Workplace Health Protection and Promotion through Participatory Ergonomics: An Integrated Approach

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SYNOPSIS

A multidisciplinary team of researchers at the Center for the Promotion of Health in the New England Workplace (CPH-NEW) developed an evidence-based approach to address three recognized challenges to workplace programs designed to improve employee health: establishing employee ownership, integrating with work organization, and sustainability. The two main innovations being introduced in combination were (*1*) integrating traditional workplace health protection (e.g., ergonomics, industrial hygiene) with health promotion (e.g., assisting workers in improving health behaviors) and (*2*) introducing a bottom-up participatory model for engaging employees in innovative iterative design efforts to enhance both components of this integrated program. In the program, which was modeled after participatory ergonomics programs, teams of workers engage in the iterative design of workplace interventions to address their prioritized health concerns with the support of a multilevel steering committee. The integrated approach being tested can complement existing worksite safety and health initiatives and promote organizational learning, with expected synergistic effects.

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The Center for the Promotion of Health in the New England Workplace (CPH-NEW)[1] is one of three centers of research excellence established by the National Institute for Occupational Safety and Health (NIOSH) WorkLife Initiative[2] to develop more effective workplace interventions to sustain and improve worker health. As its name implies, the WorkLife Initiative seeks to explore more coordinated and integrated approaches to workplace health protection and health promotion that do not ignore the complex interactions between work and nonwork factors. A multidisciplinary team of CPH-NEW researchers developed an evidence-based approach to address three recognized challenges to workplace programs designed to improve employee health: establishing employee ownership, integrating with work organization, and sustainability. The CPH-NEW approach explores two innovations for workplace programs: (*1*) integrating traditional workplace health protection (e.g., ergonomics, industrial hygiene) with health promotion (e.g., assisting workers in improving health behaviors) and (*2*) introducing a bottom-up participatory model for engaging employees in innovative iterative design efforts to enhance both components of this integrated program.

The scientific evidence and rationale for integrating traditional workplace health protection with health promotion is provided in a companion article in this issue of *Public Health Reports*.[3] Our main goals in this article are to provide the scientific evidence and rationale for including the second innovation of a bottom-up participatory approach, and also to provide an implementation plan for a program that includes both of these innovations. Evidence of the need to more actively engage employees in health promotion programs is presented first, followed by the various means the CPH-NEW research team considered for achieving this goal.

A case is made for using participatory ergonomics (PE) for both health protection and health promotion, whereby teams of workers engage in the iterative design of workplace interventions to address their prioritized health concerns with the support of a multilevel steering committee. Program startup depends on assessing organizational readiness, gaining the full support of administrators, creating meaningful support roles for supervisors, and providing training on the basic principles of ergonomics, health promotion, and teamwork. Organizational learning and the overall success of the approach depend on good macroergonomic design of the program itself, such as embedding tracking tools to enable employees at all levels of the organization to monitor health promotion efforts and progress. The program is designed to complement existing worksite safety and health initiatives, such as conventional workplace health promotion programs or the use of ergonomics to reduce musculoskeletal injuries, with expected synergistic effects. Lessons learned from ongoing field studies are presented with regard to the practical considerations of implementing and managing a program like this to assure long-term program sustainability.

WORKPLACE HEALTH PROMOTION

Participatory approaches to workplace health promotion

According to the Joint Committee on Health Education and Health Promotion Terminology,[4] health promotion is any planned combination of educational, political, environmental, regulatory, or organizational mechanisms that supports actions and conditions of living conducive to the health of individuals, groups, and communities. Thus, implementation of health promotion programs in the workplace will require a systems approach to be effective. This means that health promotion programming must consider the appropriate environmental, organizational, structural, and communication channels, as well as policy changes.[5,6] Furthermore, the worksite has been identified as an optimal place for addressing individual health. Worksites provide access to employees through a controlled environmental and communication support system, and provide a social support system needed to change behavior.[7]

To enhance employee participation in health promotion programs offered at the worksite, McLeroy and colleagues[8] recommend an ecological approach. In this framework, multiple levels of influence must be identified for an effective program. This ecological approach also emphasizes the importance of the dynamic interactions between an individual and the workplace. Four levels of influence have been identified: (*1*) intrapersonal (how people acquire knowledge, attitudes, and skills), (*2*) interpersonal (defines individual's social identity and role within the community, family, or social group), (*3*) institutional (rules, regulations, policies and/or unwritten expectations at work that may prevent an individual from participating), and (*4*) community (community resources available). This ecological perspective reveals the need to address participants' preferences, perceived barriers, and support system needs for achieving and maintaining good health.

There is good evidence that worksite health promotion programs benefit both employers and employees by addressing various areas of health, including

smoking cessation, physical activity, and dietary habits.[9] Many opportunities exist for environmental and policy changes to foster healthy lifestyle behaviors in the workplace (e.g., providing easier access to stairwells to increase physical activity). Also, management can adopt policies that provide employees with opportunities to practice lifestyle changes.[10] Fielding specifies a number of factors important to program success, such as long-term commitment, top management support, employee involvement, professional leadership, defined objectives, careful planning, and confidentiality.[11] Other conditions for success include senior management involvement, staff participation in planning, focus on employee needs, optimal use of onsite resources (e.g., access to consultants and union representatives with ergonomics expertise; in-house construction/machining capacity or access to a shop; personnel time allocated to ergonomic analysis and problem identification; and training resources), integration with workplace environment (e.g., policy, mission, goals), tailoring to specific features of the work environment, long-term commitment, and program evaluation.[12]

Evidence also suggests that the key to long-term, sustainable workplace health protection and health promotion programs may depend on new forms of participation by the workers who stand to benefit most from these programs. For example, initial successes in health promotion programs do not necessarily predict sustainability of health behavior changes.[13,14] Most worksite health promotion programs lack information regarding program maintenance and long-term outcomes for participants.[9] It has also been noted that many interventions may be too short to effect sustainable change in health behaviors.[15,16] Another concern is the program's ability to supply participants with "the means for project durability" long after the "experts" and outside consultants have left.[17]

A participatory approach in which employees are actively engaged in the decision-making, problem-solving actions, and evaluation appears to be necessary for the success of a health promotion program.[11,12,18] Such an approach does not follow the traditional top-down design and is thought to make the questions addressed, processes, and outcomes more meaningful to all employees.[19] Top management support, while crucial, does not guarantee a program's success.[20] Aust and Ducki emphasize that participation and empowerment are more crucial aspects in health promotion programs. Involving employees in decision-making processes and self-education may enhance the development of personal capacities for successful design of health promotion programs, while also being indirectly health-enhancing.[18] A study by Marcus et al. found that tailoring a program to an individual's readiness significantly increased exercise and exercise maintenance.[21] Individual preferences in physical activities should be considered when designing physical activity programs, and will ultimately affect their success rates.[22,23]

Furthermore, a participatory approach in health promotion programs contributes to sustainability, because the target population has direct responsibility for the program's identified outcomes.[24] Others have described this approach as actively engaging stakeholders in project development and in generating shared solutions to shared problems.[25] In a review of worksite health promotion programs, Birken and Linnan emphasized the importance of engaging all stakeholders in the stages of planning, development, implementation, and evaluation to achieve desired employee health outcomes that are sustained over time.[20]

MODEL APPROACHES: PE AND HEALTH CIRCLES

Health circles are largely a European phenomenon that focus on making permanent changes in organizational structure to benefit employee health.[18] Health circles are a good example of how engaging workers as subject-matter experts in design efforts can lead to improvement of physical and psychosocial working conditions, with positive impacts on employee health, well-being, and absenteeism.[26] However, PE was adopted by CPH-NEW researchers as an even better approach for continuously engaging employees in workplace health protection and health promotion efforts in ways that can be integrated with existing worksite safety and health initiatives, such as ergonomics or conventional health promotion programs.

One study has described PE thusly: "Participatory ergonomics is an approach resulting from several trends: a rise in participation in society, organization of production according to sociotechnical principles, and the development of ergonomics from 'micro' to 'macro.'"[27] PE is a sub-area of macroergonomics in which workers are involved in workplace, job, and work organization design (or redesign) efforts that will directly affect their jobs.[28] Sociotechnical principles are fundamental in designing work systems with the goal of ensuring a fully harmonized work system across several subsystems: the personnel subsystem (who performs the work), the technological subsystem (how the work is performed), the external environment (outside of the organization), the internal environment (psychosocial and physical), and the design of the organization.[29] Sustainable programs based on employee participation, such as PE, can be designed

and achieved through an understanding of the interrelationships among the sociotechnical elements within a larger work system.[30,31]

Although there is no single best way to implement a PE program due to large differences between work organizations,[27,32] all programs engage workers in an iterative design process to optimize worker well-being and productivity. Initial training in ergonomics fundamentals can enable small teams to identify workplace design features and work processes most in need of attention. With the help of a steering committee, which usually makes decisions on resource allocations, the design teams propose and develop design solutions, and also engage in the iterative testing and refining of these design solutions with the help of middle management. These efforts usually involve a professional ergonomist acting as facilitator and consultant.

PE activities are intrinsically motivating to workers when their design activities are closely linked to the workplace changes that matter most to them.[33] Workers thus engaged are known to assume ownership of the change process[34] and are more willing to tolerate and address unexpected problems that are common to any significant workplace change effort.[28] PE programs are well-suited to address both simple (individual-machine interactions) and complex (large-scale human-technology-organization interfaces) work system problems arising from poor fit between humans and workplace design, including problems found in poorly designed sociotechnical systems.[30,35]

Focusing PE on workplace health protection and health promotion

While it is not unusual for PE programs to improve employee health and well-being,[35–38] their primary focus has been on preventing injury or improving work efficiency. Thus, to adapt PE to also include health promotion within CPH-NEW intervention projects, it was necessary to go beyond the traditional focus of PE on workplace protection/design interventions and develop a more integrated health protection and health promotion approach.[39,40] Our use of PE to engage workers in both participatory workplace health protection and health promotion efforts is hereafter referred to as PExHP to symbolize the important synergy we believe this new combination can provide.

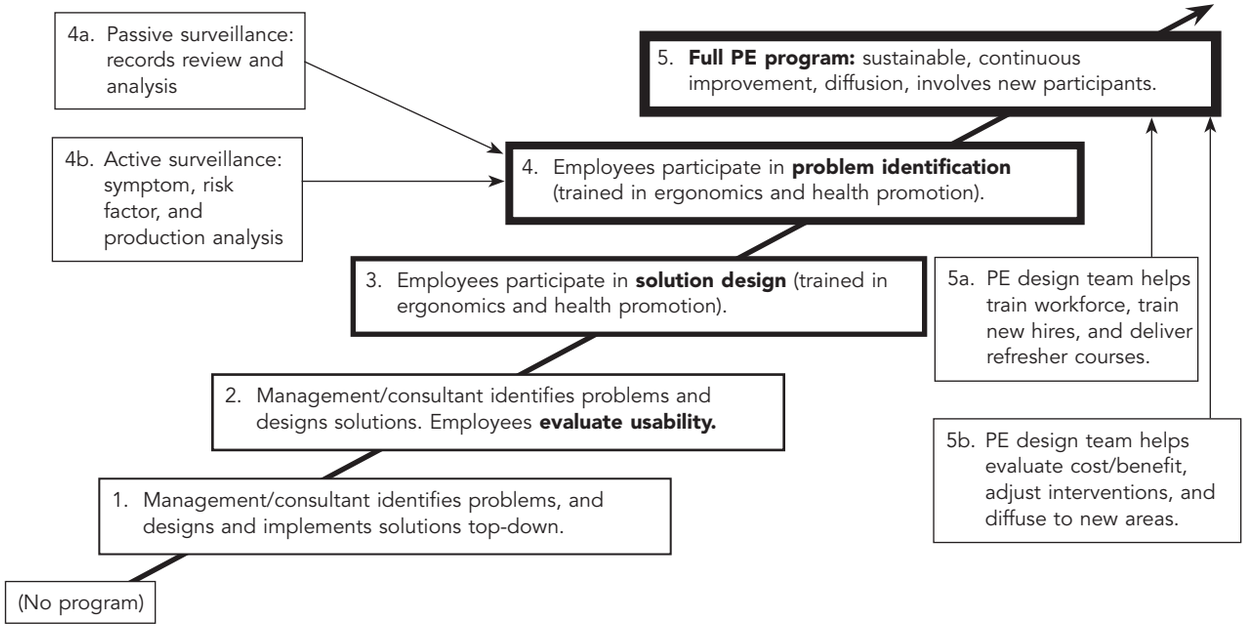
Several systematic reviews of the ergonomic intervention literature[37,41,42] have identified a common set of elements contained in the concept "employee involvement." These include employee participation in and ownership of these elements:

1. Identifying problems
   a. Passive surveillance: analysis of administrative data relating to health and productivity
   b. Active surveillance: surveys and interviews of employees to identify problems
2. Identifying possible solutions
3. Evaluating, piloting, and refining solutions
4. Implementing tested solutions
5. Evaluating effectiveness, conducting cost assessments
6. Developing a long-term, sustainable program via an iterative approach:
   a. Identifying the next problem focus and next cycle of improvement
   b. Involvement with medical management, early reporting, etc.
   c. Diffusion to new departments/facilities

Because achievement of all elements in all project dimensions would be difficult, our review focused both on the initial startup and on the identification of elements most likely to be essential for the long-term success of integrated workplace health protection/health promotion programs. Crucial elements can vary and may need modification depending on the preexisting organizational structure and culture. Nevertheless, systematic reviews by others generally include the proposed hierarchical elements shown in the Figure.[36,41,43]

Box 1 of the Figure represents a traditional, nonparticipatory, top-down program. Successive boxes ascending the arrow incorporate increasing levels of employee participation, ending at the top (Box 5) with a fully realized, participative program. We conceived of each stage as being a precondition for the successful development of higher, more participatory stages. The subheadings (4a, 4b, 5a, 5b) are included to indicate the particular methods important to fully address problem identification and diffusion, respectively. Compared with a traditional top-down intervention (Box 1), this model proposes that to improve the chances for developing a self-sustaining and self-correcting program, several steps should accompany the actual introduction of a solution. These extend employee participation both earlier in time (to include project planning, risk identification, and solution development/implementation, as shown in Boxes 2–4) and later (to encompass training, evaluation, cost justification, identification of new project foci, and diffusion to new projects/departments, as shown in Box 5).

Figure. Proposed hierarchical framework showing progressive implementation of PE elements to create a fully participatory PExHP program



PE = participatory ergonomics

PExHP = use of participatory ergonomics to engage workers in participatory workplace health protection and health promotion efforts

Although the Figure focuses on stages of employee involvement, involvement by employers, other company stakeholders, and researchers/consultants is also crucial. PExHP specifically does not encourage increased employee participation at the expense of involvement by supervisors and midlevel managers. Instead, increased collaboration and participation in workplace change efforts from all vested parties is necessary for the success of health promotion and health protection efforts. The participation of external health protection and health promotion expertise (e.g., consultants and researchers) may be valuable at some or all stages.

An understanding that the design (i.e., local, task level) and organization (i.e., higher-level workflow, scheduling, and pay structure) of work are inseparable from efforts to change employee health behavior is at the heart of the PExHP approach to integrated workplace health protection and health promotion. Considering the impact of the performance-design interaction is fundamental to all ergonomics interventions.

A contextual understanding of workplace exposures leads to the postulate that workplace design, culture, and work organization partly determine levels of "shop-floor" risk factors: physical, psychosocial, and behavioral.[44,45] For example, job stress is one outcome that can result from the combination of poor work design and poor health behaviors, with work organization underlying both. Chandola et al.[46] have used longitudinal data from the Whitehall Study[47] to demonstrate that job stress is associated with incident cardiovascular disease both directly (via neuroendocrine stress pathways, which are primarily the result of adverse psychosocial characteristics of job design and organization) and indirectly (through the risk complex of the metabolic syndrome and poor health behaviors).

Other research has documented associations between job stress and multiple chronic illnesses,[48] including musculoskeletal disorders,[48,49] and an association between job stress and accidents.[50] The two primary explanatory models for job stress etiology, the Demand-Control-Support model[51] and the Effort-Reward Imbalance model,[52] postulate that core psychosocial aspects of the work environment have causal relationships with job stress. In both formulations, work organization is a major contributor to stress-related outcomes. For example, heavy reliance on mandatory overtime increases demands at the expense of job control, while generally promoting the poor eating choices and habits associated with overtime and off-shift work.

It is therefore likely that in many workplaces, to be successful in problem identification and solution development, the PExHP approach will necessarily

need to target the broader aspects of work organization as determinants for successful workplace change and health promotion, as described previously. Examples would include the identification of workflow barriers that diminish employee control of the work process while increasing demands, or a change from a line-driven production design to semiautonomous production teams. Furthermore, engaging in the participatory process itself changes psychosocial workplace factors. The participatory process visualized in the Figure, in which employees are empowered to make changes that affect both their work design and factors affecting health behaviors, can be expected to improve the employees' level of control and level of reward, thus helping to reduce job stress. In this integrated PExHP workplace health protection and health promotion approach, continuous employee participation in the change process itself can therefore justifiably be considered a form of health promotion through reductions in job stress.

IMPLEMENTING PExHP

Developing a PExHP implementation roadmap

Successful implementation depends on developing a systematic plan outlining the necessary steps and identifying the stakeholders that will be involved at each step. A well-planned timeline specifies the necessary activities, their sequence, and their estimated completion dates. Developing this plan using a systems approach is beneficial, as all the subcomponents and elements of the tasks can be efficiently organized and established.[53] CPH-NEW researchers have developed and tested a number of tools to aid development of this plan. These include a workplace health promotion readiness checklist, relevant focus group themes, baseline surveys to assess employee health status and concerns (including open-ended questions about the positive and negative effects of work on health and obstacles to health), and a survey to assess organizational readiness to engage in PE.

An initial step is identifying the key leader(s) within the workplace who will organize and coordinate the PExHP process and create an implementation plan.[33,41,54] To facilitate the PExHP process in the most effective and efficient manner, the key leader(s) acts as a liaison to outside experts, senior administrators and managers, supervisors, the PExHP design team, employees, and other existing workplace health programs. This leader works with the aforementioned personnel to identify and establish formal and informal communication mechanisms as tracking tools to disseminate important information to all involved parties. The PExHP design team can also provide valuable input on how best to communicate the program to their coworkers. The intrinsic values and other contextual features of the organization must be recognized and incorporated into the planning process. This first step of mapping out the plan in detail establishes the nature of the project, how it will be managed, and the feedback loops that provide data on the status of the implementation progress, allowing the plan to be tracked and adapted to potential organizational changes.[53]

Communicating program elements

The next critical stage is articulating and communicating the plan across all levels of the organization and, again, establishing the tone for the project. Several informational presentations specifically designed for different audiences are important. Creating this type of "tiering" to communicate the implementation plan and project activities is necessary so that each party understands the purpose of the project, roles and expectations, action items, mechanisms for project support, and when/how feedback on intervention status will be communicated.[53–55] Specifics on the process of program execution must be clearly understood and in place as action items in the plan before the project is implemented.

Managers must understand and commit to developing mechanisms to (*1*) provide resources and time for the PExHP design team to meet and be trained, (*2*) provide overall support to the PExHP interventions, and (*3*) reward and recognize the design team's efforts as well as the supervisors' support efforts. These commitments must be communicated to all stakeholders.

The supervisors should receive communications tailored to their needs and concerns that provide specific role descriptions stating expectations for them by senior managers, the steering committee, and the PExHP design team. At the same time, communications to employees as part of design team recruitment will also inform the workforce of the plan, expectations, and desired participation level. In one of our ongoing field studies, for example, the steering committee helped write a recruitment memo for design team members, and also decided that it would be best for this memo to come from the steering committee rather than from the researchers.

Tailoring the program to different stakeholders

The third stage is to design and develop several different types of preliminary training programs for each set of stakeholders. Several researchers have highlighted the need to provide training as part of PE initiatives.[54–56] Members of the steering committee and the design

team(s) are given training on teamwork and interaction skills to allow them to perform effectively as a group. Also, management, and especially supervisors, may need instruction on how to relate to workers who are taking an active role in making decisions of this nature.[56] As part of the communications packages described previously, an outline of the various training programs and their purposes should be provided, along with the expectations of who should participate. Messages should also detail the importance of training to the process and logistics: who will conduct the training, time requirements, resources needed, and where the training will take place. Orientation and general knowledge of these training programs should be provided to senior managers so they understand what their workforce and the PExHP design team members will be learning.

Developing these training programs using an instructional systems design approach is key to ensuring an effective learning experience and transfer of training.[53,57] Researchers point to several established training principles that should be incorporated when designing training programs like these:[57–59]

- Conduct a needs analysis, which determines what knowledge, skills, and abilities are to be taught to the various groups, along with customizing the training to the organizational culture;
- Incorporate adult learning models in the training design to support enhanced learning for adults who are known to have a higher need for active, hands-on training and opportunities to problem-solve and to "learn how to learn";
- Involve all levels of the organization in role-specific training. It is interesting to note that rarely are supervisors (in less than 35% of reported projects) and senior managers (in less than 12% of reported projects) trained in the PE process (including ergonomics and teamwork training).[41] It can be speculated that the success of the PE process is compromised if training programs are not specifically designed for the appropriate audience (i.e., senior mangers, supervisors, PE design team members, and workers) and delivered in a manner that best suits their background (i.e., matching knowledge, skills, and abilities).

Supervisor training

Supervisor training should include familiarization with the PExHP process, team-building skills, health promotion knowledge, general ergonomics knowledge, and, most importantly, defining the expected supervisor roles and responsibilities in supporting the PExHP design teams. This training experience will acquaint supervisors with the decision-making authority they will have in the PExHP process, how they can help the PExHP design teams through the iterative design efforts, and some methods for identifying and developing the evaluation measures of the workplace and health promotion interventions.[55] Supervisors who better understand their critical roles in the PExHP process are more likely to commit to, and acknowledge ownership of, the intervention. They also become better prepared to interact with the employees who are participating in the PExHP design team as they identify and design new workplace and health promotion interventions.

Early successes of PExHP efforts, from carefully selected initial interventions that address "low-hanging fruit" (i.e., problems that can be addressed relatively quickly) can also foster organizational learning that will enable the organization to tackle more challenging interventions later, and in general will help sustain these programs over long periods of time.[55] For example, an initial PExHP design team intervention at one of our nursing home test sites was to arrange for vending machines to be stocked with healthier food choices. Prior to the intervention, targeted training material on healthy food choices was provided to the design team, and a nutritionist was made available for expert advice. The PExHP design team then developed a brief survey to gauge staff interest and gather suggestions. With the help of the site director and assistant director (a steering committee was not feasible due to the flatness of the organization), a new vending machine with healthy food offerings is now being tested. The goal of a more challenging follow-up project identified by another PExHP design team in this same chain of nursing homes is to reduce the stress caused by limited communication among certified nursing assistants, licensed practical nurses, and nurses regarding each resident's daily care.

Employee training

Employee training within the PExHP design team must occur in several areas: ergonomics and job design (e.g., health protection and safety), health promotion (e.g., nutrition and stress management), team building (including interpersonal skills), design as a team activity, establishing and working with a multilevel and multidisciplinary team, and determining evaluation measures with supervisors.[54,55,60] More focused training should be developed depending on health and ergonomics intervention priorities chosen by the design team. Health priorities identified from confidential

baseline surveys and employee focus groups can be targeted in the initial training.

Other specialized follow-up training may be needed at strategic points in the intervention process, such as how to develop a business case for a proposed intervention and how to assess improvements in employee health and workplace safety. For example, the need for the PExHP design team to learn how to present a business case became apparent at one of our test sites when the design team proposed a walking path for resident and staff use at a nursing home. The proposal was initially deemed too expensive, but is now being reconsidered after the PExHP design team developed plans for a less expensive walking path and presented a more convincing case for how this path would benefit residents and staff and help showcase the facility.

It is not uncommon for a PExHP design team to go through the typical four phases of team building—forming, storming, norming, and performing—or some similar stages of team development.[43] Some of these phases may be particularly frustrating to newly formed PExHP team members working on health promotion. Thus, it is essential that members of the PExHP design team are prepared for such challenges, and are trained in the teamwork skills necessary to handle these difficult periods.

The rest of the employees in the organization should, at minimum, receive an orientation program describing the PExHP process; they would also benefit from learning about some fundamentals of ergonomics and health promotion. This allows for a common language to be established among the workforce so that the nature of PExHP interventions is uniformly articulated and communicated to all workers. Equally important, this lays the groundwork for organization-wide training that could come later at other worksites. An example of organization-wide dissemination and diffusion of the participatory approach is shown in Box 5 of the Figure.

PROGRAM MANAGEMENT

No leaders of a work organization can be expected to agree to major changes in the design of work processes without being reassured that these changes can be managed carefully, with little or no negative impact, and with some expectation of measurable gain. A well-conceived blueprint has been developed to guide the management of PE programs.[42] However, expansion of the role of PE to focus on health promotion in addition to its traditional focus on ergonomics is likely to require additional program oversight in regard to evaluating and tracking the effectiveness of interventions. In this way, the PExHP program can self-correct in an iterative manner.

Multilevel steering committee

A multilevel steering committee should be formed from a cross-section of the organization to provide resource support, such as arranging access to consultants, and to provide general program oversight. Membership of a key administrator serves as a liaison to upper management and also symbolizes top-down support. Representation from existing health-related initiatives, such as the safety committee, is important so that any health promotion interventions will complement rather than compete with other programs. Representation by midlevel managers and supervisors on the steering committee is necessary because their support is a key determinant of PE program success.[61] For example, the release time for design team members is usually arranged by immediate supervisors. Key components of the PExHP program from the employees' perspective, such as the perceived level of supervisor support, can be evaluated periodically using validated scales designed for this purpose.[62] We have found that forming an additional PExHP design team comprising supervisors who can focus on their specific health concerns greatly increases their support of the PExHP program.

Union representation on the steering committee will provide both program endorsement and much needed guidance regarding interventions proposed by the PExHP design team. The union can also help recruit employees to serve on the design teams, as well as assist with evaluations of the PExHP design program by shielding workers from a breach of confidentiality. This type of representation can also forestall potential conflicts with the collective bargaining process. A recent example of representation at one of our test sites was to receive advice from the multilevel steering committee to not allow the PExHP design team to focus its initial intervention on the practice of requiring employees to work double shifts whenever there is a staff shortage. Although the negative effects of this practice on health were concerns raised in focus groups, any change in work scheduling practices would impact union-negotiated seniority rights, making this too complicated for a startup project. An initial intervention in this same problem area could instead focus on helping employees develop coping methods until a more comprehensive solution can be found.

CONCLUSIONS

An integrated approach for engaging employees in workplace health protection and health promotion

efforts is proposed. It expands the focus of PE programs to include iterative design of workplace interventions to address the full range of health concerns identified and prioritized by workers. A PExHP program can complement other safety and health initiatives, such as an existing ergonomics and safety program, with the potential for synergistic beneficial effects on worker health. Evidence suggests that with proper training, resources, oversight, and tracking controls in place, organizational learning will occur to further support the health protection and health promotion activities of a PExHP program, contributing to overall program effectiveness and sustainability.

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