Field tests of a participatory ergonomics toolkit for Total Worker Health

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Abstract

Growing interest in Total Worker Health® (TWH) programs to advance worker safety, health and well-being motivated development of a toolkit to guide their implementation. Iterative design of a program toolkit occurred in which participatory ergonomics (PE) served as the primary basis to plan integrated TWH interventions in four diverse organizations. The toolkit provided start-up guides for committee formation and training, and a structured PE process for generating integrated TWH interventions. Process data from program facilitators and participants throughout program implementation were used for iterative toolkit design. Program success depended on organizational commitment to regular design team meetings with a trained facilitator, the availability of subject matter experts on ergonomics and health to support the design process, and retraining whenever committee turnover occurred. A two committee structure (employee Design Team, management Steering Committee) provided advantages over a single, multilevel committee structure, and enhanced the planning, communication, and team-work skills of participants.

Keywords

Total Worker Health; Participatory ergonomics; Toolkit

1. Introduction

Since 2004, federal public health authorities in the United States began developing the evidence base to support comprehensive, integrated models for worksite programs to advance worker health, safety, and well-being (NIOSH, 2012, 2015). Initially called "Work-

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Life" programs, these integrated program models were subsequently renamed Total Worker Health® (TWH) programs, offering specific strategies for integrating occupational health and safety with health promotion to advance the health, safety, and well-being of employees (NIOSH, 2015; Schill and Chosewood, 2013). A primary feature of the TWH programs being tested by the Center for Promotion of Health in the New England Workplace (CPH-NEW) is a macroergonomic focus on the workplace as a complex socio-technical system. Inasmuch as work organization is known to be a determinant of a broad range of worker health and safety outcomes (NIOSH, 2015; Schill and Chosewood, 2013; Ipsen and Jensen, 2010; Punnett et al., 2009), TWH programs seek to make work organization more conducive to safety, health, and well-being.

In recent years there has been growing scientific literature examining TWH program design, evaluation, and measurement indicators (Sorensen et al., 2013; von Thiele Schwarz et al., 2015; Williams et al., 2015; Punnett et al., 2013). These articles have explored and defined various criteria for essential elements of TWH programs, and have also reported some successes (NIOSH, 2012; Sauter, 2013; Goetzel, 2005; Hunt et al., 2005; Sorensen et al., 1998; Loeppke et al., 2015; Anger et al., 2015; Pronk, 2013; Carr et al., 2016) There is less known about prevalence of TWH-style programs in workplace settings, and it seems likely that the adoption by employer organizations is limited, in part, by the lack of program implementation tools (Sauter, 2013; Loeppke et al., 2015; Nelson et al., 2015).

Researchers in CPH-NEW have previously described the rationale for integrating occupational ergonomics with health promotion in the workplace (Punnett et al., 2009), as well as the critical benefits of using participatory methods for engaging workers in the design of TWH interventions for more sustainable programs (Henning et al., 2009a, 2009b, 2013). This combination of participatory ergonomics in combination with health promotion ("PE × HP") provides many potential benefits, such as focusing on issues that are more salient to workers, improving intervention fit to the workplace context, identifying a greater range of work organization features that may contribute to these problems or issues, greater organizational learning and employee self-efficacy, and a wider scope of intervention targets that more completely address underlying work organization contributors to poor health (Nielsen and Randall, 2012; Nielsen et al., 2010). Taken together, these benefits can offer interventions with higher participation, impact, and overall employee satisfaction as compared with conventional "top down" management-led interventions.

Although prior CPH-NEW research and other studies have reported on the benefits of employee participation (Hunt et al., 2005; Henning et al., 2009b; Egan et al., 2007; Ferraro et al., 2013; Reeves et al., 2012; Rivilis et al., 2007) and others have published relevant guidelines for TWH programs (Compensation CoHaSaW, 2010; McLellan et al., 2012), there are few programmatic tools available for employers, particularly in the United States, to engage employees in comprehensive employee health protection and promotion efforts for TWH (Loeppke et al., 2015). Similarly, while there are published studies of effective participatory ergonomics (PE) program components (Sorensen et al., 2013; Rivilis et al., 2007) and implementation (Van Eerd et al., 2016; Rasmussen et al., 2016) there is very little evidence-based guidance relative to the application of PE principles in the context of TWH

program implementation or within workplace management systems for safety and health (Yazdani et al., 2015).

The purpose of this study was to harness the CPH-NEW research team's knowledge from prior and ongoing work in TWH participatory action research to develop and refine a suite of program tools into a Healthy Workplace Participatory Program Toolkit (HWPP) that would enable workplace safety and health practitioners to implement their own participatory TWH program. Developing the HWPP Toolkit was also intended to fill a gap in the TWH translational research literature. The instruments in the Toolkit are unique in that they set the stage for implementing a Total Worker Health program that combines PE together with worksite health promotion (HP) (i.e. the PE × HP approach) (Henning et al., 2009b). Assessment instruments in the Toolkit cover a broad range of health, safety, and well-being topics, and gather perspectives from front-line workers as well as middle and upper level managers. A foundational assumption is that engaging front-line workers is essential to identify the full scope of root causes of poor health, unsafe work, or a lack of well-being in an organization. This is a necessary first step for interventions that appropriately address work organization and individual health behavior risks in one integrated approach (Lax, 2016).

This paper will describe how the HWPP Toolkit materials were developed and field-tested in four varied employer organizations. Process evaluations include descriptions of the outputs and outcomes of using the program start-up guides to form and train employee intervention design teams, employee assessment tools to identify and prioritize health/safety concerns, and a systematic, step-by-step participatory process for designing integrated TWH interventions. Challenges, successes, and the need for future effectiveness research are discussed.

2. Methods and instruments

2.1. Field test protocol

Fig. 1 outlines the overall field test protocol. Mixed methods were used to document and evaluate the iterative design and development of the new toolkit materials in workplace settings, as well as to document process outputs and impacts on worker wellbeing. Process evaluation methods were used for capturing outputs (activities and who participated) and short term outcomes (what happened as a result of participation) during each of two distinct stages of the field test study: program start-up period, and intervention design period. The program start-up stage included committee formation and assessment and prioritization of work-force health/safety concerns. The intervention design stage included the period of time during which employees worked together to design and propose interventions that addressed priority health/safety issues. The methods section will begin by describing recruitment methods and characteristics of the field test sites (Section 2.2), as well as the iterative design approach for developing the program toolkit materials (Section 2.3). Then each stage of program implementation will be described, along with the framework and measures for process evaluation.

2.2. Site recruitment

Four employer organizations in New England were recruited from a group of organizations that had recently completed a year-long worksite wellness training and capacity-building program sponsored by a state public health agency. The HWPP was marketed as an opportunity to expand the scope and sustainability of employers' current wellness activities by addressing root causes of health issues and concerns, including work organization factors consistent with an integrated TWH approach. Selected characteristics of the four field test study sites are provided in Table 1. Organizations varied in industry sector, and occupational groups. Organizations ranged in size from 160 to 24,000 employees. Two organizations targeted specific work units for the participatory program, and two implemented the program with the goal of reaching all employees with interventions. All but one organization had work units in multiple locations.

Study sites were asked to provide an internal champion who could coordinate study activities over a two year period. A memorandum of understanding was signed by the organization and the university which emphasized the importance of protecting workers from retribution given the participatory nature of the interventions. Researchers commenced baseline interviews with 6–8 key personnel from all levels of the organization in order to gain an understanding of the organizational culture, communication, and current state of health/safety programs. Interview results were also used to help identify a preliminary set of health and safety issues and concerns within the organization as well as to recruit well-placed managers to serve on the management-level Steering Committee (SC) of the HWPP (detailed below). Focus groups were also conducted with non-managerial employees to further examine health and safety issues and to assess organizational climate. All participants in interviews, program committees and focus groups provided informed consent.

2.3. Toolkit development – an iterative design process

The research team developed prototype "step-by-step" start-up guides, protocols and support materials for program implementation that would make implementation of a HWPP feasible across a wide range of organizations without researcher assistance. Prototypes were based on best practices from the PE literature (Henning et al., 2009b, 2013; Nielsen et al., 2010; Haims and Carayon, 1998; Haines et al., 2002) combined with the authors' own experiences with participatory action research. Table 2 describes the prototype tools and materials which were later refined through iterative design efforts with program facilitators, and sometimes with participants from the test sites.

At each test site, one program facilitator from the research team was assigned to lead the program implementation and toolkit testing. Facilitators were trained professionals with a master's degree and experience in worksite health promotion or industrial/organizational psychology. The facilitator's role was to function both as a program provider within field test host sites and as a member of the research team. As the facilitator used the Toolkit for program implementation, the research team systematically gathered worksite feedback (via verbal report-backs and written comments on the materials themselves) and exchanged experiences and findings at bi-weekly or monthly research team meetings. The research team used this feedback to refine the materials, and then the refined materials were either re-

tested at a field site or further reviewed by facilitators. This iterative design process enabled the research team to develop Toolkit materials quickly, based on ongoing testing at all four sites. This protocol is consistent with principles of formative program evaluation (Brown and Gerhardt, 2002) and the use of heuristic evaluation (Nielsen and Molich, 1990) methods to assess the usability, feasibility, and overall effectiveness of the tools for facilitating the participatory program processes.

2.4. Program start-up activities

2.4.1. Committee formation in field test sites—Each program facilitator worked in collaboration with senior leaders at the organization to use the "Steering Committee and Design Team formation tools" for recruitment and training. The "Design Team" (DT) is a group of 6–8 front-line employees that develops intervention proposals consistent with best practices in participatory ergonomics (Haines et al., 2002; Van Eerd et al., 2010). The Steering Committee (SC) consists of senior and mid-level managers who provide program oversight and resources to the HWPP program, decide which interventions proposed by the DT should be implemented, and oversee data collection for assessment and evaluation purposes. The tools provided guidance on key members to recruit, member roles/ descriptions, how members should be invited to participate along with sample letters and other communication tools, as well as training topics and group formation activities. Facilitators set agendas and coordinated all team meetings.

Following each meeting of the DT or SC, facilitators used a customized Microsoft Access database to track attendance, topics discussed, progress on intervention design, and also signs of team leadership, engagement, taking on responsibilities, and commitment (Haims and Carayon, 1998). Only data on the time periods for committee formation and intervention design efforts are reported here; data about outcomes related to intervention implementation and evaluation were not collected.

2.4.2. Health/safety assessment and issue prioritization—One of the first tasks of the SC was to review, approve and then administer an All-Employee Survey (AES) for assessing a broad range of safety, health and workplace factors. Potential uses of each survey domain were explained, and the SC was given an opportunity to identify any questions that might be potentially sensitive or did not reflect the current organizational culture. No questions were deleted from the AES at any of the four sites. The AES consisted of 41 items and required 20–25 min to complete. Survey domains included diagnosed health conditions, health behaviors, work ability, mental health concerns such as stress, burnout, and depression, job satisfaction and intention to leave, desired health improvements, and demographics, as well as workplace risk factors (e.g., physical and psychological job demands, incivility, and work/family balance). The process of AES development was previously published (Warren and Dugan, 2011); an updated version of the AES instrument with a user manual (and development history) is available at www.uml.edu/cphnewtoolkit.

Following survey administration, one or two focus groups (FG) were conducted with a sample of non-managerial employees in each site. Participants were selected by the SC based upon representation of various work units as well as potential to serve on the DT. A

structured script (Nobrega et al., 2011) was used to guide discussion of health and safety issues, factors on and off the job that positively and negatively impact health, barriers to getting jobs done, and how changes and decisions are made within the organization (issues relevant to participatory program success).

Results of the AES and the FG data collection in each site were summarized by the research team, and presented by the facilitator to the SC and the DT in their initial meetings. Facilitators then helped the DT prioritize and gain consensus on two to three health/safety/ well-being issues or concerns. The facilitator then guided the DT in an exercise called, the "Ideal Workplace Activity" as a positive and creative exercise to demonstrate and reinforce how the group should work together to plan and design TWH interventions during the course of the study.

2.5. Intervention design

Intervention design commenced with the DT and facilitator using a step-by-step design process (Robertson and Courtney, 2004; Robertson, 2002). Refinement of this design process in the present study yielded the Intervention Design and Analysis Scorecard (IDEAS) Tool. The IDEAS Tool consists of a set of worksheets, quick reference guides and facilitator guides necessary to support a 7-step, structured, participatory intervention design protocol for TWH interventions (Fig. 2).

A full description of the IDEAS Tool and its use in a case study has been reported previously (Robertson et al., 2013, 2015). In the IDEAS process, the Design Team has primary responsibility for Steps 1–5a, and the Steering Committee has primary responsibility for Steps 5b-7. The research team, together with the program facilitators, used an iterative process of testing and refining the facilitator instructions and worksheets to better support DT and the SC in carrying out the seven steps of the IDEAS design process. Facilitators guided the DT and SC through the IDEAS steps, recorded notes about challenges and successes, and later provided verbal and written feedback to the research team to support refinement efforts. If, for example, the facilitators reported that the materials were difficult to understand or follow, the research team edited them to improve simplicity, clarity, and layout. Facilitators also used the customized database to track and document the DT and SC progression through the seven IDEAS steps, the participatory group dynamics, and other relevant process measures (such as barriers, facilitators, satisfaction) that were relevant to implementation at each step in the process. Two years after program initiation, facilitators were interviewed individually by the research team to gather final opinions about the usability and effectiveness of the 7-step IDEAS Tool as well as contextual factors that influenced implementation and outcomes to inform discussion of lessons learned and implications for future dissemination.

2.6. Process evaluation framework, methods, and measures

The research team collected data on the program implementation process and short term outcomes using an adaptation of the Re-AIM evaluation framework (Glasgow et al., 1999). Together with the toolkit heuristic evaluation, these process evaluation activities were designed to gather information about contextual factors inside and outside the organization

that impacted program implementation and outcomes. Table 3 summarizes the evaluation measures and tools used to evaluate toolkit components that supported committee formation, health/safety issues identification, and intervention design.

Consistent with the Re-AIM framework and other published implementation science research methods (Chaudoir et al., 2013; Damschroder et al., 2009), data were gathered from all key program participants (facilitators, DT and SC members) as well as the overall workforce to measure participant and organizational factors influencing HWPP implementation and tool use, as well as perceived outcomes of the program (including the DT-inspired interventions).

Two years following initiation of program start-up, interviews with key managers (22 in total) were conducted to assess overall perceptions of program, and to gather contextual information that could have impacted program implementation and outcomes. Participants included members of the SC as well as other upper-level managers whose opinions could determine whether the program would be sustained beyond the 3-yr study period. Each interview was conducted by a primary interviewer who was not a member of the research team, and also a note taker. The interview script covered the following domains: background organizational changes during the study period, program effectiveness/impact (of DT/SC, of overall program, factors related to success/failure, unmet expectations), acceptability of participatory design process, quality of the program facilitator, feasibility and resources needed for program sustainability. At about this same time, focus groups were conducted with members of each DT (25 in total) to gather their views of the program in these same dimensions. Focus groups were also administered by pairs of researchers. DT members in one site could not be gathered due to schedule conflicts; instead they submitted written responses individually to questions sent to them by the researchers.

The interviewer or FG facilitator read and amended the notes immediately following the data collection event to ensure completeness; areas of disagreement or uncertainty were resolved through discussion. The interviews were recorded (except when one participant objected) and the audio transcript was typed verbatim by a graduate research assistant.

Analysis of the text from interviews and focus groups was done independently by two new researchers, each of whom examined the transcribed notes and recordings from the interviews. Researchers cut the data into discrete meaningful segments, assigned descriptive codes to the segments, and then categorized the codes into themes related to the domains from each script (Savin-Baden and Major, 2013; Strauss and Corbin, 1998). Each researcher's results were then compared and discussed until consensus was reached on meaning. Those themes occurring multiple times, as well as those important to a particular study site, were organized into a descriptive table.

On the same day that DT members gathered for the post-study Focus Group, each DT member completed a paper DT survey questionnaire. The survey was adapted from the Employee Perceptions of Participatory Ergonomics Questionnaire (EPPEQ) (Matthews et al., 2011). This modified EPPEQ consisted of 14 multiple-choice questions across five domains (Table 6). DT members used a 5-point Likert Scale to indicate their agreement with

each survey item. In addition, an open response section asked about the positive and negative impacts of participating on the DT for the members themselves, as well as for the organization. Scaled items from the survey were summarized using statistical software to generate counts and proportions of respondents that agreed or strongly agreed with each item. Participants who did not respond to a question were not included in the denominator count of total respondents. Open responses were grouped thematically.

3. Results

3.1. Steering committee and design team formation

Process outcomes—The committee structure and composition for each test site are outlined in Fig. 3. A two-committee structure (SC and DT) was implemented (at least initially) at 3 of 4 test sites, in accordance with Toolkit guidelines. SC members included senior level managers of the corporation or the agency, reporting directly to the top-most executive leaders and responsible for the work units represented by the DT. SC members had decision-making authority on interventions proposed by the DT, and therefore could make purchases, and process or policy changes as needed for their implementation. DT members included either "line-level" or supervisory-level employees; no DT members had subordinates within the same DT. At Site 1 (property management and real estate) and Site 4 (prison), DTs were formed *de novo* for the study; these teams had not previously existed. In contrast at Site 2 (human services non-profit), members of an existing mixed-level employee wellness committee were retrained to become a DT. Site 4 (correctional facility) initially formed both a SC and DT but eventually these merged into a single mixed-level committee because of reduced personnel availability following an 8-month labor-management dispute and major reduction in force.

In Sites 2 and 4, the organizations decided to develop interventions that could benefit the full workforce. Therefore, careful attention was paid to selecting DT and SC members representing varied work units, and in some cases satellite offices. In Site 3 a single, large, decentralized work unit was targeted for interventions. The property management firm (Site 1) decided to only target its maintenance and landscaping workers. These employees had historically low participation in the company wellness program and were prioritized based upon presumed risk for physical hazards and work-related musculoskeletal disorders.

Program start-up time, defined as months from first SC meeting to first DT meeting, varied from 5 months to 11 months (Fig. 4). One to three months of this time was consumed by the process of administering and compiling results from the AES. Committee formation activities took much longer at government agency sites due to formal and bureaucratic decision-making procedures requiring approvals at the highest levels.

Toolkit revisions—Facilitators reported that the committee formation guides provided all the information needed to identify and recruit appropriate members to the SC and the DT. The guides had provided suggestions for the activities and content of initial team meetings, including reviewing roles, content training in er-gonomics and health promotion, goals and key timeline for the study, and process for forming interventions. The guides were fine-tuned and supplemented with more detailed content based upon actual meeting experiences and

based on any gaps in the guides that were identified by facilitators. For instance, added clarity was needed about appropriate SC and DT members when organizations had geographically distributed workers. A flow timeline was created to provide a sequential map of sample meeting agendas for each step in program start up (i.e. SC orientation and training, Design Team nomination, administration of the All Employee Survey, and prioritization of topics for interventions).

3.2. Assessment and issue prioritization

Process outcomes—The All-Employee Survey (AES) and Focus Group (FG) tools revealed a broad range of physical and psychosocial concerns as barriers to health and safety and the health improvements most desired by employees (see Table 4). Two of the sites reported the amount of time spent sitting at a desk with poor ergonomic design as a barrier to health and a cause of back pain and poor posture. High workload, conflicting job demands, and emotional demands were common issues revealed by the AES and focus groups across all sites, as well as the stress of being on-call during non-work hours (Site 1) and poor work-life balance (Site 3). Desired health improvements in weight loss, exercise, sleep, and stress were common concerns across the sites; there was high readiness to quit smoking at 2 sites (Sites 2 & 4).

A summary of safety and health issues was provided to both the SC and the DT at each site to set the stage for designing integrated TWH interventions. At these data report-back meetings, the facilitators used group activities from the Toolkit (see Table 2) to facilitate DT prioritization of health and safety issues and concerns via a voting procedure. Members were also encouraged to think creatively about ways in which the workplace could be transformed. The report-back process, voting, and discussion of the ideal workplace were accomplished in one or two meetings.

Toolkit revisions—As described above, the facilitator reported back to the research team on the successes and challenges of using the Toolkit materials, and recommended refinements as well as new content for the training materials used for the SC and DT, and facilitators. The collective experience of the facilitators in managing the group dynamics in these activities was useful for improving the guides to address the real-world challenges involved. For example, the AES step-by-step implementation manual was expanded with guidance on how to maintain confidentiality, establish effective communication patterns with managers, and set realistic time allocations for the report-back meetings (which usually triggered extensive discussion).

3.3. Intervention design using the IDEAS tool

Process outcomes—A substantial amount of the field test effort was expended to iterate the design of the IDEAS Tool which brought needed structure to the participatory design of interventions (Figs. 1 and 2). A detailed description of the final revised IDEAS materials from the current study – including the facilitator guide, group activities, and worksheets – has been published elsewhere (Robertson et al., 2013), as was a case study of IDEAS Tool use at Site 1 from this same study (Robertson et al., 2015). The focus here is instead on process outcomes at all four field test sites and how these shaped the design of the HWPP

Toolkit and the use of participatory ergonomics for the design of integrated TWH interventions. The fidelity to project guidelines and duration of participatory design process, user satisfaction, and barriers to intervention adoption, implementation, and so on, are outlined in Table 3.

The IDEAS Tool was used with greatest fidelity to guidelines at Site 1 (property management and real estate firm) and at Site 3 (government administration) – two sites which maintained the separate SC and DT program structure throughout the study. The DTs and SCs at these two sites completed six steps of the IDEAS process, ending with intervention implementation. The study period was not long enough to complete Step 7 – evaluating and monitoring interventions.

In contrast, at Site 2 which had a single mixed-level DT, only IDEAS Steps 1 and 2 of the intervention design process were completed, despite facilitator attempts to engage the Design Team in Steps 3–5 to assess cost benefits of various intervention options. Managers on the mixed-level DT felt that scoring and prioritizing interventions was unnecessary since they would be the decision makers who would choose which interventions would be implemented. Although progression through IDEAS Steps 1 and 2 initially seemed to proceed efficiently, the proposed policy interventions failed to be presented to the highest level of management at this site, and so were not fully adopted. The non-managerial DT members at this site expressed concerns about upper management dominating the meetings in a way that undermined priorities and ideas of the front-line workers. They reported that it was difficult to fully explore root causes of job-related stress in the mixed groups, in part because of the sensitive nature of these topics. They also expressed their frustration with the final interventions which did not address the organizational factors underlying the problems. A relevant quote is as follows:

> "A lot of times, I do not feel like what the workers tell me that they want is being heard by the Design Team and considered."

> Front line worker in a mixed-level Design Team

In Site 4 (prison) a lack of progress beyond IDEAS Step 1 was due in large part to severe budget and staffing cuts that interrupted the field test activities for nearly one year, at which point a single mixed-level DT was formed (with fewer correctional officers). Intervention design subsequently resumed with a mixed level committee that completed an adapted version of IDEAS Steps 2–6.

The speed and duration of the intervention design process varied widely between sites, and was impacted primarily by meeting frequency and duration as well as DT and facilitator skills and experience levels. For scoring purposes, the "intervention design period" was defined as the time between the first DT meeting and when the first intervention was presented to the SC (or when the intervention was officially adopted, in the sites using a mixed level committee). The intervention design period ranged from 4 to 8 months (Fig. 4). At Site 1, the DT completed the IDEAS process for a total of three interventions. The first intervention took 5 months to design (including time for initial training), whereas their second and third interventions were designed in substantially less time (1–2 months, or 2–3 meetings) because training was no longer necessary. DTs that met infrequently (monthly)

and which were strictly limited to one-hour meetings had a difficult time advancing through IDEAS Steps 1–5 in less than 6–8 months. This was because brief re-orientations and some training were needed at each meeting, which cut into time and slowed forward momentum. In one such site, there were staffing changes in the SC membership due to retirements, and when new SC members were assigned they were not appropriately oriented to the program. This lack of training was problematic when the DT brought their proposal to the SC for review and approval, and collaboration with the DT suffered.

During follow-up interviews at the conclusion of the study, many site participants expressed a wide range of benefits and positive outcomes from using the IDEAS Tool (see Table 7). For instance, participants from multiple sites reported the step-wise design process was useful for organizing their thinking, and for uncovering underlying issues that can affect workplace health. Taking a participatory approach to explore root causes of an issue helped DT members to think through the problem solving process and generate new ideas for solutions. Another benefit noted was that the systems analysis approach allowed multiple solutions to be evaluated in order to find the best fit for their workforce, company culture, and budget.

> "It was helpful for me because I don't usually break things down. You realize what goes into everything. It makes you think about how you get to the end."

> DT Member

> The results went way beyond what I expected."

> SC Member

Toolkit revisions—The long period of time to accomplish the design process was a common complaint shared by facilitators, DTs and SCs in interviews and focus groups. The study team responded by reducing the program start-up timeline (e.g., by using the DT as a focus group), and by providing facilitators with clear guidelines for the number of meetings needed to accomplish each step of the IDEAS process. For example, the facilitator guides were updated with instructions to plan for a minimum of 90 min per meeting twice monthly during the Steps 1–4 of the IDEAS design process. This enabled the DT to develop an intervention proposal within a more reasonable two-to three-month time period, depending on the level of challenge associated with their health/safety problem/issue.

To help ensure continued management support, the committee formation tools were revised to emphasize the importance of ongoing training for SC members, and the importance of maintaining SC engagement throughout the IDEAS design process in a way that supports, but does not usurp, DT decisions. For example in response to the following expressed concern by a DT member, the IDEAS Tool was amended to encourage more SC/DT communication regarding interventions prior to their presentation to management for consideration:

> "I think that the process design intended for there to be more check-ins with the SC, but there was so much going on, we were just floating without doing a reality check. We need more interaction with the SC."

Design Team Member

Another example of Toolkit refinement was simplifying Step 5 –the cost-benefit analysis worksheets and procedures. Managerial personnel found it difficult to use the prototype materials that required numerical rating of interventions. The scoring was found to be too detailed and technical for the way decisions were typically made in the organization. The scoring system was subsequently changed to a simpler low/medium/high scoring system, which DT and SC members were able to apply more easily and intuitively.

One frequently-cited challenge of the IDEAS process was the meeting time required for DT meetings (Table 7). This challenge seemed to be more of a concern in organizations with recent reorganizations and reductions in force (Sites 2 and 4). In these organizations the DT meetings were infrequent, which prolonged the duration of the intervention design process. As a result, the DT and SC members reported loss of momentum and enthusiasm. SC and DT members at the sites with the two-committee structure expressed a desire to have more direct contact and communication at key points, such as when cost/benefits were being assigned to different intervention alternatives. The research team used this process feedback to augment the facilitator guide with tips for keeping SC members involved, and to emphasize the need for sufficient DT meeting time as a key organizational readiness criterion for participatory program implementation. Other challenges cited were staff changes (which resulted in delays), lack of funding for interventions, selecting interventions that could benefit multiple sites, and organizational aspects such as hierarchical decision making or regulations that generally limited the scope of the interventions. These challenges similarly informed revisions in the program start-up materials and IDEAS facilitator guide.

3.4. Interventions proposed by design teams

The DT at each study site designed at least one intervention that was approved and implemented. Table 5 summarizes examples of intervention activities that were proposed and approved (bolded in column 2). Job stress in some form was identified as a priority issue at each of the test sites. However, only Site 1 implemented an intervention to address the root causes of job stress identified by the DT during the study period. Other sites selected ergonomic or lifestyle health issues as a starting point because they felt these topics would be widely supported and that interventions would straight-forward to implement. These sites wanted to accomplish early wins before attempting to tackle the more complicated issues such as workplace stress, a strategy recommended in the Toolkit that would help establish the HWPP.

3.5. Participant views of the overall participatory program

DT members from all four organizations reported high engagement and satisfaction with the participatory program in the Design Team survey administered near the end of the study. Table 6 displays the results in each domain. "*Involvement in Design Team activities*" and "*Employee supportiveness for the Design Team*," were rated high (above 85% agreement for all questions within each domain). The domain of "*Management Support*" for DT proposals scored moderately strong (73%). However, the domain of "*Knowledge Base*" scored lower compared with other domains. A little over half of respondents reported they had sufficient access to experts (59%) and training (55%) needed to plan and design interventions, even

though ratings were higher for access to information (73%). No respondents reported "*Unplanned Consequences.*"

Managers reported in follow-up interviews that DT members had gained news skills in problem-solving, decision-making, and working as a team. In particular, communication was perceived by many participants as a large benefit to the program, in terms of promoting communication between peers and between different work units. The interaction between management and front-line workers improved managers' understanding of the health and safety issues that front-line workers faced as a part of their jobs. This interaction led to DT members feeling that their opinions were valued. Table 7 lists the number of sites where these perceived benefits were noted. One relevant quote is as follows:

> "He looked forward to the meetings and felt empowered to go and have a say in things."
>
>   Manager commenting on DT member

> "If this group was not around our ideas would not be heard as much and less would be accomplished."
>
>   DT member

SC and DT members as well as facilitators were asked about organizational characteristics that promoted or detracted program success. Layoffs and retirements, a change-resistant managerial culture, highly bureaucratic decision and approval processes, and high staff turnover were identified as factors that impeded intervention approvals and prevented timely progress (see Table 7). At sites where intervention design progressed fairly quickly, participants and facilitators noted a strong culture of quality and continuous improvement, relatively good existing communication channels, and consistent upper management involvement and support. Maintaining a good health and safety climate as an established priority in the organization was another factor promoting success. Some relevant quotes are as follows:

> "Communication is one of the main factors that made it possible to achieve some of the changes that we did. [Our organization] is like a big family; when one person does something, the word travels."
>
>   Steering Committee Member

> "It goes back to staff; we work in a negative, environment… It is routine, the same duties every day. To get and accept change is very difficult."
>
>   Mixed-level DT Committee Member

4. Discussion

This study entailed two levels of evaluation for development of the Healthy Workplace Participatory Program Toolkit: 1) evaluation of the iterative design/test/refinement of the IDEAS tools and process which incorporated participatory ergonomics methods to involve front-line workers in the design of health-focused interventions, and 2) evaluation of the program functions involving organizational dynamics such as communication between the

Design Team and Steering Committee. The two major challenges were to determine the amount of structure to impose on the participatory design process to achieve TWH types of interventions, and how best to facilitate these design efforts with collaboration but not interference from management.

Judging by the health/safety concerns selected and interventions proposed, the HWPP Toolkit was effective for engaging front-line employees in participatory ergonomics to design integrated interventions that addressed both work organization factors and aspects of individual behavior, consistent with TWH principles. The participatory program created opportunities for employees at multiple levels to engage with each other in new ways on health and safety topics, and to create a shared understanding of work-related obstacles to health, safety, and well-being. These outcomes align with measures and indicators of Total Worker Health® programs that are reported in the occupational health literature (Sorensen et al., 2013; von Thiele Schwarz et al., 2015; Anger et al., 2015) as well as the characteristics of a healthy workplace as defined by the World Health Organization (World Health Organization, 2010).

There were various obstacles to program implementation and satisfaction that could not be fully overcome by Toolkit refinements and training. The external economic/industrial context impacted the participatory program and the team participants at all study sites. The US economic recession was at its worst throughout this study (2009–12). Three of four study sites (public agencies and the non-profit that received government funding) experienced reductions in funding and staffing, and this proved to be highly disruptive to group processes. These impacts underscored the importance of having sufficient staff time for successful implementation of a HWPP, consistent with best practices in participatory ergonomics programs of any kind (Van Eerd et al., 2010).

Committee structure also was relevant to program implementation and outcomes. At the sites with the recommended two-committee HWPP structure (SC and DT), the IDEAS steps were followed with greater fidelity, more systematically and completely, whereas the IDEAS steps were only partially implemented in the sites with mixed level committees. At these sites there was more formal interaction between different levels of the organization, authentic exchanges of useful information, and organizational learning. However, the two committee structure requires consistent communication and attention to providing meaningful roles for the SC to remain engaged and supportive.

The need for greater efficiency when designing interventions was a common concern with managers. However by far, the most important factor determining progress in intervention design was meeting frequency. DTs that met more frequently (every two to three weeks) progressed more steadily through the IDEAS process than teams that met monthly. It's likely that the research team activities (administration of the All-employee survey, iterative design of the HWPP tools) unavoidably slowed down intervention design. It can be noted however, that the DT at Site 1 managed to plan multiple interventions, showing that once a DT was fully trained, the cycle time for designing interventions could be substantially reduced. The research team is also optimistic that with the resulting improvements to the facilitator guides

and program start-up materials that were made, intervention design is likely to be more efficient going forward.

DT members' perception of management support was not as high as expected based on prior studies of PE programs reporting on the crucial nature of management support (Reeves et al., 2012; Hunt et al., 2007; Rasmussen et al., 2006). However this lack of perceived top-down support may have been partly due to the focus of the present study being on program development and process refinement rather than improving the organizational climate for health or quality of work life per se. It is also possible that low resources due to the economic recession took more of a toll on the program than was immediately evident because SCs were less able to quickly and efficiently fund worthwhile interventions proposed by a DT. Members of the DT also rated their access to specialized knowledge and support in ergonomics as moderate despite the research team providing access to ergonomists during the study. This has implications for facilitator and DT training on the appropriate timing for inviting a subject matter expert to support the IDEAS process. We also found that it is important for subject matter experts to support rather than supplant DT efforts to gather data and plan interventions. If organizations do not have internal experts, they may need help in identifying external experts available to them through workers compensation carriers, health insurers, or local universities. Local or state government (e.g. OSHA consulting program) may also have experts available who can assist when needed.

Taken together, the lessons from the four study sites provide important insights regarding future use of this and other toolkits for implementing participatory TWH programs in the workplace.

1. We learned that providing a comprehensive suite of training and implementation materials was necessary, but not sufficient for ongoing program maintenance. The authors recommend that future toolkit users plan for inevitable participant turnover, and provide ongoing training opportunities for new participants to ensure they become oriented to the principles and protocols associated with a participatory TWH program

2. It is crucial to gain management support for allocating sufficient personnel time for facilitator and DT members, particularly during the program start-up process. This will enable DT members to engage in the participatory program activities, build momentum, and progress efficiently so the program achieves its full potential. Early success will help prevent cynicism from developing within the DT due to a lack of forward progress on intervention design and implementation.

3. Development of a practical and evidence-based organizational readiness instrument for TWH may be helpful in assuring sufficient resources, and avoiding the pitfalls mentioned above, and is the focus of ongoing research by the authors. For the interim, the research team used the results of this study to create a short organizational readiness survey to assess the resources already in place to support a HWPP. This survey is included in prototype form in the HWPP Toolkit that is freely available online at the CPH-NEW website (CPH-NEW, 2011) but still requires further testing and validation. Training materials

for HWPP program facilitator, DT, and SC are also provided as part of the HWPP Toolkit.

One of the strengths of this study was the combination of qualitative methods that involved data gathering from multiple participants and stakeholders, allowing for the program and training materials to be refined and augmented with tips for their successful use. Another strength is that the iterative design process for development of the tools themselves allowed for testing, refinement, and retesting in different settings and across different users. This multi-pronged, participatory action research approach to program toolkit development provided abundant opportunities to learn how the materials were understood by users, what happened in natural settings where they were used, and what types of program training and management techniques would help to ensure successful implementation. We were able to package the knowledge gained in the form training tools, and refined implementation and evaluation instruments to be used by future program facilitators and participants. Additionally, the findings led to the formulation of new research topics, such as the need for better instruments to assess organizational readiness for participatory TWH interventions.

Four limitations to this study can be readily acknowledged. First, there was site variability in the fidelity to the recommended program structure due to a combination of external factors and requests from key personnel at some sites, resulting in a single, mixed-level committee structure at two sites. While this provided a natural experiment to observe differences in implementation and outcomes between a one-committee and two-committee program structure, this also limited our ability to study either structure in more depth. (At the same time, the insights derived from the site variability provided much more information for generalization to future sites). A related limitation is that only one site was able to complete multiple intervention design cycles over the two-year study. It is possible that the future DTs using the refined IDEAS protocols and tools will be able to develop interventions with more efficiency.

Second, the study was not able to perform long-term evaluation of the overall participatory initiative, nor of the interventions designed and implemented by the DT in each site. Therefore, it is not possible to fully report on TWH outcomes.

Third, the professionals facilitating the program, while they match characteristics of intended end-users of the Toolkit, did not use the Toolkit materials totally unaided. Therefore, the success of using the HWPP Toolkit by these facilitators may have depended, in part, on additional helpful information received in the feedback sessions with the study team. It is therefore still unknown how easy it will be for professionals to use the HWPP Toolkit without a similar source of support, even though a diligent effort was made to incorporate the tools with tips to overcome all known barriers and pitfalls. Testing the effectiveness of the toolkit materials is a possible area of future research to optimize the translational potential of the materials developed in this study. A series of web-based training videos with additional tips and advice has also been created and is available as part of the HWPP Toolkit.

Fourth, facilitators are central actors in any participatory program, and are therefore important targets of evaluation (Nielsen and Abildgaard, 2013). Although all interview

participants were given an opportunity at the end of the study to comment on the effectiveness of their program facilitator and forms of support available to the intervention design process, there was no objective assessment of the facilitators' knowledge, skills and abilities that might help to explain differences in implementation outcomes across sites in the present study, and separately from the quality of the tools or intervention design process.

5. Conclusions

The purpose of this study was to develop, test, and refine a toolkit in which participatory ergonomics is used to plan and implement integrated Total Worker Health® interventions for improving employee safety, health and wellbeing. Masters-level trained professionals in either industrial/organizational psychology or health promotion were able to use the toolkit materials in workplace settings to form a Design Team and Steering Committee, to identify and prioritize a wide range of work organization and lifestyle factors of concern to workers, and to use a systems approach when designing integrated interventions to address health/safety issues/concerns prioritized by front-line workers. Key lessons learned from this study were that: consistent training of facilitator and committee members on ergonomics and TWH principles, as well as allocation of sufficient time and resources (including subject matter experts), are both vital for the viability and success of a participatory TWH program. In addition, a separate Design Team and Steering Committee structure is desirable when designing TWH interventions, and planning for normal turnover on the design team and steering committee requires regular training efforts by the facilitator.

Iterative design by researchers, facilitators and in some cases participants from the four field sites was effective in supporting both the development and refinement of a toolkit consisting of a suite of "practitioner-ready" program tools to assist with implementing a Healthy Workplace Participatory Program (HWPP). The Toolkit startup materials aided practitioners with introducing a program structure and process that facilitated multi-level communication and collaboration between front-line workers and managers on safety/health/well-being issues. The Toolkit instruments enabled organizations to gather multi-level perspectives about a broad range of safety/health concerns that set the stage for front-line employees to plan integrated TWH interventions. Use of the HWPP Toolkit made it possible for an organization to employ a comprehensive systems approach consistent with macroergonomic principles when addressing a wide range of work environment, work organization, safety, and employee health concerns. The HWPP Toolkit has the potential to positively impact employees who are disproportionately impacted by stressful working conditions but who may be least likely to participate in and benefit from conventional top-down worksite health promotion program approaches. The HWPP Toolkit is available online at www.uml.edu/cphnewtoolkit.

Acknowledgments

Abbreviations

PE	Participatory Ergonomics
HP	Health Promotion
SC	Steering Committee
DT	Design Team
TWH	Total Worker Health
HWPP	Healthy Work-place Participatory Program

References

Anger KE, Diane Bodner T, Olson R, et al. Effectiveness of total worker health interventions. J Occup Health Psychol. 2015; 20:226–247. [PubMed: 25528687]

Brown KG, Gerhardt MW. Formative evaluation: an integrative practice model and case study. Pers Psychol. 2002; 4:951.

Carr L, Leonhard C, Tucker S, Fethke N, Benzo R, Gerr F. Total worker health intervention increases activity of sedentary workers. Am J Prev Med. 2016; 50:9–17. [PubMed: 26260492]

Chaudoir SR, Dugan AG, Barr CH. Measuring factors affecting implementation of health innovations: a systematic review of structural, organizational, provider, patient, and innovation level measures. Implement Sci. 2013; 8:1–20. [PubMed: 23279972]

Commission on Health and Safety and Workers' Compensation. The Whole Worker: Guidelines for Integrating Occupational Health and Safety with Workplace Wellness Programs. Oakland, CA: 2010. p. 1-44.https://www.dir.ca.gov/chswc/WOSHTEP/Publications/WOSHTEP_TheWholeWorker.pdf

CPH-NEW. The Healthy Worksite Participatory Program Online Toolkit. University of Massachusetts Lowell: Center for Promotion of Health in the New England Workplace; 2011. www.uml.edu/cphnewtoolkit

Damschroder L, Aron D, Keith R, Kirsh S, Alexander J, Lowery J. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implement Sci. 2009; 4:15. [PubMed: 19284660]

Egan M, Bambra C, Thomas S, Petticrew M, Whitehead M, Thomson H. The psychosocial and health effects of workplace reorganisation. A systematic review of organisational-level interventions that aim to increase employee control. J Epidemiol Community Health. 2007; 61:945–955. [PubMed: 17933951]

Ferraro L, Faghri PD, Henning R, Cherniack M, Team CftPoHitNEW. Workplace based participatory approach to weight loss for correction employees. J Occup Environ Med. 2013; 55:147–155. [PubMed: 23291996]

Glasgow RE, Vogt TM, Boles SM. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. Am J Public Health. 1999; 89:1322–1327. [PubMed: 10474547]

Goetzel, RZ. Policy and Practice Working Group Final Report. NIOSH; Washington D.C: 2005. Examining the Value of Integrating Occupational Health and Safety and Health Promotion Programs in the Workplace.

Haims MC, Carayon P. Theory and practice for the implementation of 'in-house', continuous improvement participatory ergonomic programs. Appl Ergon. 1998; 29:461–472. [PubMed: 9796792]

Haines H, Wilson JR, Vink P, Koningsveld E. Validating a framework for participatory ergonomics (the PEF). Ergonomics. 2002; 45:309–327. [PubMed: 12028727]

Henning, RA., Nobrega, S., Flum, MR., Punnett, L. CPH-NEW Research Team. Engaging workers in health promotion and health protection efforts: a participatory approach for innovation and sustainability at two worksites. In: Lapointe, PA., Pelletier, J., editors. Different Perspectives on Work Changes, Proceedings of Second International Workshop on Work and Intervention Practices. Les Presses de I'Universite Laval; Quebec, P.Q: 2009. p. 199-208.

Henning RA, Warren N, Robertson M, Faghri P, Cherniack MG. CPH-NEW Research Team. Workplace health protection and promotion through participatory ergonomics: an integrated approach. Public Health Rep. 2009; 124:26–35.

Henning, RA., Reeves, DW. CPH-NEW Research Team. An integrated health protection/promotion program supporting participatory ergonomics and salutogenic approaches in the design of workplace interventions. In: Bauer, GF., Jenny, GJ., editors. Salutogenic Organizations and Change: the Concepts behind Organizational Health Intervention Research. Springer; 2013.

Hunt MK, Lederman R, Stoddard AM, et al. Process evaluation of an integrated health promotion/ occupational health model in wellworks-2. Health Educ Behav. 2005; 32:10–26. [PubMed: 15642751]

Hunt MK, Barbeau EM, Lederman R, et al. Process evaluation results from the healthy directions small business study. Health Educ Behav. 2007; 34:90–107. [PubMed: 16740502]

Ipsen, C., Jensen, PL. Causes of work-related stress and individual strategies in knowledge work. Kgs. Lyngby: DTU Management; 2010. (DTU Management 2010; No. 10), http://orbit.dtu.dk/ws/files/4370742/Causes%20of%20work-related%20stress%20in%20knowledge%20work.pdf

Lax MB. The perils of integrating wellness and safety and health and the possibility of a worker-oriented alternative. New Solut. 2016; 26:11–39. [PubMed: 26864848]

Loeppke RR, Hohn T, Baase C, et al. Integrating health and safety in the workplace: how closely aligning health and safety strategies can yield measurable benefits. J Occup Environ Med. 2015; 57:585–597. [PubMed: 25951422]

Matthews RA, Gallus JA, Henning RA. Participatory ergonomics development of an employee assessment questionnaire. Accid Anal Prev. 2011; 43:360–369. [PubMed: 21094334]

McLellan, D., Harden, E., Markkanen, P., Sorensen, G. SafeWell Practice Guidelines: an Integrated Approach to Worker Health. version 2.0. Harvard School of Public Health; 2012. p. 1-188.

Nelson CC, Allen JD, McLellan D, Pronk N, Davis KL. Integrating health promotion and occupational safety and health in manufacturing worksites: perspectives of leaders in small-to-medium sized businesses. Work. 2015; 52:169–176. [PubMed: 26410231]

Nielsen K, Abildgaard JS. Organizational interventions: a research-based framework for the evaluation of both process and effects. Work Stress. 2013; 27:278–297.

Nielsen J, Molich R. Heuristic evaluation of user interfaces. Proc SIGCHI Conf Hum factors Comput Syst. 1990:249–256.

Nielsen K, Randall R. The importance of employee participation and perceptions of changes in procedures in a teamworking intervention. Work Stress. 2012; 26:91–111. [PubMed: 22745519]

Nielsen K, Randall R, Holten AL, Gonzales ER. Conducting organization-level occupational health interventions: what works? Work Stress. 2010; 24:234–259.

NIOSH. Total Worker Health History Webpage. Centers for Disease Control and Prevention; 2015. http://www.cdc.gov/niosh/twh/history.html

NIOSH. NIOSH. Research Compendium: the NIOSH Total Worker Health Program. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH); Washington DC: 2012. seminal research papers 2012; p. 1-214.

Nobrega, S., Belice, L., Henning, R., Warren, N., Robertson, M. Team TC-NR. Field tests of the CPH-NEW Toolkit: a grassroots participatory program for workplace health promotion/protection. The

9th International Conference on Occupational Stress and Health. American Psychological Association/National Institute for Occupational Safety and Health; Orlando, FL. 2011.

Pronk NP. Integrated worker health protection and promotion programs: overview and perspectives on health and economic outcomes. J Occup Environ Med. 2013; 55:S30–S7. [PubMed: 24284747]

Punnett L, Cherniack MG, Henning RA, Morse T, Faghri P. CPH-NEW Research Team. A conceptual framework for integrating workplace health promotion and occupational ergonomics programs. Public Health Rep. 2009; 124:16–25. [PubMed: 19618803]

Punnett L, Warren N, Henning RA, Nobrega S, Cherniack M. CPH-NEW Research Team. Participatory ergonomics as a model for integrated programs to prevent chronic disease. J Occup Environ Med. 2013; 55:s19–s24. [PubMed: 24284754]

Rasmussen K, Glasscock D, Hansen O, Carstensen O, Jepsen J, Nielsen K. Worker participation in change processes in a Danish industrial setting. Am J Ind Med. 2006; 49:767–779. [PubMed: 16804911]

Rasmussen CD, Lindberg NK, Ravn MH, Jorgensen MB, Sogaard K, Holtermann A. Processes, barriers and facilitators to implementation of a participatory ergonomics program among eldercare workers. Appl Ergo. 2016; 58:491–499.

Reeves D, Walsh B, Tuller M, Magley V. The positive effects of participative decision making for midlevel correctional management. Crim Justice Behav. 2012; 39:1361–1372.

Rivilis I, Van Eerda D, Cullena K, et al. Effectiveness of participatory ergonomic interventions on health outcomes: a systematic review. Appl Ergo. 2007; 39:342–358.

Robertson MM. Macroergonomic methods: assessing work system processes. Int J Hum Factors Ergon. 2002; 1:67–96.

Robertson M, Courtney T. A systems analysis approach to solving office work system health and performance problems. Theor Issues Ergon Sci. 2004; 5:181–197.

Robertson M, Henning R, Warren N, et al. The Intervention Design and Analysis Scorecard: a planning tool for participatory design of integrated health and safety interventions in the workplace. J Occup Environ Med. 2013; 55:86–88.

Robertson MM, Henning RA, Warren N, et al. Participatory design of integrated safety and health interventions in the workplace: a case study using the Intervention Design and Analysis Scorecard (IDEAS) Tool. Int J Hum Factors Ergon. 2015; 3:303–326.

Sauter S. Integrative approaches to safeguarding the health and safety of workers. Ind Health. 2013; 51:559–561. [PubMed: 24292810]

Savin-Baden, M., Major, C. Qualitative research: the essential gu8de to theory and practice. Routledge; London: 2013.

Schill AL, Chosewood LC. The NIOSH total worker health program: an overview. J Occup Environ Med. 2013; 55:S8–S11. [PubMed: 24284752]

Sorensen G, Stoddard A, Hunt MK, et al. The effects of a health promotion-health protection intervention on behavior change: the WellWorks Study. Am J Public Health. 1998; 88:1685–1690. [PubMed: 9807537]

Sorensen G, McLellan D, Dennerlein J, et al. Integration of health protection and health promotion: rationale, indicators, and metrics. J Occup Environ Med. 2013; 55:7.

Strauss, A., Corbin, JM. Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. Sage Publications; Thousand Oaks: 1998.

Van Eerd D, Cole D, Irvin E, et al. Process and implementation of participatory ergonomic interventions: a systematic review. Ergonomics. 2010; 53:1153–1166. [PubMed: 20865600]

Van Eerd D, King T, Keown K, et al. Dissemination and use of a participatory ergonomics guide for workplaces. Ergonomics. 2016; 59:851–858. [PubMed: 26328617]

von Thiele Schwarz U, Augustsson H, Hasson H, Stenfors-Hayes T. Promoting employee health by integrating health protection, health promotion, and continuous improvement: a longitudinal quasi-experimental intervention study. J Occup Environ Med. 2015; 57:217–225. [PubMed: 25654524]

Warren, N., Dugan, AG. A NIOSH WorkLife project: development and validation of a multi-purpose short practitioner survey. The 9th International Conference on Occupational Stress and Health. American Psychological Association/National Institute of Occupational Safety and Health; Orlando, FL. 2011.

Williams JAR, Nelson CC, Caban-Martinez AJ, et al. Validation of a new metric for assessing the integration of health protection and health promotion in a sample of small and medium sized employer groups. J Occup Environ Med. 2015; 57:1017–1027. [PubMed: 26340291]

World Health Organization. Healthy Workplaces: a Model for Action. World Health Organization; Geneva, Switzerland: 2010.

Yazdani A, Neumann WP, Imbeau D, et al. How compatible are participatory ergonomics programs with occupational health and safety management systems? Scand J work Environ health. 2015; 2:111–123.
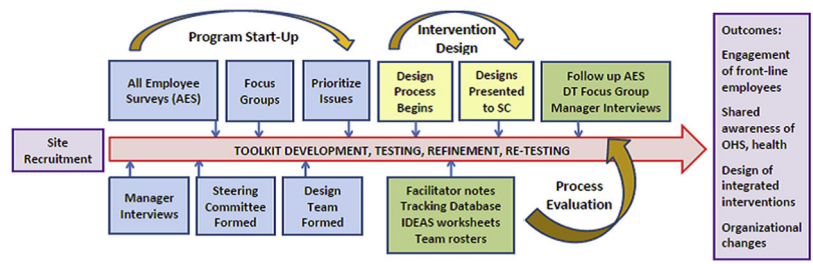
Fig. 1.
HWPP Toolkit field tests protocol: program start-up, intervention design, and evaluation.
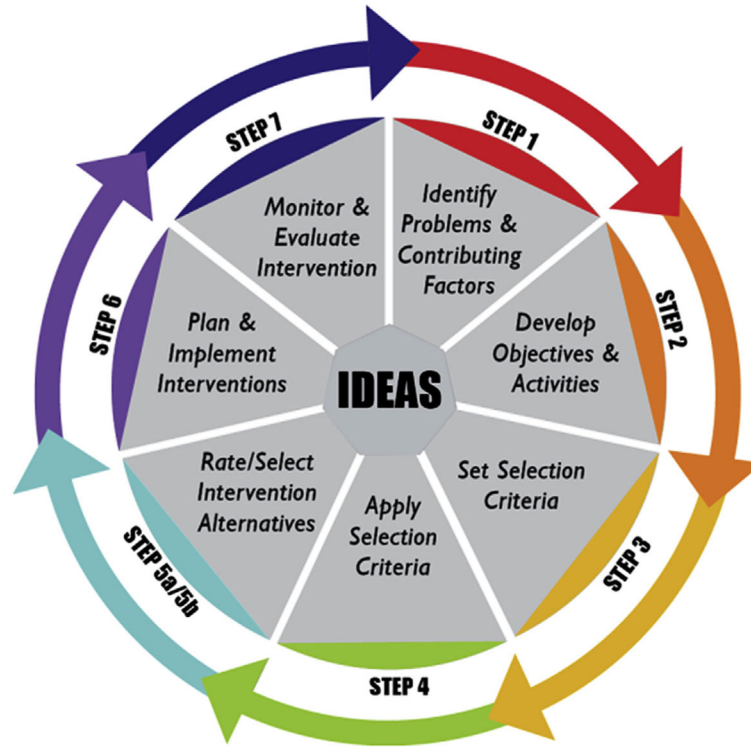
Fig. 2.
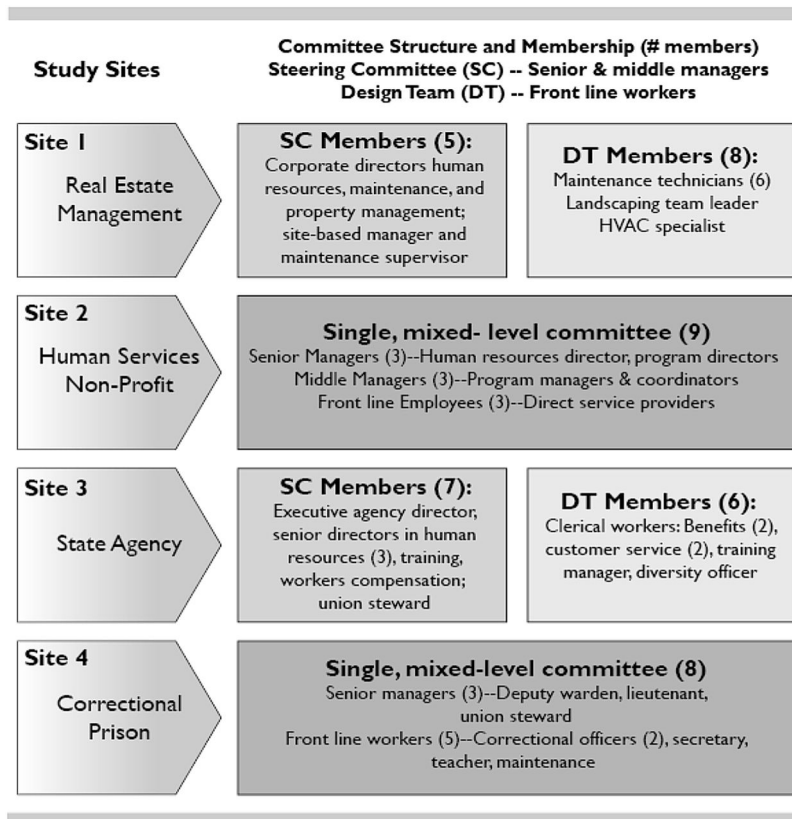The IDEAS 7-Step design process.

Fig. 3.
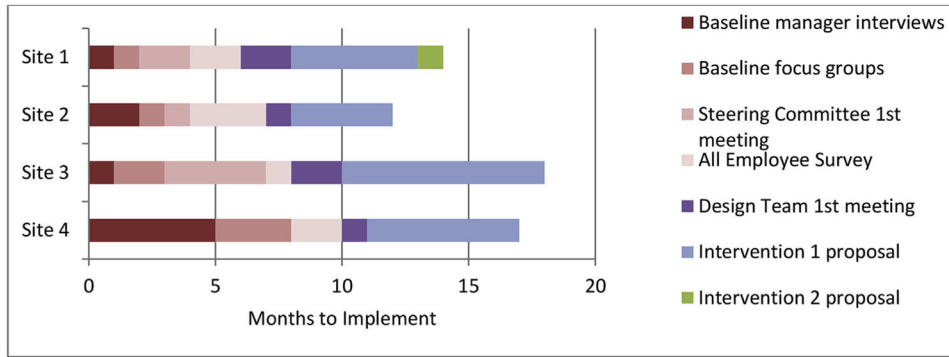Program participants and committee structure in field test organizations.

Fig. 4.
Start-up and implementation timeline by test site.

Table 1

Characteristics of study sites where the toolkit was field tested.

Field test site	Characteristics
Site 1	Privately-owned real estate rental and property management firm
	Total workforce–160 employees
	Program target–55 maintenance and landscape workers distributed among 8–10 properties in New England region.
Site 2	Non-profit healthcare and social assistance agency
	Total workforce–346 employees
	Program Target–346 social workers, dietitians, office workers, pre-school teachers distributed among multiple offices throughout state.
Site 3	Public administration, state government executive office
	Total workforce–24,000
	Program target–260 human resources employees; 130 located in a single headquarters office; others distributed in offices throughout state.
Site 4	Public safety, correctional facility
	Total workforce–289 officers, administrative staff
	Program target–289 employees.

Table 2

Total Worker Health Toolkit materials developed for field test study.

Toolkit items	Description/Examples
Recruitment, organizational readiness assessment	-Baseline assessment interview guide for managers -Participatory ergonomics organizational readiness survey
Committee Formation tools	-Step-by-step guides for Design Team & Steering Committee recruitment, training and facilitation -Ergonomics and health promotion basics presentation -Overview presentation of participatory intervention design
Assessment and issue prioritization tools	-All-Employee Survey on health, safety & workplace design, with implementation manual -Design Team focus group guide on health & work environment -Activity guide for prioritizing health and safety problems/issues -Activity guide for envisioning the ideal workplace
Intervention design tools	-Facilitator guide to the 7-step Intervention Design & Analysis Scorecard (IDEAS) Tool for designing interventions -Quick reference guides for each IDEAS design step (1–7) (e.g. group activities for root causes analysis, cost/benefit analysis for each proposed workplace intervention) -Worksheet templates for IDEAS design steps 1–5
Program evaluation tools	-Follow up interview guide for managers -Design Team process evaluation survey & focus group script

Table 3

Process evaluation data collection measures and tools.

Re-AIM component	Measures	Evaluation data source
Reach *#participants, representativeness*	- Number and job titles of Design Team (DT) members	- DT and SC membership rosters
	- Number and job titles of Steering Committee (SC) members	- DT IDEAS worksheets
	- Planned reach for proposed interventions	
Effectiveness *Program process outcomes (short term)*	-Team engagement/involvement	- DT survey
	- Health/safety concerns identified	- Process tracking database
	- Number of Interventions designed and implemented	- DT IDEAS proposal worksheets
	- "Integratedness" of interventions	- Manager interviews
	- Perceived intervention effectiveness	
	- Perceived organizational communication	
Adoption *# agents willing to initiate a program*	- Intention of managers to sustain program	- Manager interviews
	- Satisfaction and perceived benefits/barriers of IDEAS & participatory process	- DT focus group
	- Perceived benefits of interventions designed by DT	
Implementation *Extent of fidelity to the program protocol*	- Fidelity to recommended formation of DT and SC committees	- Meeting notes
	- Fidelity to recommended implementation of all 7 steps of IDEAS tool	- Team rosters
		- DT IDEAS worksheets
		- Tracking database (facilitator)
Maintenance *Program institutionalization*	- Perceptions of resources needed to sustain the program and feasibility	- Manager interviews

Table 4

Health/Safety issues identified using All-Employee Survey and Focus Group tools.

Site	Aspects of work that get in the way of health/safety	Health behaviors ready to change and/or most desired health improvements
Site 1 real estate management firm	Conflicting demands, heavy lifting, heat, on-call when not at work, low-decision making.	Lose weight, exercise, less stress, improved sleep.
Site 2 Human services non-profit	Poor lighting, sitting, poor temperature control, timing of lunch breaks.	Lose weight, reduce stress, and quit smoking.
Site 3 State government administration	Workload, too much sitting, workstation discomfort Poor communication Poor air quality, lighting	More energy, stress reduction, exercise, better work/family balance, improved sleep.
Site 4 Correctional institution	Issues with co-workers, air quality, emotionally demanding, lack of healthy vending choices.	Reduce stress, improved sleep, reduce substance abuse (smoking, drinking)

Table 5

Health/safety interventions designed in each study site.

Health/Safety problem/Issues Considered and selected	Proposed intervention activities (Activities approved for implementation are bolded)
Site 1, Intervention 1	**Educational materials for new rental customers to reduce unnecessary work orders.**
Stress from high workload and poor communication	Better wireless phone service to decrease missed calls.
	Already underway at time of proposal
	Improved work order management software or better adherence to work order system.
Site 1, Intervention 2	More uniform choices–**Shirts with breathable fabric**, pant styles to hold more tools, looser
Overheating, uniform discomfort	
Site 1, Intervention 3	Increase opportunities for recognizing quality work
Low morale due to low recognition	(E.g. recognition awards, share customer feedback, use customer feedback as part of performance appraisals)
	This proposal was not formally rated by SC before conclusion of the study.
Site 2	Procurement policy to support ergonomic equipment purchases.
Stress, workstation discomfort from poor fit and too much sitting	**Computer workstation adjustment tips for new staff**
	Training program for ergonomic champions (internal staff) at each office location
	Walking breaks
Site 3	Ergonomic procurement policy
Too much sitting, workstation discomfort	**Informational fact sheets and newsletters**
	Training program for ergonomic champions (internal staff) at each office location
Site 4	**Health fair with information responding to health concerns prioritized by correctional officers**
Sleep disorders, overweight, mental health, injuries	

Note: Bolded items were approved and implemented during the study.

Table 6

Design team survey outcomes.

Design team survey All questions N = 25		Agree or strongly agree Frequency (number reported) (Percentage of responses)
A priori domain	**Question**	**All**
Involvement	1a) Interested in remaining involved in DT	21 (95.5%)
	1b) Asked for personal input in H + S discussions	22 (100%)
	1c) Actively involved in planning H + S interventions	19 (86.4%)
Knowledge Base	2a) Can meet with experts to develop plans for workplace interventions	13 (59.1%)
	2b) Training available to help me understand/identify health and ergonomic risks	12 (54.5%)
	2c) Able to obtain useful information about health and ergonomics	16 (72.7%)
Managerial Support	3a) Upper management supportive of DT proposals	16 (72.7%)
	3b) Immediate supervisor is supportive of DT proposals	16 (72.7%)
	3c) Supervisor encourages me to take advantage of health-related training	13 (59.1%)
Employee Supportiveness	4a) Try to represent the views of other employees when participating on DT	21 (95.5%)
	4b) Workplace changes made by the DT are a good thing for employer to support and/or invest in	21 (95.5%)
	4c) Support the workplace changes proposed by DT	20 (90.9%)
Unplanned Consequences	5a) Workplace changes/proposals by DT have created other workplace problems	0 (0.0%)
	5b) Workplace changes/proposals by DT are a source of conflict between coworkers	0 (0.0%)

'Agree/Strongly Agree' defined as score 4 on this survey item on a scale from 1 to 5.

Table 7

Perceived benefits and challenges of the participatory program.

Theme and source	Specific examples	Relevant quotes

Benefits

Design process was structured and easy to follow (Managers-2 sites, Non-managers-3 sites)

Examples: Takes you step-by-step, timeline keeps you on track, organizes our thinking

"*It was helpful for me because I don't usually break things down. You realize what goes into everything. It makes you think about how you get to the end*"-DT member

Design process was solution-oriented (Managers-3 sites, Non-Managers-1 site)

Examples: Addresses underlying issues, allows for multiple solutions, generated new interventions, interventions were successful

"*These design team meetings have shown me that through work, research, and proper planning substantial changes can be made to better your work environment and improve employee satisfaction*" –DT member

Program enhanced collaboration and communication (Managers-3 sites, Non-Managers-1 site)

Examples: Brings together departments, management and front line interaction about health/safety, peer-to-peer communication

"*Yes, [I have a] better understanding of … employee needs across divisions*" –DT member

Raised awareness of health concerns on the job (Managers-2 sites, Non-Managers-4 sites)

Examples: General employee awareness of health or safety concerns, management understanding of health impacts of front line work conditions

"*I may have been more opinionated, but [the program materials] made me see things more objectively...I had to think of all the employees instead of just the [team].*"-Manager

Promoted positive climate, (Managers-3 sites, Non-Managers-1 site)

Examples: Shows management values employees' opinions, openness to discuss work environment, co-workers talk about health, positive feelings of being valued, respected

"*If this group was not around our ideas would not be heard as much and less would be accomplished.*"- DT member

Professional skill building (Managers-3 sites, Non-Managers-3 sites)

Examples: Problem-solving, decision-making, engagement/motivation, communication- presenting, listening, working as a team, knowledge about ergonomics, organization processes, confidence building

"*It enables you to make a proposal for presentation to management. It made us more equipped to answer some of their questions we were able to provide more background information.*" –DT member

Challenges

Required a lot of meeting time (Managers-4 sites, Non-Managers-4 sites)

Examples: Hard to pull employees from work, time consuming to schedule and attend meetings, need to meet every couple of weeks to make progress, keep momentum

"*The only complaint I would have is that it does take valuable time away from work.*"-DT Member

Characteristics/policies of organization (Managers-4 sites, Non-managers-4 sites)

Examples: Staff changes (e.g. reductions, retirements) require retraining, shift workers make it difficult to get consistent attendance, regulations, rigid hierarchy, multiple sites with varying issues, lack of funding for interventions