

A Conceptual Framework for Integrating Workplace Health Promotion and Occupational Ergonomics Programs

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SYNOPSIS

Musculoskeletal, cardiovascular, and mental health are all associated with the physical and psychosocial conditions of work, as well as with individual health behaviors. An integrated approach to workplace health-promotion programs should include attention to the work environment, especially in light of recent findings that work organization influences so-called lifestyle or health behaviors. Macroergonomics provides a framework to improve both physical and organizational features of work and, in the process, to empower individual workers. The Center for the Promotion of Health in the New England Workplace (CPH-NEW) is a research-to-practice effort examining the effectiveness of worksite programs that combine occupational safety and health—especially ergonomics—with health promotion, emphasizing the contribution of work organization to both. Two intervention studies are underway in three different sectors: health care, corrections, and manufacturing. Each study features participatory structures to facilitate employee input into health goal-setting, program design and development, and evaluation, with the goal of enhanced effectiveness and longer-term sustainability.

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The National Institute for Occupational Safety and Health (NIOSH) WorkLife Initiative (<http://www.cdc.gov/niosh/worklife>) seeks to promote a coordinated or integrated approach to the control of occupational health hazards and health-risk reduction that targets individual health behaviors or hazards originating outside the workplace. The Center for the Promotion of Health in the New England Workplace (CPH-NEW) is a Center for Excellence funded in 2006 through the NIOSH WorkLife Initiative. The CPH-NEW research and translational projects share the objective of implementing and comparing several strategies for integrating occupational safety and health (OSH) with workplace health promotion (WHP). The OSH focus is on ergonomics because of the many influences of physical and work organization hazards on musculoskeletal, cardiovascular, and mental health. These same conditions are also closely related to common health promotion (HP) targets such as smoking, exercise, diet, and obesity. Traditional HP programs often have low compliance from lower socioeconomic groups; participatory rather than top-down programs are favored as a means to ensure that worker priorities are addressed in a context-sensitive manner. In addition, the key factors of decision latitude and social support at work are enhanced more consistently through participatory programs, which have much in common with participatory ergonomics models.

OCCUPATIONAL ERGONOMICS AND HEALTH

Occupational ergonomics attempts to improve the fit between the workforce and the work environment through the optimized design of jobs and work systems. Ergonomics programs most often focus on physical job features, such as tool or workstation dimensions, heavy lifting, awkward postures, and repetitive tasks. The most common goal is avoidance of work-related musculoskeletal disorders (MSDs) such as low back pain and tendonitis, which represent a major cause of morbidity and absenteeism and generate high disability and medical care costs in the U.S. and other developed countries.^{1,2}

Musculoskeletal health represents not only specific disorders, but also the continuum of normal and abnormal age-related physiological changes in muscle, bone, and joint function, as well as fitness-related performance capacity involving strength, mobility, and lean muscle mass. Declining musculoskeletal performance can be reversed into the seventh decade, thus supporting a comprehensive approach to risk identification and intervention.^{3,4} For example, a benchmark prospective study of 6,500 Finnish municipal employees

found that loss of function after 45 years of age was clustered and conditional on physical work-demand profiles.^{5,6} Active jobs did not enhance musculoskeletal fitness later in life.⁷ Protective factors included a positive attitude toward aging and fitness, the presence of teamwork and coworker support, reductions in unabated repetitive work, lower management strain and noise at work, better work postures, satisfaction with supervisor's attitude, and leisure exercise.⁸ Two other cohort studies have similarly highlighted the qualitative difference in effects of occupational and voluntary physical activity on cardiovascular outcomes and all-cause mortality.^{9,10}

Musculoskeletal, mental, and cardiovascular health all share several occupational risk factors, both physical and psychosocial. The proportion of musculoskeletal morbidity attributable to physical work demands is considerable.¹¹⁻¹³ Psychosocial stressors, especially low decision latitude, are also linked, but the mechanism(s) may not be fully independent of physical factors.^{11,12,14-18} In contrast, key psychosocial factors such as quantitative demands (e.g., time pressure), supervisor and coworker support, and intrinsic and extrinsic rewards have well-documented effects for cardiovascular disease (CVD)¹⁹⁻²⁵ and mental health.²⁶⁻³³

Shift work is another widespread organizational stressor with diverse direct and indirect health effects.³⁴⁻³⁶ Besides sleep disruption, night work is associated with redistributed eating, lower intake of dietary fiber,³⁷ adverse serum lipid and cholesterol profiles,³⁸ oxidative stress,³⁹ and obesity.^{35,40} Consequent risks include higher incidence of heart disease, particularly from interactions with smoking and obesity.^{36,41,42} Night work, irregular schedules, and involuntary overtime increase absenteeism⁴³ and work-family conflict⁴⁴ with implications for mental health (notably in low-reward jobs⁴⁵) and for women with primary family responsibilities.^{46,47}

Workplace interventions to reduce MSDs tend to focus primarily on reduction of physical job demands, but sometimes interventions on physical workplace conditions require addressing upstream organizational factors that operate at the group or systems level and are influenced by work technology. This is the macro-ergonomic approach.⁴⁸ Work organization represents a set of underlying determinants of both the physical job demands and the psychosocial work environment.⁴⁹ An effective occupational ergonomics program must address work organization features such as task design, incentive pay, decision latitude, quality of supervision, work scheduling, understaffing, and division of labor among workers and between people and machines.⁵⁰

When the explicit intervention goal is to improve

mental or cardiovascular health through the psychosocial work environment, more complex, large-scale organizational change is usually required.⁵¹ A few studies have shown benefits ranging from reduced work-related disability to better work/family balance.⁵² Multiple health indicators improved following a health-motivated, multifaceted program to promote institutional change.⁵³

HEALTH PROMOTION, SOCIOECONOMIC DISPARITIES IN HEALTH, AND THE WORK ENVIRONMENT

Undesirable physical and psychosocial job features are distributed differentially by gender, socioeconomic status, race/ethnicity, and national origin^{54–59} in many societies. These factors are thus part of the context of any attempt to improve the health of people in a low socioeconomic position, who are also more likely to experience poor diet, inadequate exercise, tobacco smoke and other environmental hazards, and lack of access to primary care and medical screening.^{60,61} Additive or even synergistic effects may result from hazardous workplace exposures, whether physical or organizational.

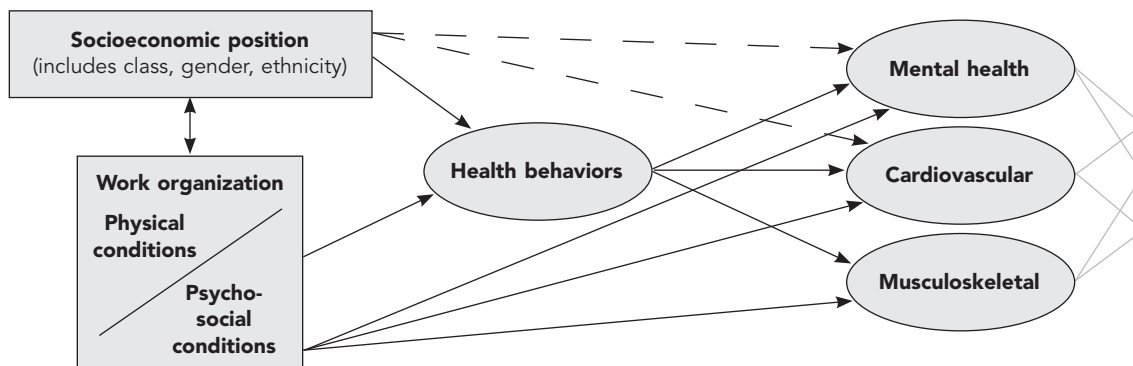
Traditionally, HP practice has focused on individual change in health behaviors such as exercise, diet, tobacco smoking, and stress management and coping skills, with these lifestyle risk factors being well-established contributors to chronic conditions such as obesity, hypertension, CVD, and diabetes. They have also been associated with MSD risk, albeit inconsistently.^{62–72}

However, HP is a broader public health activity than the prevention of specific diseases at the individual level. More recent evolutions have addressed environmental influences on health behaviors in the community^{73,74} and in the work setting.⁷⁵ “Social HP”⁷⁶ involves activities conducted at the community or societal level, complementing the individual focus. The World Health Organization’s Ottawa Charter for Health Promotion highlighted the impact of working and living conditions on socioeconomic health disparities:

Health promotion action aims at reducing differences in current health status and ensuring equal opportunities and resources. . . . People cannot achieve their fullest health potential unless they are able to take control of those things which determine their health.⁷⁷

Health behaviors represent decisions based on intrinsic factors (knowledge, beliefs, motivation) and also in relation to factors in the physical and psychosocial environment. An emerging literature indicates the effect of working conditions on individual health behaviors such as smoking, diet, and exercise (Figure). For example, low decision latitude, low rewards relative to effort, and other psychosocial stressors at work have been associated with leisure time inactivity, obesity, and tobacco and alcohol consumption.^{78–90} In turn, such combinations of risk factors may challenge health even further; examples are the interaction of cigarette smoking with physically heavy jobs on the risk of vertebral pathology,⁹¹ and that of body mass index with physical workload on the risk of chronic shoulder disorders.⁹² Thus, to be effective, WHP programs should address organizational conditions^{93,94} in addition to individual behaviors. Healthy workplaces should

Figure. Overview of associations among working conditions, socioeconomic position, health behaviors,^a and selected health domains^b



^aHealth behaviors include tobacco and alcohol consumption, aerobic exercise, nutrition, and sleep.

^bNot shown in the diagram: mediators of other links from socioeconomic status to health or the reciprocal effects of health on socioeconomic position, working conditions, or health behaviors.

involve employees in decisions about work processes, promote learning, reward appropriately, and attend to interpersonal relationships.

HEALTH DECISION-MAKING AND PARTICIPATORY PROGRAMS

Traditionally designed WHP programs show overall positive impact, albeit with variable study rigor.⁹⁵⁻⁹⁹ A review of 316 WHP programs reported positive results for weight control; borderline positive results for nutrition, exercise, and cholesterol management; and weak results for health-risk appraisals.⁹⁸ However, detailed analyses of intervention components suggest equivocal success in changing lifestyle characteristics such as dietary habits or physical activity.^{96,97,99} These uncertainties are mirrored in workplace preventive lifting programs (as opposed to ergonomic interventions): evident short-term benefits but problematic long-term adherence and benefits.¹⁰⁰⁻¹⁰³ Program and behavioral sustainability are, therefore, major concerns.¹⁰⁴

One potential indicator of durable effectiveness is health self-efficacy (HSE), the belief in one's own capacity to improve and maintain health. HSE, an important component of healthy decision-making, can be viewed as an intermediary variable on the path to good health, being associated with smoking cessation, increased exercise, improved diet,¹⁰⁵⁻¹¹⁰ and reduced disability from musculoskeletal pain.¹¹¹ HSE can change over time^{109,110} and is affected positively by successful health mastery experiences and the removal of barriers to healthy behaviors. If the goal is healthy decision-making by individuals, the work environment itself should reinforce employee competence in decision-making.¹¹²

Participatory programs that instill a sense of empowerment are likely to bolster program effectiveness,¹¹³ as HSE supports a range of healthy behaviors. The very act of participating in a team working toward a common goal can improve psychosocial aspects of the work environment.^{114,115} Thus, workplace programs empowering participant decision-making at the workplace could also directly reduce psychosocial strain and its negative health consequences.¹¹⁶ Michie et al. summarized the potential health benefits of increased worker participation in decision-making, including better communication, improved support, and feedback.²⁹

Comprehensive employee health programs should identify potential obstacles and facilitators that operate at multiple levels.^{60,113,117-121} Workers are often best qualified to evaluate programmatic congruence with their own psychosocial and material needs, and can identify incumbent health barriers and opportunities

from their experiential knowledge of the workplace culture and environment.^{118,122}

Participatory approaches to organizational flexibility, cited as important ingredients in successful community health interventions,¹²³ can apply in work settings. Semi-autonomous groups, such as workplace health and safety committees and apprenticeship training programs, can be modified as agents for individual health change, provided that parameters of action are predefined and acceptable to the workforce. In our own program experience, smoking cessation in an asbestos-exposed workforce, which had initiated its own health prevention programs, exceeded national norms by a large margin.¹²⁴

Workplace participatory ergonomics programs can both remediate hazardous working conditions and engage workers in a process that is empowering.¹²⁵ Worker expertise and confidence in applying knowledge are also critical to maintain improvements and avoid the introduction of new hazards as production technology changes over time. The iterative design approach that is central to participatory ergonomics provides ample opportunities for addressing health concerns during a workplace change process. Successful participatory ergonomics thus represents a form of HP¹¹² and produces a strong sense of commitment to the broader program,¹²⁶ thereby enhancing program sustainability.

RISK ASSESSMENT, INCENTIVIZATION, AND COST-EFFECTIVENESS

Many of the cost-effectiveness arguments for WHP seem to show a return on investment.¹²⁷ Chapman reviewed 42 epidemiologic studies with a total of 537,319 employee participants followed for a mean of 3.6 years. In his meta-analysis, employee absenteeism decreased by a mean of 30.0% (range: 22.3-38.4), and health-care costs decreased by 21.8% (range: 12.7-31.0).¹²⁸ Among the 16 studies with cost-benefit analyses, each dollar spent returned \$5.67 to the company (range: \$3.40-\$7.88). There are, however, difficulties controlling for selection and short-term efficacy; when substantive economic metrics, such as reduced group health costs among participants, are weighed, positive effects may be more modest.¹²⁹ Indirect benefits of WHP programs for employers have also been reported, such as improved morale, increased productivity, enhanced retention, and reduced health-care costs.^{113,130-133} These may extend to family members.¹³¹

One commonly used assessment instrument in WHP is the health risk appraisal (HRA), a standardized compilation of questionnaire and test results that often

serves as a baseline for both risk attribution and incentivization. HRAs rarely assess occupational risk factors that may contribute to long-latency morbidity, either directly or through interaction with personal behaviors. Further, multifactorial health outcomes such as MSDs and CVD are disproportionately likely to be rejected as claims for workers' compensation.¹³⁴⁻¹³⁸ For both of these reasons, work-related components of multicausal morbidity are likely to be undervalued. This speaks to the importance of the combined assessment of workers' compensation and group health data.

One important distinction differentiates individual motivation and group behavior. There are sound reasons to base HP incentives on changes in individual behavior among individuals at highest risk.^{139,140} In the workplace, there is a potentially corresponding tradition of individual productivity incentives, such as overtime pay and bonuses. However, workplace culture also imposes a collective sensibility regarding group-insured benefits, union dues, seniority, and charitable contributions. For example, there is often unease about altering the benefit structure in ways that transfer risk to the employee. Although the "moral hazard" argument for transparent health-care costs has support in health policy debate, there is strong employee resistance to the concept that individuals must assume a larger portion of their costs.¹⁴¹

CPH-NEW: AN INTEGRATED APPROACH TO HEALTH PROMOTION AND PROTECTION

Following on these scientific and policy considerations, CPH-NEW promotes a combined approach to addressing risks arising from both personal behaviors and the work environment, with a focus on ergonomic hazards broadly defined.¹¹⁵ Previous studies have suggested that adding OSH interventions to WHP increases their effectiveness compared with traditional WHPs alone;^{60,113} those OSH programs primarily addressed chemical exposures rather than occupational ergonomics. There does not appear to be any reported evaluation of adding WHP to OSH interventions, compared with OSH alone.

There is a recognized disparity between the willingness of workers to accept health and safety activities directed at workplace hazards and their acceptance of employer-sponsored HP activities.⁹⁵ Employees who feel that workplace hazards are ignored may be understandably unreceptive to employer advice about their activities during personal time. Conversely, managers have blamed MSDs and CVD on worker obesity, smoking, and other personal risk factors. Combining the two sets of concerns may offer an equitable solution to this impasse by facilitating the sharing of responsibility

between workers and employers. Further, integrating ergonomics with HP, in both the needs assessment and program recommendations, is likely to produce more tailored interventions that take into account the full risk profile, rather than compartmentalized approaches. For example, WHP programs often emphasize walking programs for fitness, but these may have little perceived value to people who already spend the entire workday on their feet.

In two separate research projects with complementary study designs, CPH-NEW is comparing the health benefits and cost-effectiveness of an integrated approach vs. an OSH intervention alone, and of an ongoing participatory process vs. more conventional, expert-directed control measures. The economic analyses utilize a comprehensive net-cost approach^{142,143} to incorporate the costs of investment on equipment and labor (direct costs) plus the avoided costs of lost work time, medical care and turnover (indirect costs), and productivity improvements (spillover effects).

One of these projects evaluates the benefits of an ergonomics intervention in long-term-care centers (nursing homes) with and without wellness programs, followed by a second stage in which participatory health design teams have been initiated in three centers without existing wellness programs. The second project is implementing and comparing traditional best-practices programs with participatory programs in both public sector (department of corrections) and manufacturing environments. There will be multiple measures of effectiveness, evaluating both changes in exposures and in morbidity, with at least two years of follow-up for each project.

Some preliminary findings from the nursing home study illustrate the need for an integrated approach to employee health. Baseline questionnaire surveys were distributed to direct care personnel (primarily nurses and aides) in 12 centers in Maryland and Maine owned by a single company. A total of 920 surveys were returned (mean response was 70% of all eligible employees). Respondents were mostly female (92%), 47% were African American or African, and the mean age was 42 (± 13) years.

The study population was notable for a high prevalence of chronic health conditions and risk factors (Table 1). One-third (35%) reported diagnosis or treatment of a chronic health condition (diabetes, high blood pressure, high cholesterol, or low back disease), of which hypertension was the most common. More than 70% of respondents reported musculoskeletal symptoms during the previous three months, and 21% said that their pain interfered at least moderately with paid work or housework.

Table 1. Baseline health characteristics of 920 clinical staff in 12 nursing homes, surveyed by self-administered questionnaire, 2006–2007

Health condition or risk factor	Prevalence (percent)
Body mass index	
Overweight (>25–30)	34
Obese or extremely obese (>30)	37
Smoking	
Current	26
Former	19
Disease history ^a (self-reported)	
Diabetes	9
Hypertension	24
High cholesterol	18
Aerobic exercise at least three times per week	13
MSD pain in past three months	
Back	54
Knee/leg	39
Shoulder/arm/hand	45
Physical or verbal assault at work, by resident or family member, in past three months	48

^aMedical diagnosis and/or treatment
MSD = musculoskeletal disorder

Fewer than half of the respondents reported frequent exercising to work up a sweat. Six of 10 non-exercisers planned to begin exercising more, but only 39% were confident that they could do so for six months. In contrast, despite the high prevalence of overweight, only 30% reported that they planned to lose weight. Six respondents who indicated smoking “often” planned to quit within the next six months.

Preliminary analyses demonstrated several associations between features of the work environment and individual health behaviors. For example, current smokers were more likely than nonsmokers to be in jobs with psychosocial strain (high demands relative to decision latitude) and to have had at least one recent physical assault at work. Those who exercised at least three times per week experienced about a 10% higher degree of control over their work schedules than those who exercised less than once per week. Higher self-rated health (SF-12)¹⁴⁴ was associated with lower job strain, better supervisor support and work-family balance, and no recent physical assault. Confidence in one’s ability to get a full night’s sleep was lowest among night (third-shift) workers and also slightly lower among those who had experienced three assaults at work in the past three months. Mental health (SF-12 Mental Components Summary)¹⁴⁴ was lower with increasing age and body mass index, physically

awkward work, and work interference with home life, while weekly aerobic exercise and coworker support had protective influences (model R² = 0.152).

Concurrent with these findings were the replies to open-ended questions at the end of the survey, to which a large proportion of the participants provided responses (Table 2). Staffing, work hours, and general overload clearly represented a major challenge to the health of these employees, while resident handling and associated back pain was a secondary although important concern. Simultaneously, a large number also wanted to lose weight, improve their diets, and exercise more regularly.

The current intervention program in this sector involved employee-centered design teams¹⁴⁵ in three centers; another three centers served as the control group. Initial focus groups of nursing aides in the intervention centers highlighted an overlapping set of health concerns with those noted in the survey responses. Stress at work was linked to staffing levels (e.g., effects of absenteeism on coworkers); quality of communication with and support from supervisors; having to handle combative residents; and general sensory overload at work.

These survey and focus group findings not only provided empirical support for the feasibility of the overall approach, but the availability of these findings was critical to launching the first phase of the

Table 2. Categorized responses to open-ended questions on self-administered survey of 658 nursing home employees, Maryland, 2006

Questions	Proportion of responses to the question (percent)
“How does your job or the workplace affect your health?” (total response = 63%) ^a	
Insufficient staffing	30
Stress, long hours, overwork, exhaustion	22
Heavy lifting	12
Inadequate lifting equipment	12
Back pain	12
“What changes in personal health would you most like to see?” (total response = 77%) ^a	
Weight loss	41
More exercise	12
Better nutrition	12
Quit smoking	12

^aProportion of all participants who answered this question; answers were not mutually exclusive.

participatory intervention. Regarding feasibility, the results indicated that these employees were able to articulate and prioritize their HP concerns, and they also reflected a general desire to improve their health. The interdependent nature of the identified concerns confirmed that an integrated OSH and WHP program employing macroergonomics would be necessary to fully address them. Availability and consistency in the findings was essential to successfully launching the activities of the participatory health design teams. The findings allowed team members to immediately begin focusing on the set of HP topics that mattered most to a large number of employees; in general, this also helped validate the approach to the organization.

For example, the design teams at all three centers prioritized activities to improve access to healthy food and to facilitate aerobic exercise during active rest breaks (also for stress reduction) during the workday, while issues of teamwork, communication, and supervision were identified for longer-term action. There has also been discussion of reducing back injury risk through stretching and strengthening exercises, as well as enhancing the effectiveness of the corporate program on safe resident handling (lifting reduction) already in place.

CONCLUSION

WHP programs can approach the workplace as more than a venue for delivering services, by addressing environmental obstacles to HP in the workplace and by accounting for the effects of working conditions, including whether employees are empowered as decision makers. Workers are more apt to accept HP programs if they are accompanied by workplace changes as well. Occupational ergonomics in its broadest sense provides a framework to address workplace preconditions for musculoskeletal, cardiovascular, and mental health. The principle of combining OSH and HP could readily be extended to other domains, such as respiratory health (with interventions on indoor air quality, smoking, and other asthma-control measures) and reproductive health (workplace chemical exposures and maternal nutrition). With employee input into program priorities and activities, improved HSE may help sustain behavioral change. Thus, there is a strong scientific justification for integrating WHP and ergonomics programs, although only modest empirical evidence is available to date on potential health effects. CPH-NEW is addressing these questions in two workplace intervention studies that emphasize macroergonomic issues (i.e., work organization and participatory programs) to the extent possible.

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An earlier literature review on some of these topics is found in "Conceptual Issues in Worksite Health Promotion," by Eberhard Wenzel, available from: URL: <http://www.ldb.org/whpr.htm>.

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