposure*Smoked		0.2438		0.2049
		(2.49)*		(2.05)*
Cancer				
Exposed	0.1840	0.1868	0.1853	0.1493
	(4.46)**	(2.64)**	(4.38)**	(2.00)*
Ever Smoked	0.1590	0.1605	0.1590	0.1428
	(3.86)**	(3.09)**	(3.86)**	(2.89)**
Exposure*Smoked		-0.0040		0.0513
		(0.05)		(0.58)
Heart Disease				
Exposed	0.0811	0.1048	0.1213	0.1019
	(2.28)*	(1.68)+	(3.33)**	(1.58)
Ever Smoked	0.1784	0.1912	0.1776	0.1688
	(4.92)**	(4.16)**	(4.89)**	(3.85)**
Exposure*Smoked		-0.0338		0.0274
		(0.46)		(0.36)
Arthritis				
Exposed	0.1971	0.0452	0.1489	0.0343
	(5.93)**	(0.81)	(4.33)**	(0.59)
Ever Smoked	0.0803	-0.0009	0.0814	0.0312
	(2.47)*	(0.02)	(2.50)*	(0.81)
Exposure*Smoked		0.2272		0.1693
		(3.42)**		(2.43)*

Notes: Each column and panel reports the estimated coefficients from a probit model taking into account the sampling in the HRS. t-statistics are reported in parentheses. A ** represents statistical significance at the 1% level, a * represents significance at the 5% level and a + represents significance at the 10% level. All regressions include dummy variables for the respondents' age, education, race, gender and the industry for which they worked the longest.

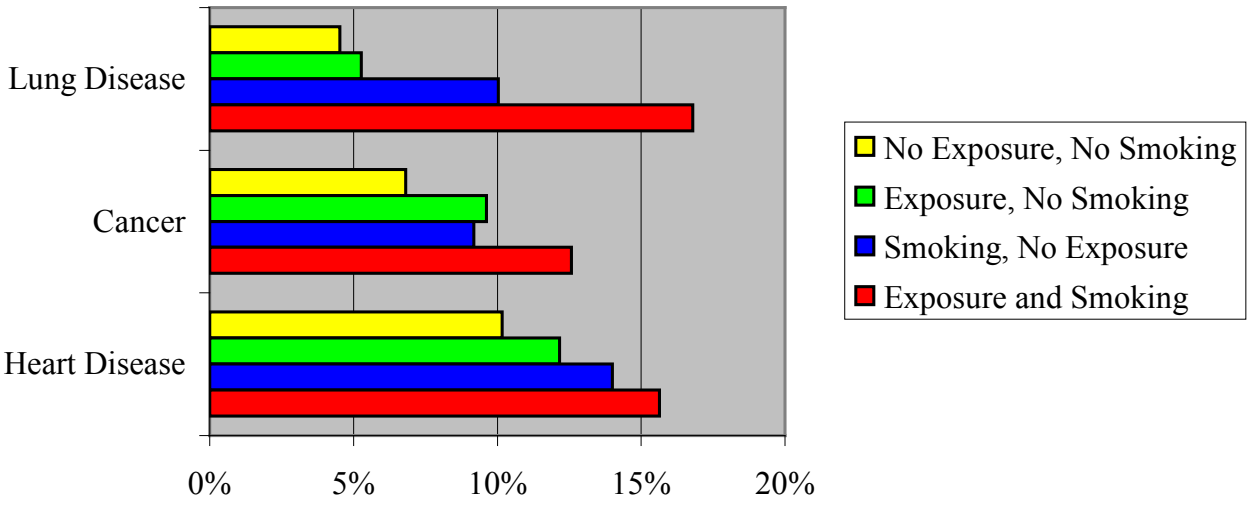
With reference to our earlier model, the variable for smoking represents the individual investment and the variable for exposure the private investment in reducing health shocks. We cannot say for sure what the impact of this investment on individual and employer value functions is, because we cannot translate from the health shock to the welfare of either party. Clearly these conditions will be negative for individuals, but it is less clear whether or not they will be so for employers (particularly for individuals at old age). The interaction term can be seen as a test for spillovers between the individual and employer investments.

Column I of Table 3 shows that both smoking and exposure are correlated with significantly increased risk for all conditions. Looking at Column III, we see that exposure for more than a year is associated with a larger risk for the three primary health risks, which we would expect, but the effect is not large. For all conditions except arthritis, the direct effect of smoking is larger than that of exposure. Table 3 also indicates that smoking and exposure are complements with regards to their impact on lung disease, though the interaction term is not statistically significant for heart disease or cancer. Note that the effects of any exposure and exposure for more

than a year are nearly identical, likely reflecting the fact that most who were exposed were exposed for at least a year.

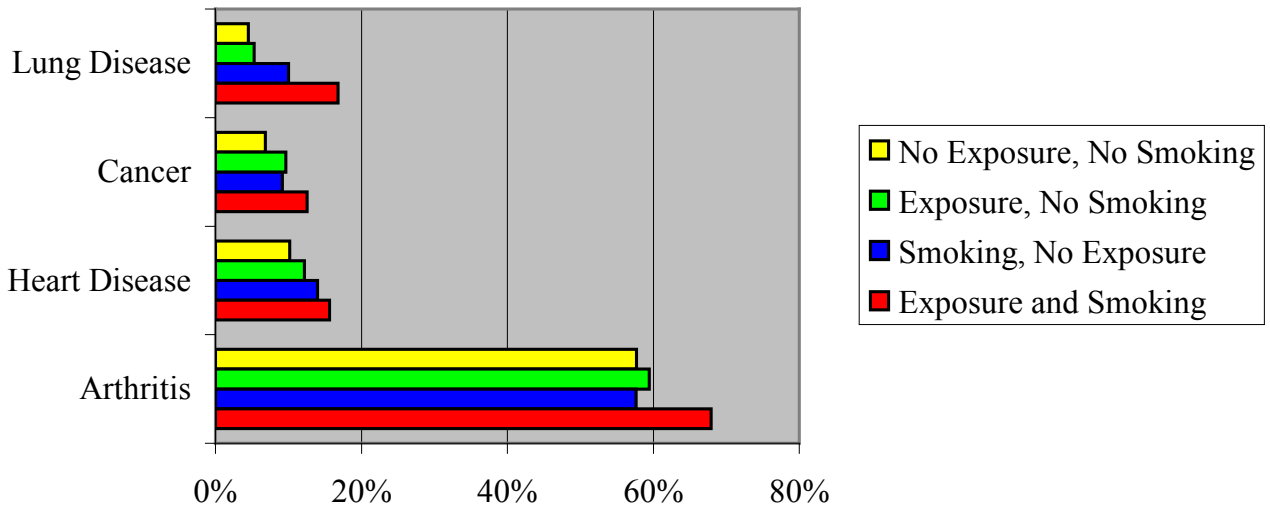
It is generally difficult to directly interpret probit coefficients in an intuitive manner, so in Figure 3 we report the predicted probabilities from the model by smoking and exposure (taking the other variables at their mean values). The figure suggests that there is a direct effect of both smoking and exposure, though the direct effect of exposure is small for lung disease (and not statistically significant in Table 3). The direct effects are larger for cancer and heart disease, though the interaction terms do not appear as large. In general, smoking and exposure appear to be complements with regards to their impact on these diseases, though the effect is only strong for lung disease.

Figure 3. Predicted Probability of Ever Suffering a Condition by Smoking and Exposure to Hazardous Materials



In Figure 4 we extend the analysis to display the predicted results for arthritis. Note that arthritis is far more common than the other three conditions, with our model predicting nearly 60 percent frequency for all four groups. In general, we see that there appears to be very little direct effect of smoking or exposure on the prevalence of arthritis, but there is a joint effect. Workers who smoked and report being exposed to hazardous materials appear roughly 8–10 percentage points more likely to suffer from arthritis. The most likely explanation for this would appear to be selection; smokers who are exposed to toxic chemicals could have more physically demanding jobs or worse baseline health characteristics that make them more susceptible to arthritis.

Figure 4. Predicted Probability of Ever Suffering a Condition by Smoking and Exposure to Hazardous Materials



The results for arthritis clearly suggest that one explanation for the strong impact of both smoking and exposure to hazardous materials on the other health conditions could be selective rather than causal. The causal interpretation is that exposure to hazardous materials at work and smoking combine to worsen health outcomes for individuals. The selective interpretation would suggest that individuals who are more vulnerable to poor health, perhaps because of heavier smoking or some other unobserved characteristic, are also more likely to be exposed to hazardous materials at work. This result raises important public policy concerns regardless of which interpretation is the correct one. However, the selection explanation does not as readily suggest that integrating health promotion and injury reduction programs will have multiplicative health benefits.

Overall, our analysis reinforces that there are large potential gains to individual health from modifying individual and employer risk variables. Furthermore, there is at least some evidence that the health outcomes for individuals could be made better off by jointly reducing smoking and exposure to harmful chemicals at work. We only consider two types of behaviors and a handful of health conditions, but there are many possible combinations that one could consider. Future work should expand the analysis to determining the effect of different behaviors on different kinds of individual health, but clearly must be careful to control for the possible selection on unobserved characteristics.

Conclusions

As long as we maintain a system in which the health and health care of individual workers are tied so closely to the employer, we will in all likelihood continue to see a strong interest in health promotion programs. And as long as the distinction between occupational and nonoccupational injuries continues to fade, it is likely that there will also be continued interest in coordinating health promotion and injury and illness prevention programs. However, there remain substantial gaps in our knowledge about just how cost-effective such programs are, taken in isolation or considered jointly.

This paper discusses some economic issues that need to be considered when studying health promotion and injury and illness prevention programs. We outline a model for discussion of how individuals and employers could benefit from investing in individual health. Our primary finding is that the gains, in terms of economic efficiency, to coordinating health promotion and injury and illness prevention programs arise if there are spillovers between the effects of occupational and nonoccupational risk factors on health. If positive spillovers are present, then recognition of the interaction between the two programs will be necessary in order to correctly evaluate the cost effectiveness of either programs, and there are likely to be health benefits from their coordination.

We also discuss some empirical issues related to estimating the gains to these programs, and illustrate these with an analysis of how smoking and exposure to toxic chemicals combine to affect the health of individuals. Our results suggest that workplace conditions and health habits both influence individual health, and that the effect appears more than additive for some health conditions (suggesting a positive spillover). However, the analysis is also suggestive of the possibility that sample selection could be contributing to the estimates of spillovers.

Clearly, much work remains to be done on this issue. The outcomes we focus on in this paper are restricted primarily to those directly related to the health of workers, but there are other potential gains to coordinating health promotion and injury and illness prevention programs that we do not consider. For instance, the administrative savings from a coordinated program could potentially be large, particularly for larger firms that self-insure both occupational and nonoccupational health-care costs.

However, even focusing on just the direct impact of interventions on health outcomes, it is no simple matter to determine cost-effectiveness. Given the various ways in which the costs of health and health risks may be transferred between individuals and employers through wage negotiations, it could be very difficult to obtain a complete accounting of the difference between employer costs with and without an integrated program. Also, given that our empirical results suggest that some of the impact of workplace safety investments may occur in older

individuals (our sample of individuals were all age 50 or over), there are reasons to believe that the full benefits of prevention measures will not be recovered by employers (as most health-care costs for older individuals will likely be borne by Medicare). All of this suggests a need for a great deal of additional research aimed at determining the optimal intervention in health promotion and injury and illness prevention programs.

Technical Appendix

In this appendix, we present a formal model of investment in individual health by employers and workers. We then show how maximizing investment for each agent without considering the impact on the other agent's welfare will lead to sub-optimal levels of investment in health. If we think of integrated health promotion and injury and illness prevention programs as facilitating the joint maximization of investment, then such integration will be welfare enhancing for both parties. Here we focus primarily on the technical aspects of the model, and leave the intuition for the results to the text.

Model Setup

In this section we set up a model where both workers and employers have the ability to reduce the likelihood of adverse shocks to future health, though not eliminate them entirely. As we proceed, we also derive the equilibrium conditions for worker and employer investment levels *assuming that neither considers the possible impact of one's own investment on the other's welfare*.

We formulate the relationship between health in one time period to that in the previous time period with Equation 1

$$(1) \qquad H_{t+1} = (1-\partial)H_t - \theta_t,$$

where H_t represents the stock of available health in time t, d is the rate of depreciation on health, and q is a random health shock.[1] This equation simply states that as an individual, your health in the future is equal to your health in the past minus any natural depreciation (through the aging process) and any adverse health shocks. We assume that the shock is a random variable distributed according to the distribution function $F(q \mid s, g)$, where s represents individual health habits (controlled by the worker) and g represents the quality of the work environment in terms of health (controlled by the employer). The likelihood of a health shock is decreasing in both individual health habits and workplace health investments at a decreasing rate.[2]

Individual utility is increasing concave in both consumption of goods and health subject to a budget constraint. Suppose that individual investment in reducing health shocks is costly, with a unit cost of m_s. Let individual utility in time t be given by the function

$$(2) \qquad U_t(z_t, H_t),$$

where z are goods consumed by the individual. Consumption is subject to the budget constraint

$$(3) \qquad z_t + m_\sigma \sigma_t \le w(H_t),$$

where $w(H)$ represents the individual's wages.[3]

Consider the value function $v(H_t) = U_t(c_t, H_t) + b\, v(H_{t+1})$, where b is the next period discount rate. In our model, health is known in time t, but individual current period investments in health only affect health shocks in the next period. Thus, in time t individuals choose c_t and σ_t to maximize $U_t(c_t, H_t) + b\, \mathrm{E}(v(H_{t+1}))$ subject to the resource constraint

given by Equation 4. Carrying out this maximization yields the first order conditions $U_c = \lambda$ for c_t and $\frac{\beta}{\lambda}\left[\frac{\partial E(v(H_{t+1})\,|\,\sigma_t,\gamma_t)}{\partial \sigma_t}\right] = m_\sigma$ for σ_t, where l is the Lagrange multiplier for the optimization problem. As long as $W_H > 0$, next period health and utility unambiguously increase in current period investments.[4] Given this, economic theory holds that individuals will invest in s until the discounted value of the marginal increase in expected, next-period utility equals m_s.

Now consider employers. Let employer profits be given by

$$(4) \qquad Y(H_t) - \{w(H_t) + c(H_t)\},$$

where $Y(H)$ is per-worker output and $c(H)$ represent the per-worker costs of poor worker health that are borne by the employer.[5] We assume that the marginal product of workers is increasing concave in their health, so $Y_H > 0$ and $Y_{HH} < 0$.[6] The cost function c is decreasing concave in health, so $c_H < 0$ and $c_{HH} > 0$. As long as wages do not increase too quickly with H, employer profits at time t are increasing in the health of workers at time t.

As with individuals, we assume employers make current period investments that only affect future health shocks. Employers choose some fraction of current period profits to devote to future reductions in health shocks and some fraction to give to shareholders. Letting s_t denote the value of profits given to shareholders in time t, we can define the resource constraint for per-worker investment in health as

$$(5) \qquad s_t + m_\gamma \gamma_t \le Y(H_t) - \{w(H_t) + c(H_t)\}.$$

Since we ignore savings, profits are fully distributed between investment and payments to shareholders.

Suppose that employers operate to maximize shareholder value, and the value function of shareholders is $X(H_t) = D(s_t) + \beta X(H_{t+1})$, where D represents the direct gain to shareholders from consuming current period surplus. As with the individual value functions, future surplus is uncertain because of health shocks. Taking expectations and maximizing shareholder value with respect to s_t and γ_t constrained by Equation 6 yields the first-order conditions $D_s = \eta$ for s_t and $\frac{\beta}{\eta}\left[\frac{\partial E(X(H_{t+1})\,|\,\sigma_t,\gamma_t)}{\partial \gamma_t}\right] = m_\gamma$ for γ_t, where h is the Lagrange multiplier. Analogous to the case of individuals, employers invest in health until the discounted value of the marginal increase in expected next period surplus equals the marginal cost of investment.

Information Asymmetries and Spillovers

Here we examine the model under the assumption that information asymmetries prevent workers and employers from negotiating the optimal level of investment. We assume a complete failure, though analogous results are obtained if there is only a one-sided asymmetry (for example, if worker investments are unobservable but employer investments are not). Essentially, the failure of employers and workers to consider the effect of one's own investment on the other's welfare leads to externalities, and therefore the equilibrium levels of investment described above are sub-optimal. We then show that if there are spillovers, if worker and employer investments are strategic substitutes or complements, then interventions designed to promote investment will only be optimal if they choose the level of promotion jointly. This result lays the foundation for the economic argument in favor of integrating health promotion and injury and illness prevention programs.

Consider the value functions from before, $v(H_t)$ and $X(H_t)$. In the model discussed above, individuals and employers maximize only their respective value function irrespective of the other. A social planner who, for simplicity, places equal weight on both workers and employers would maximize the sum $v(H_t) + X(H_t)$ with respect to c_t, s_t, σ_t, and γ_t while taking Equations 3 and 5 as constraints. It is straightforward to show that the first order condition for σ_t in this maximization

is $\frac{\beta}{\delta_1}\left\{\frac{\partial E(v(H_{t+1})\,|\,\sigma_t,\gamma_t)}{\partial\sigma_t}+\frac{\partial E(X(H_{t+1})\,|\,\sigma_t,\gamma_t)}{\partial\sigma_t}\right\}=m_\sigma$

and the first-order condition for γ_t is $\frac{\beta}{\delta_2}\left\{\frac{\partial E(v(H_{t+1})\,|\,\sigma_t,\gamma_t)}{\partial\gamma_t}+\frac{\partial E(X(H_{t+1})\,|\,\sigma_t,\gamma_t)}{\partial\gamma_t}\right\}=$, where δ_1 and δ_2 are the Lagrange multipliers for Equations 3 and 5, respectively. These equations clearly differ from the previous first-order conditions, because of the introduction of terms representing the externality that one agent's investment has on the other's welfare. Because both left-hand side terms in both first-order conditions are decreasing in *s* and *g*, respectively, the socially optimal equilibrium will involve higher levels of investment in safety than the privately optimal equilibrium.

It is important to emphasize that externalities such as these would normally only occur outside the context of a contractual relationship. The Coase Theorem tells us that externalities are only problematic if there are transaction costs of some sort that prevent the parties from negotiating a solution (Coase, 1960). However, information asymmetries create a market failure that can prevent these private negotiations from generating the efficient solution (because when investment is unobservable, incentives exist to report a higher level of investment than is actually taken).

Note that the social planner maximizes social welfare with respect to σ_t, and γ_t jointly. This means that any spillovers between the two will be incorporated into the estimation. In this context, spillovers arise when there is strategic complementarity or substitutability between the two types of investment. Consider the value functions $E(v(H_{t+1})\,|\,\sigma_t,\gamma_t)$ and $E(X(H_{t+1})\,|\,\sigma_t,\gamma_t)$. The investment variables *s* and *g* are considered strategic complements if $\frac{\partial^2 E(v(H_{t+1})\,|\,\sigma_t,\gamma_t)}{\partial\sigma_t\partial\gamma_t}>0$ and $\frac{\partial^2 E(X(H_{t+1})\,|\,\sigma_t,\gamma_t)}{\partial\sigma_t\partial\gamma_t}>0$, and strategic substitutes if the inequalities are reversed. If health promotion and injury and illness prevention programs are designed separately it is possible that they will be "myopic," in the sense that they will fail to consider these spillover effects.

Suppose that a government felt that *s* and *g* were below their optimal levels, and decided to implement separate programs to raise them. The natural solution for a myopic program is to design the intervention to raise each to the point that the private marginal benefit of investment with respect to *s* and *g* equaled their respective marginal cost. However, suppose that *s* and *g* are complements. If this is true, and the policies were implemented separately and without any coordination, then the programs would be designed to implement the optimal level of *s* assuming that *g* is fixed at its old level, and vice versa. But because of the complementarity of the two, this will result in a marginal value of investment that is greater than the marginal cost, so there will be too little investment in worker health. The opposite result will hold if the two are substitutes.

References for Technical Appendix

1. The health shock could be introduced in any number of ways, such as a jump in the level of depreciation, but we make it additive for simplicity.
2. Thinking in terms of the expected health shock, denoted $E(\theta\,|\,\sigma,\gamma)$, then we have

$$\frac{\partial E(\theta\,|\,\sigma,\gamma)}{\partial\sigma}<0\quad,\quad\frac{\partial E(\theta\,|\,\sigma,\gamma)}{\partial\gamma}<0\quad,$$

$$\frac{\partial^2 E(\theta\,|\,\sigma,\gamma)}{\partial\sigma^2}<0\quad\text{and}\quad\frac{\partial^2 E(\theta\,|\,\sigma,\gamma)}{\partial\gamma^2}<0$$

3. Throughout this paper we assume that there is no borrowing, by individuals or by employers.

4. We expect that wages increase in health either because healthier workers have a higher marginal productivity or simply because they are able to work more. In practice, there are programs (such as workers' compensation and disability compensation programs) that reduce the economic impact of a disability. Nevertheless, these compensation mechanisms typically replace much less than 100% of lost wages.
5. In principle, employers should care about maximizing aggregate profits. For our analysis, we must assume identical workers and a production function that is linear homogeneous of degree one, allowing us to divide through by total employment and focus on the individual worker level.
6. Strictly speaking, we do not need the cost function for our analysis, so our results would be the same if $c(H) = 0$ for all H.

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Abbreviations

ACOEM	American College of Occupational and Environmental Medicine
ADA	Americans with Disabilities Act
APQC	American Productivity and Quality Center
BLS	Bureau of Labor Statistics
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CDHP	Consumer Driven Health Plan
CRA	Cardiovascular Risk Assessment
EAP	Employee Assistance Program
EHM	Employee Health Management
EHS	Environmental, Health and Safety
EWC	Executive Wellness Council
FMLA	Family and Medical Leave Act
GDP	Gross Domestic Product
GM	General Motors
H&W	Health & Wellness
HPQ	Health Profile Questionnaire
HPM	Health and Productivity Management
HPM-EVT	Health and Productivity Management Economic Valuation Tool
HRA	Health Risk Appraisal
HRS	Health and Retirement Study
HSSP	Health, Safety, Security, and Productivity
IAM	International Association of Machinists & Aerospace
IFCN	International Fitness Club Network
IHPM	Institute for Health and Productivity Management
JSC	Johnson Space Center
NASA	National Aeronautics and Space Administration
NBGH	National Business Group on Health
NIOSH	National Institute for Occupational Safety and Health
NORA	National Occupational Research Agenda
OCHMO	Office of the Chief Health and Medical Officer
OHG	Occupational Health Group
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
P&G	Proctor and Gamble
PPACA	Patient Protection and Affordable Care Act
ROI	Return on Investment
TANA	Trucking Across North America
TI	Texas Instruments
UAW	United Automobile, Aerospace and Agricultural Implement Workers of America
VFC	Virtual Fitness Center
VPP	Voluntary Protection Program
WBMS	Well-Being and Management System
WELCOA	Wellness Councils of America
WHP	Worksite Health and Promotion

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