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The Ecology of Work and Health: Research and Policy Directions for the Promotion of Employee Health

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This article identifies new research and policy directions for the field of worksite health in the context of the changing American workplace. These directions are viewed from an ecological perspective on worksite health and are organized around three major themes: (1) the joint influence of physical and social environmental factors on occupational health, (2) the effects of nonoccupational settings (e.g., households, the health care system) on employee well-being and the implications of recent changes in these settings for worksite health programs, and (3) methodological issues in the design and evaluation of worksite health programs. Developments in these areas suggest that the field of worksite health may be undergoing a fundamental paradigm shift away from individually oriented wellness programs (provided at the worksite and aimed primarily at changing employees' health behavior) and toward broader formulations emphasizing the joint impact of the physical and social environment at work, job-person fit, and work policies on employee well-being.

This article applies a social ecological perspective to the discussion of current limitations, challenges, and future directions for worksite health programs and research. The field of worksite health has grown substantially over the past 15 years with the development of sophisticated programs that are both health conscious and cost-effective.[1-6] At the same time, however, the research literature on worksite health reflects certain limitations and challenges that remain to be addressed. The first portion of the article outlines the social ecological perspective as a guiding framework from which to develop more comprehensive and effective strategies for promoting employee health. Next, limitations and challenges reflected in earlier worksite health programs and research are discussed. The remaining sections of the article examine research questions and directions for the field of worksite health in relation to the proposed social ecological framework.

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The Social Ecology
of Worksite Health: Theoretical Principles

This discussion of worksite health is guided by a social ecological perspective.[7-11] The term *ecology* pertains broadly to the relationships between organisms and their environments.[12] The field of social ecology focuses on the interactions between humans and their environments and places greater emphasis on the social, institutional, and cultural contexts of people-environment relations than did earlier versions of bioecology.[13,14,15] Social ecology offers a set of theoretical principles for understanding the relationships between diverse personal and environmental factors in human health and illness. Three of these principles are outlined below.

First, an individual's or group's health status is assumed to be influenced by multiple environmental and personal factors. Environmental factors relevant to health subsume several features of one's physical and sociocultural surroundings. Personal variables related to health status also encompass a variety of factors such as biogenetic heritage, psychological dispositions, and patterns of behavior. Rather than focusing exclusively on environmental or personal factors, social ecological models emphasize the importance of considering the joint influence of these factors on employee well-being. Moreover, from a social ecological perspective, worksites are viewed as complex systems, comprising multiple social and physical environmental conditions, which jointly influence physical, mental, and social well-being.[16,17] Thus the health-promotive capacity of a work environment reflects the cumulative influence of multiple environmental conditions on several facets of employee well-being—all of which should be considered in the design and implementation of worksite health promotion programs.

Second, social ecological models of worksite health emphasize the linkages that exist between the workplace and employees' other life settings, such as their residential environments, their modes of commuting to and from work, and the community health care system that exists beyond the workplace. Employee health can be influenced by circumstances within any and all of these life domains. Accordingly, social ecological approaches to worksite health consider employee well-being within the context of both work and nonwork settings. Moreover, they highlight the importance of developing comprehensive programs that integrate the wellness resources offered to employees at the worksite with the health care and medical services available in the broader community.

Third, social ecological models emphasize a multilevel and multidisciplinary perspective on health and illness. Just as environmental influences on health span multiple levels of one's surroundings (e.g., from the physical and social conditions existing within one's immediate worksite to community-wide occupational safety regulations), the manifestations of health and illness also can be examined at several levels of analysis (e.g., physiological, psychological, interpersonal, organizational, institutional, and community). The fact that an individual's or group's health status is influenced by multiple circumstances found at different levels of the environment suggests that worksite health can best be understood from a multidisciplinary perspective—one that integrates knowledge and research methods drawn from several different fields (e.g., occupational safety and health, health education, medicine, law, facilities planning and management)—rather than relying exclusively on unidisciplinary theories and methods.

Limitations and Challenges Reflected in
Earlier Worksite Health Programs and Research

The social ecological perspective highlights some important limitations of earlier worksite health programs and research. First, U.S. worksite health programs generally have emphasized behavioral change efforts to modify individuals' lifestyles, while often neglecting opportunities to combine person-focused interventions with environmental enhancement strategies.[7,18,19] Worksite health programs outside the United States (e.g., in Scandinavia), however, have been more attentive to environmental factors.[8] Second, behavioral interventions to promote employee well-being have focused, for the most part, on changing personal health practices rather than the actions of corporate and public decision makers who influence others' well-being.[20,21] Third, worksite health programs have emphasized the reduction of physical and mental health problems, while paying less attention to opportunities for cultivating highly positive states of well-being (e.g., enhanced levels of creativity, group cohesion, and organizational effectiveness).[22,23,24]

Fourth, the methodological shortcomings evident in many earlier studies pose a variety of challenges for future research. These challenges include the design and implementation of prospective field-experimental studies to evaluate the effectiveness of worksite health promotion and occupational health and safety programs;[25,26] the development of improved measures for gauging the health, productivity, and economic outcomes of these programs;[27] and the customization of worksite health programs to address the special needs of small businesses as well as large corporations, part-time or unemployed workers, and diverse age, ethnic, and cultural groups within the workforce.[28,29,30]

Finally, the emergence of new models for managing the delivery of medical and preventive services is dramatically altering the structure of worksite health programs. Large employers are shifting the burden of providing health promotion and disease prevention services to outside vendors by incorporating such services into the bid specifications given to competing providers. In the future, large companies and purchasing cooperatives may not actually deliver health promotion and disease prevention services at the worksite, but instead function as well-informed purchasers of such services from competing health plans, insurance carriers, community hospitals, and other sources. As new models of managed care evolve, they will likely forge closer collaboration between payers and providers in the delivery of health promotion, disease prevention, and medical services for employees.[31]

Opportunities for Future Research and
Practice in the Field of Worksite Health

The core principles of social ecology outlined earlier suggest some important issues that remain to be addressed in future worksite health programs and research. This section offers a brief overview of these issues. The following section, focusing on research questions and directions, examines these issues in greater detail.

First, the systemic organization of work settings posited by social ecological analyses of employee health suggests that certain high-impact "leverage points" for health promotion can be identified within work organizations and should be targeted by worksite health interventions.[21]

Programs that directly influence the decisions and behavior of these pivotal roles and individuals within organizations may have a greater capacity to enhance worksite health than those that rely exclusively on efforts to modify individual workers' health behavior.

Moreover, the systemic view of work organizations suggests that levels of productivity and organizational effectiveness may be closely related to employee health, creativity, and morale, and that efforts to gauge the health and cost benefits of worksite interventions should examine these outcomes as interrelated criteria rather than as separate and isolated indicators of program success.[4,32,33] Previous studies have been unable to ascertain the relationships among these phenomena due to limitations in the measurement of employee creativity, productivity, and organizational effectiveness.[27,33] In the future, methodological improvements may permit a better understanding of the circumstances under which employee health status is positively, negatively, or negligibly related to levels of productivity or organizational effectiveness. We are not suggesting that a positive association between employee wellness, productivity, and organizational effectiveness is a prerequisite for investing in worksite health programs. Clearly, the justifications for and benefits of such programs are multifaceted (e.g., moral and legal grounds for ensuring healthful working conditions; improved quality of worklife; employee recruitment and retention), and noneconomic considerations often outweigh the financial investment required to implement and sustain them. Nonetheless, a better understanding of the relationships between noneconomic benefits of worksite health programs and those pertaining to productivity and organizational effectiveness would be desirable, as it would provide a basis for improving the health benefits and cost-effectiveness of such programs.

Second, the assumption that work settings are situated within a broader structure of community settings (including residential and transportation environments, the health care system, regulatory and public policy contexts) suggests some important issues for future research,[7,19,34,35] including (1) the joint influence of workplaces, family settings, and commuting conditions on employee health and productivity; (2) the influence of community economic conditions and trends toward downsizing, part-time employment, and unemployment on personal, family, and organizational well-being; (3) the relationship between community norms for corporate behavior (e.g., providing on-site day care, a smoke-free workplace, and flexible scheduling of work hours) on the healthfulness of work environments; (4) the implications of demographic shifts in the age, ethnic, and gender composition of the workforce for worksite health promotion; (5) the spillover of community-wide problems, such as neighborhood and workplace violence (especially toward women) and the AIDS epidemic, to the workplace; (6) the impacts of legal interventions (e.g., the Americans With Disabilities Act (ADA); California's Worksite Injury and Illness Prevention Law (SB198); legal reforms regarding workers' compensation for occupational illness and injury) on employees' health, productivity, and medical insurance claims; and (7) the influence of technological innovations within the broader community (e.g., electronic mail, fax machines, mobile phones, and telecommuting) on the development and delivery of innovative worksite health programs (e.g., "electronic housecalls," telephone care, and computer-assisted screening for medical risk factors).[4,36-39]

Third, the assumption that multidisciplinary perspectives and diverse methodologies are essential for the design, implementation, and evaluation of effective worksite health programs points toward some important directions for future research. Too often, evaluations of worksite health interventions focus narrowly on a limited subset of potentially relevant criteria (e.g., biometric response indices or toxicant exposure levels) for judging program success. Future studies of worksite health programs should encompass a broader

array of measures and tools, including health assessments, questionnaires, behavioral observations and activity logs, and environmental recordings, and be subjected to both epidemiologic and financial analyses.

Moreover, the social ecological perspective highlights the value of conducting prospective evaluations of intervention outcomes and effectiveness. For example, broad-gauged program evaluations might incorporate pre- and postintervention assessments of individuals' health practices and emotional well-being; levels of cooperation and conflict within organizations; personal or group exposure to physical environmental hazards; archival data on illness and mortality rates among different occupational and demographic groups; and direct or proxy measures of employee health costs, productivity, and organizational effectiveness. In addition to summative evaluations of program outcomes, formative evaluations of the effectiveness with which intervention components are implemented should be incorporated to assess overall program results.[40,41]

The next section outlines high-priority research questions and directions and is organized around the three social ecological principles noted above: (1) physical and social environmental factors that jointly contribute to the healthfulness of the workplace, (2) the influence of nonoccupational and community settings on employee well-being and worksite health programs; and (3) methodological approaches to the design of worksite interventions and multimethod strategies for gauging the health and cost-effectiveness of these programs.

RESEARCH QUESTIONS AND DIRECTIONS FOR THE FIELD OF WORKSITE HEALTH

Physical and Social Environmental Factors in Occupational Health

Earlier worksite health programs have emphasized behavioral change and lifestyle modification programs aimed at individual employees, while giving less attention to interventions involving the restructuring and enhancement of work environments. Future worksite interventions and evaluation studies should pay more attention to the health-promotive as well as the health-impairing qualities of the physical and social environment at work.

The Impacts of Workplace Hazards, Physical Environmental Stressors, and Facility Design on Employee Health and Productivity

Several physical conditions of workplaces have been found to influence employee health, productivity, and morale. These conditions include poor indoor air quality, or the "sick building syndrome";[42,43] poor ergonomic design of office furnishings and computer terminals;[44,45,46] involuntary exposure to tobacco smoke,[47] lead, and asbestos;[48-51] and environmental demands such as noise, distraction, and privacy infringements often associated with inadequate spatial arrangements and facility designs.[52,53]

To date, very few prospective studies have been conducted to evaluate the health and productivity impacts of environmental changes aimed at alleviating these problems. There is a need for new worksite health studies that evaluate the separate and joint effects of active and passive interventions to promote employee well-being.[54] Active interventions

include a variety of behavioral change and lifestyle modification programs (e.g., regular use of protective equipment by employees working with hazardous materials; proper lifting techniques; smoking cessation, exercise, and dietary interventions) that require voluntary and sustained effort by individuals as a prerequisite for achieving the desired health benefits. Passive interventions include various environmental interventions (e.g., removal of cigarette vending machines from factories and office buildings, use of nontoxic furnishings and equipment, installation of high-quality air conditioning and purification systems, environmental supports for privacy regulation) that require little or no effort on the part of individuals.[55,56,57]

In recent years, innovative worksite health programs incorporating multicomponent versus single-factor interventions have been implemented by several large corporations (e.g., AT&T, Johnson & Johnson, IBM, Steelcase, American Airlines).[4] Future evaluations of comprehensive worksite programs that include both active and passive interventions for promoting employee health will likely require a multidisciplinary team of individuals who are familiar with diverse theoretical and methodological perspectives (e.g., occupational safety, health education, disease prevention, employee assistance programs, facilities planning and management), and are capable of integrating these perspectives in the design of worksite health interventions and policies.[7,51,55,56,58]

A trend toward greater integration of occupational medicine concerns and worksite wellness programming is evidenced by recent efforts in several states (e.g., California, Florida, Oregon, Minnesota) to curb rapidly rising rates of workers' disability claims. In California, for example, legislation was enacted in 1993 to counter the unchecked rise in workers' compensation claims for both physical and psychological (stress-related) disabilities. That legislation established a new state-regulated managed care system for occupational injuries and illness.[59] An important goal of this mandate, in conjunction with CAL-OSHA's regulations relating to worksite injury and illness prevention,[60,61] is to combine environmental and behavioral interventions for preventing employee injuries with disability management and clinical services for injured workers.

Social Structural Interventions to
Promote Employee Health and Productivity

Numerous studies have documented the significant correlations between socially supportive work groups, positive organizational climates, and employee well-being.[23,62-67] Yet few studies have prospectively evaluated the health and productivity gains attributable to social structural interventions at the worksite.[68] For example, the health effects of implementing participatory management strategies, quality circles, and conflict resolution procedures remain to be evaluated in future research.[69-72]

Moreover, the role of organizational climates in moderating employees' responses to physical environmental stressors (e.g., high levels of ambient noise, faulty ergonomics, and poor environmental design), and in encouraging their maintenance of good health practices (e.g., physical fitness activities, avoidance of smoking, excessive alcohol consumption, and high-fat diets) has not been investigated in prior research.[21] Finally, the joint contributions of organizational and facility design interventions in fostering teamwork and collaboration among coworkers (e.g., office layouts that promote informal communication and effective privacy regulation) remain to be explored in future studies.[32,73,74,75]

Worksite Interventions to Enhance Creativity and Innovation

Worksite health promotion programs generally have placed greater emphasis on the avoidance of physical and mental health problems, and the reduction of risk factors for major illnesses, than on the promotion of high levels of performance, organizational commitment, perceived quality of work life, and emotional well-being. For example, little is known about the physical and social environmental conditions (e.g., supportive social climates, changes in the physical design and decor of the workplace, movement between alternative work environments) that may enhance creativity and productivity in occupational settings.

Measures of employee creativity and organizational innovation are usually omitted from studies of worksite health promotion. Future research should incorporate multiple measures of employees' physical health status, the quality of their social relations with coworkers, and indices of mental health and work performance, including levels of creativity, perceived quality of work life, and job satisfaction.[16,22,24,76,77] The measurement of employee creativity and organizational innovation poses both conceptual and methodological complexities that remain to be addressed in future research. First, criteria for identifying creative products or processes in the workplace vary considerably across different industries and job categories. For instance, creativity may be manifested quite differently among factory workers, data entry clerks, and corporate managers. Also, workplace innovations often emerge gradually and may be difficult to detect through short-term studies. These considerations suggest that careful attention must be given to the selection of measurement strategies and research designs if employee creativity and organizational innovation are to be effectively evaluated as potential outcomes of worksite health programs.

*Targeting High-Impact Organizational
"Leverage Points" in Worksite Health Promotion Programs*

Certain key roles, behaviors, and environmental conditions within work settings exert a disproportionate influence on employee well-being. For example, plant supervisors are entrusted with maintaining safe work practices and operable emergency equipment in factory settings. Similarly, facility managers can influence the health of office workers by ensuring that they are provided with ergonomically adjustable chairs and work surfaces. And corporate nutritionists can decide to include only heart-healthy selections on their cafeteria menus. These and other occupational roles, behaviors, and environmental factors can be targeted as high-impact "leverage points" for enhancing worksite health.[21] Previous research on behavioral change strategies of health promotion have focused primarily on modifying personal health behavior (actions taken by individuals that affect their own well-being), rather than influencing organizational and community decision makers whose behavior affects the health of many other people.[54,78] Yet corporations are increasingly relying on intermediaries to ensure the health and safety of their employees.

Within large companies, for example, medical benefits are often administered by health maintenance organizations whose case managers decide whether to approve payment for mental health counseling visits, diagnostic tests, medical treatment, and rehabilitative therapy for particular employees. Also, legal initiatives to protect the healthfulness of

occupational environments generally require companies to designate a coordinator who is officially responsible for maintaining organizational compliance with the legislative requirements.[60,79,80] The delegation of responsibility for providing employee medical and preventive services (to intermediaries and third parties) will substantially increase the extent to which a small number of decision makers can either enhance or impair the health of large numbers of workers. Future health promotion studies and intervention programs should identify high-impact roles in corporate settings that have the capacity to influence the health and safety of numerous employees, design and evaluate train-the-trainer programs aimed at facilitating the health-promotive activities of decision makers in both small businesses and large corporations, and reduce organizational barriers (e.g., bureaucratic rigidities, overload of work demands) that can undermine the effectiveness of worksite health coordinators.

Influence of Nonoccupational Settings on Employee Well-Being and Worksite Health Promotion

This section addresses the functional links and reciprocal influences among work environments, residential and family settings, the health care system, and the regulatory and public policy contexts that impinge on worker health and safety. The rapidity and pervasive scope of technological, sociodemographic, and legislative changes over the past decade, and the implications of these societal events for worksite health programs, raise several important questions for future research.

Health Consequences of Rapid Changes in Occupational and Family Roles

Over the past 10 years, the composition of the U.S. workforce has changed substantially. During this period, increasing numbers of women and older workers have joined the labor force. The proportions of single-parent and dual-career families in the United States also have grown dramatically during this period. And, in certain regions of the country such as the Southwest, the cultural and ethnic diversity of the workforce also has increased.

One consequence of these demographic shifts is that U.S. workers must now cope with more stringent job pressures and constraints on their discretionary or leisure time. These work pressures and time constraints are especially pronounced among dual-career and single parents who must balance child care and occupational roles.[81,82,83] The potentially adverse effects of job strain on health may be particularly severe among single mothers.[84] Also, the pressures of dual-career and single parenting, physical and social constraints associated with aging, and minority ethnic status may render employees more vulnerable to work-related stress and health problems.

Future research should examine the empirical links between marital and parental status, family structure (e.g., number and ages of children, single- vs. dual-career status), and employee well-being. Earlier studies suggest that certain demographic groups in the workforce may be more sensitive to the physical and social demands of their jobs and to stress-related disorders.[81-85] In future research, employee health programs that are tailored to the unique needs of different groups (e.g., worksite child care services, flexible work schedules, ergonomic equipment to accommodate the requirements of older workers, and

health support programs for retirees)[86] should be designed, implemented, and evaluated for their health benefits and cost-effectiveness.

Health Consequences of
the Commute Between Home and Work

Commuting between home and work is an important extension of the occupational environment. Rush-hour commuting has been identified as a source of psychological stress, elevated blood pressure, performance decrements, and increased illness symptoms among full-time workers.[87-90] A recent study found that the negative emotional states associated with rush-hour commuting carry over from occupational and transit settings to the home environment.[91] Furthermore, working mothers whose commutes to and from work include stops at their children's day care centers are especially vulnerable to commuting stress.[92]

These findings pose a key question for future research: Are company-sponsored ridesharing programs effective in improving workers' health, job performance, and morale? A growing number of companies are investing in vanpool and carpool programs for their employees, yet little is known about the impacts of these programs on employee health and performance at work. Future studies should evaluate the health and performance effects of employees' participation in corporate ridesharing programs, as compared with alternative commuting modes (e.g., solo automobile driving, telecommuting from home or other remote locations via electronic links to a central worksite).[93,94]

Health Impacts of Economic Recessions,
Corporate Restructuring, and Unemployment

Economic recessions of the 1980s and 1990s raised the unemployment rate among U.S. workers and prompted major changes in corporate structure, including downsizing, rightsizing, and a shift from full-time to part-time employment in many sectors of the economy. These structural changes in work organizations have eroded the quality and scope of health insurance coverage and other employee benefits, especially among workers who have shifted from permanent to temporary or contract status and, generally, have placed greater demands on employees who are often asked to do more work for less compensation. There is also concern about workers who may remain employed but in positions they dislike or perceive to be below their level of competence. Merely surviving in a job may have deleterious health consequences under such conditions.[24] Moreover, employees are frequently confronted by changes in the physical arrangement and location of their worksite,[95,96] and the threat of job displacement through workplace automation.[97] Not surprisingly, then, workers' concerns about job security and the challenges of midlife career changes have increased in recent years.[98]

According to the demand/control model of occupational stress,[99,100] highly demanding jobs that offer few opportunities to workers for exercising "decision latitude" and personal control create the greatest psychological burdens or job strain and increased vulnerability to stress-related diseases. These occupational health risks can be expected to become more severe during times of rapid economic, organizational, and technological change. Moreover, the higher levels of stress and interpersonal strain brought about by corporate

restructuring and impending job loss may increase the incidence of employee burnout and workplace violence.[101,102,103]

Societal changes that have transformed the American workplace in recent years pose several challenges for worksite health programs. First, high-strain jobs need to be identified and redesigned to achieve a better balance between workers' psychological needs for control, the day-to-day demands of their work, and the performance criteria of their employers.[97,100,104,105] Second, employee assistance programs (EAPs) should develop strategies for providing increased counseling and social support among those employees most concerned about job security, relocation, and outplacement.[106,107] Finally, corporate programs designed to assist former employees who have lost their jobs, as they make the transition to new careers, need to be developed and evaluated for their effectiveness in preventing the health problems that are often associated with unemployment.[108-112]

Integrating Worksite Health Programs
With Community-Based Health Care Services

The rapid escalation of U.S. health care costs has provoked national debate about the feasibility and effectiveness of alternative cost-containment strategies. Managed competition, global budgets, and the rationing of medical care are among the structural reforms that have been proposed.[4,113] Regardless of the particular reforms enacted during the next few years, it is clear that health promotion, disease prevention, and injury prevention programs will play an increasingly important role in corporate, community, and providers' efforts to reduce the demand for, and costs of, medical care.[31,114,115]

The impending reform of the health care system has stimulated the development of several innovative worksite health programs in recent years.[3,4] Examples of these programs include the combined use of blood pressure monitoring, follow-up counseling, and referral to community physicians to reduce hypertension among employees at manufacturing plants;[116,117] and the establishment of employee advisory boards in blue-collar worksites to enhance social support, environmental quality, and workers' participation in the planning and evaluation of worksite health programs;[66,67,71] the Stanford Corporate Health Program, in which university researchers, corporate executives, insurance carriers, and physicians collaborate in evaluating the health and cost outcomes of employee wellness and medical programs;[4] the Stanford Coronary Risk Intervention Program (SCRIP), in which cardiac patients at the Stanford University School of Medicine are offered multicomponent treatment programs that combine lifestyle change regimens with pharmacological interventions delivered by telephone using computer algorithms;[36] and a variety of medical surveillance and risk-appraisal programs that use mail, telephone contacts, and "electronic house calls" to deliver primary care services to prospective or recovering patients at their homes and worksites.[24,37,38,39,118,119]

These innovative programs provide a solid foundation for developing even more comprehensive approaches to worksite and community health promotion in future research. For example, the collaboration among university researchers, corporate managers, insurance carriers, and primary care physicians, reflected in the SCRIP and Corporate Health Programs at the Stanford University School of Medicine, could be expanded to include other sectors of the community (e.g., public health officials, environmental health specialists, urban planners, television and news media) in an effort to establish comprehensive "healthy cities" programs.[120-124]

Also, telecommunications technologies such as electronic mail, telefax, video, and computer interactive systems could be used in corporate settings to encourage employee participation in worksite health promotion programs. Such systems could be used for the delivery of educational programs on AIDS prevention,[125,126] smoking cessation, environmental health and safety, emergency preparedness, social support, conflict management, and risk factor reduction through lifestyle change. Finally, corporate strategies for containing worksite health costs without compromising the quality of employees' medical care need to be developed and evaluated in future studies.

Methodological Issues in the Design, Implementation, and Evaluation of Worksite Health Promotion Programs

Ecologically oriented analyses of health promotion encompass a broad range of theoretical and disciplinary perspectives (e.g., medicine, public health, the behavioral sciences, environmental design, urban planning, law, and public policy). They also emphasize the importance of developing comprehensive interventions that span multiple life domains (e.g., residential, occupational, recreational, and health care settings) and using multiple methods to assess the health and cost-effectiveness of these programs. Considering the broad scope and complex structure of community-wide health promotion programs, it is not surprising that they often prove to be too cumbersome to implement effectively or, at best, difficult to sustain over extended periods of time.

The challenges of implementing broad-based interventions raise several practical questions about how best to foster and sustain community-wide health promotion programs and encourage the transfer of medical, behavioral, and environmental change technologies from academic settings to corporations, community organizations, and government agencies. Additional challenges include the integration of multimethod strategies for evaluating the health and financial outcomes of worksite health programs, and the provision of health promotion, disease and injury prevention, and managed care programs for nonpermanent workers, unemployed individuals, and minority populations.

Organizational Infrastructure to Foster and Sustain Comprehensive Health Promotion Programs

An important focus for future research is the development of collaborative links between corporate, community, and health care settings to foster comprehensive health programs. Successful efforts to establish community-wide collaboration in the development of health promotion programs have been made by the Stanford Corporate Health Program,[4] the Stanford Five City Project,[122] and the lifestyle modification programs developed at the University of California, Los Angeles.[1,127] Important goals are to promote the sharing of medical archives and databases and to avoid an adversarial stance among the various interest groups participating in these programs.[128]

A second research focus concerns the development and refinement of methodologies to encourage community-wide exchange of research findings, educational programs, and innovative health promotion programs. Examples of these technology transfer strategies include the *U.C. Berkeley Wellness Letter*, circulated to nearly one million subscribers throughout the nation; the statewide distribution of the *Wellness Guide* and *La Guia del*

Bienestar to low-income residents of California; the *Healthtrac* risk appraisal and self-care programs;[119] and the *Catalog of the Stanford University Health Promotion Resource Center*, which provides low-cost access to the print and media materials used in Stanford Medical School research projects.

In the future, successful employee health programs will be those based on collaboration between the business community, medical service providers, insurance carriers, government agencies, and universities.[4,5] The anticipated growth of managed care and community rating systems in the United States is likely to prompt the development of integration technologies or employer-community liaison groups to ensure the coordination of health promotion and medical services for employees, whether they are provided at the worksite or entirely off-site. Some coordinating group or agency will need to take a broad, integrative view of health care to ensure that a particular catchment area is well serviced and that periodic appraisals of community health are monitored as a basis for health care decision making.

Developing Multimethod Strategies to Evaluate the Health Outcomes of Worksite Wellness Programs

The extent to which worksite health promotion programs result in improved health outcomes for their participants is a major criterion for judging their value. Empirical studies of changes in employees' health status as a function of their involvement in worksite health promotion programs become more convincing to the extent that they employ prospective research designs comparing individuals and/or worksites randomly assigned to intervention and control groups, and demonstrate a pattern of theoretically predicted causal linkages among behavioral and/or environmental changes; intervening cognitive, emotional, physiological, and interpersonal processes; and multiple criteria of illness symptoms or improved health status.[8,129] In recent years, a growing number of studies undertaken to evaluate the health impacts of worksite interventions have met the first methodological requirement.[4] However, field-experimental demonstrations of theoretically predicted relationships between intervention components, intervening processes, and health outcomes have been more difficult to achieve.[25,26]

A major challenge for future research is to develop theoretically based and broader gauged studies that specify linkages among hypothesized predictor variables, moderating and mediating factors, and multiple criteria for evaluating the health impacts of worksite interventions. Among the categories of measures that might be usefully combined in future studies are (1) genetic and behavioral risk factors for disease,[130] socioeconomic, demographic, and job status[131] to identify employees who are at highest risk for health problems; (2) behavioral and physiological processes that may render employees more or less vulnerable to health problems, including their lifestyle modification efforts,[127,132] psychoneuroendocrine processes,[133,134] hypertension,[135] psychological stress and coping strategies;[136,137,138] and (3) a variety of social and personal health outcomes including organizational conflict and cohesion,[23,62,139] employee illness symptoms,[36] injury rates,[140] and wellness levels.[24] By adopting a broader array of measurement strategies than has been used in the past, researchers will be better able to test hypothesized links among behavioral and environmental interventions, physiological and psychosocial processes, and disease or wellness outcomes.[8]

Another methodological approach that warrants greater attention in future studies is the use of "real time" measurement strategies for (1) recording patterns of emotional

response, health behavior, and physiology across different environmental contexts (e.g., at work, at home, and during the commute between home and work), and (2) providing feedback to employees about their levels of exposure to chemical pollutants. Real-time measures of workers' exposure to air contaminants[141] and random-event sampling of behavior and subjective experiences using electronic paging devices,[22] daily time budgets and activity logs,[92] telephone care and computerized housecalls,[4,38] and ambulatory blood pressure monitoring[142,143] are examples of innovative data-gathering techniques that could be usefully combined in future studies of worksite health.

Linking Measures of Productivity, Organizational Effectiveness, and Cost-Effectiveness in Worksite Health Program Evaluations

From both ethical and regulatory perspectives, employers are morally and legally bound to maintain healthful working conditions and to provide high-quality health programs for their workers, despite the fact that these programs require a substantial financial investment that affects the corporate "bottom line." Ideally, financial considerations should not diminish employers' efforts to provide high-quality work environments and health programs for their employees. However, it is important to recognize that corporate decisions to invest in and sustain worksite health programs are influenced by estimates of their anticipated cost-effectiveness and cost benefits. Therefore, developing improved measures of the financial and organizational outcomes of worksite health programs is an important task for future research. In particular, it is necessary to develop more standardized and uniformly acceptable definitions of terms such as cost-effectiveness, cost benefit, and productivity, which currently are defined in highly idiosyncratic ways, thereby precluding meta-analytic evaluations of the data from multiple studies.[3,27,33,144,145]

Appraisals of the cost-effectiveness of worksite health programs are based on estimates of direct, indirect, and net program costs. The direct financial costs associated with worksite health programs include expenditures for research and development, capital investment, and overhead associated with implementation and maintenance of interventions. Indirect financial costs include employees' time away from work and opportunity costs associated with their participation in health-related programs. Net costs reflect the difference between total financial expenses associated with a particular program and its total financial benefits (e.g., higher levels of productivity and reduced corporate expenditures for workers' injuries, illnesses, absenteeism, and attrition).[144,145] Cost-effectiveness is defined as net program costs expended per health benefits achieved.

Reliable estimates of cost-effectiveness, both prior and subsequent to the initiation of health-promotive interventions, have been difficult to calculate because the financial costs and health benefits associated with these programs are not always apparent (let alone measurable) in the short run. For example, the higher levels of energy and morale associated with improved physical health may eventuate, over time, in greater creativity and innovation among office workers. Yet these psychological and cognitive benefits of program participation are more difficult to calibrate than biometric health outcomes (e.g., reduced hypertension and cholesterol levels). Moreover, the corporate financial benefits (e.g., income from patents or operational efficiencies) associated with improvements in employees' mental health may become evident only after a prolonged period, rendering them less likely to be reflected in short-term cost-effectiveness or cost-benefit appraisals.

Future research on the cost-effectiveness of these programs can be improved in several respects. First, a wider array of productivity and organizational effectiveness criteria should be incorporated in future studies. Productivity refers to the quantity, quality, and timeliness of an employee's work performance. Organizational effectiveness is defined more broadly to include not only individualized measures of productivity but also aggregate rates of absenteeism, staff turnover and retention, frequency and quality of communication among coworkers, the corporation's image in the broader community, employee health, injury reduction, and morale at the level of work groups, departments, and whole organizations.[51,146-150] The conceptual and empirical links among diverse criteria of productivity, organizational effectiveness, and well-being warrant further study in future research.

Second, the relative cost-effectiveness of behavioral, environmental, and biomedical interventions based on primary prevention (reduction of injury or illness risk factors), secondary prevention (early detection and treatment of disease), and tertiary prevention (provision of medical and rehabilitative services to minimize morbidity and hasten recovery from illness or injury) is an important issue that should be evaluated more thoroughly in future research.[4,27,113,151]

Developing Health Promotion Programs for Nonpermanent Workers, Unemployed Individuals, and Minority Populations

One of the greatest challenges facing the field of worksite health and community health promotion, more generally, is to reduce disease prevalence among low-socioeconomic and minority populations—groups that are at greater risk for a variety of illnesses and for whom large-scale disease prevention programs have been shown to be less effective than for higher socioeconomic and nonminority populations.[131,152,153,154] These pockets of disease prevalence within low-income and minority populations suggest some important directions for the design and evaluation of worksite health programs that address the specialized needs of high-risk groups.

For example, most health maintenance organizations (HMOs), preferred provider organizations (PPOs), and managed care organizations (MCOs) have been designed to address the medical needs of permanent employees and their families, rather than those of nonpermanent workers, unemployed individuals, and indigent groups. Challenges for the future include (1) the broadening of HMO, PPO, and MCO programs to encompass a wider variety of wellness, disease prevention, and injury prevention services; (2) the development of new managed care options for vulnerable groups in the population that currently lack access to adequate health care; and (3) the development of employee assistance and community health programs to assist marginally employed and unemployed workers.[155]

Recently, important strides have been made toward achieving these goals through the establishment of healthy community initiatives in several states[124,156,157] and disease prevention programs for minority and indigent populations.[158-162] These efforts should be expanded in future research through further consolidation of managed care programs for permanent employees with innovative medical and preventive services that address the needs of underserved populations.

CONCLUSIONS

Our review of research developments and emerging directions in the field of worksite health programming suggests that a fundamental paradigm shift may be occurring, from individually targeted, organization-specific corporate wellness programs toward broader formulations that reflect the rapidly changing contexts of work and health. This broader view highlights the importance of linking organizational, educational, medical, techno- logical, and regulatory strategies to enhance the health of employees and their dependents. The emerging paradigm is broadly concerned with the ecology of work and health.

Corporate wellness programs traditionally consisted of individually focused lifestyle change programs, organized and presented by employers for their workers at the worksite. Implementing and evaluating these isolated interventions on an organization-specific basis made sense when both the nature of work and its societal contexts were relatively stable. However, in the context of rapid societal change and powerful megatrends that are altering the structure, locations of, and incentives for work (e.g., current trends toward corporate downsizing and part-time employment, telecommuting and homework, and rising employer health costs), narrowly focused models and applications of worksite health programs are no longer adequate. Instead, a broader ecological perspective is required—one that views the workplace as part of a larger community system and accounts for the pervasive influence of changes in work organizations and technologies, household structures, the health care system, and the regulatory environment on employee well-being.

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