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A Conceptual Model for Guiding Integrated Interventions and Research

Pathways Through the Conditions of Work

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There is a paradigm shift underway in protection and promotion of worker safety and health, as is evident in this volume. The National Institute for Occupational Safety and Health (NIOSH; n.d.) has led this shift through its *Total Worker Health*® program, which defines an integrated approach to worker safety and health as "policies, programs, and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness prevention efforts to advance worker well-being" (para. 1). This approach builds on NIOSH's long-standing efforts to ensure that workers are

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protected from harm at work by acknowledging the broad impact that working conditions have on worker health and well-being. For example, wages, work hours, workload, relationships with coworkers and supervisors, and stress levels at work may contribute not only to health, safety, and well-being but also to health behaviors that increase or decrease risk of chronic diseases (LaMontagne et al., 2014; Montano, Hoven, & Siegrist, 2014).

The recent trend toward adoption of this approach underscores the need for defining best practices and processes to ensure optimal results (Hammer & Sauter, 2013; Sorensen, Landsbergis, et al., 2011). This trend builds on growing evidence about the potential benefits of integrated approaches for improvements in health behaviors (Okechukwu, Krieger, Sorensen, Li, & Barbeau, 2009; Olson, Anger, Elliot, Wipfli, & Gray, 2009; Sorensen et al., 2002, 2005); enhanced rates of employee participation in programs (Hunt et al., 2005); potential reductions in pain, occupational injury, and disability rates (Pronk, Katz, Lowry, & Payfer, 2012; Shaw, Robertson, McLellan, Verma, & Pransky, 2006); strengthened health and safety programs (LaMontagne et al., 2004); potentially reduced costs (Goetzel, Guindon, Turshen, & Ozminkowski, 2001); and support for market performance of companies (Fabius et al., 2016). These findings are supported by multiple reviews of integrated interventions (Anger et al., 2015; Cherniack, 2013; Cooklin, Joss, Husser, & Oldenburg, 2017; Institute of Medicine [IOM], 2005; NIOSH, 2012; Pronk, 2013; Sorensen, Landsbergis, et al., 2011), although a recent systematic review concluded that although integrated interventions may improve health behaviors, there remains a need for further evidence on their impact on injuries and overall quality of life (Feltner et al., 2016).

Despite growing evidence, this field of inquiry is still in its infancy, needing further evaluation of the effectiveness of this approach. A common conceptual model can structure intervention research to elucidate the pathways through which occupational factors influence safety and chronic disease risk. Thus, a conceptual model is useful in making explicit the underlying assumptions of integrated interventions. The purpose of this chapter is to present a conceptual model that will guide research on determinants of worker safety and health and inform the design, implementation, and evaluation of integrated approaches to protecting and promoting worker safety and health. This model embeds worker health within the work environment, placing a focus on the conditions of work. The chapter also illustrates the application of this model to both social epidemiological and intervention research.

DEVELOPMENT OF THE CONCEPTUAL MODEL

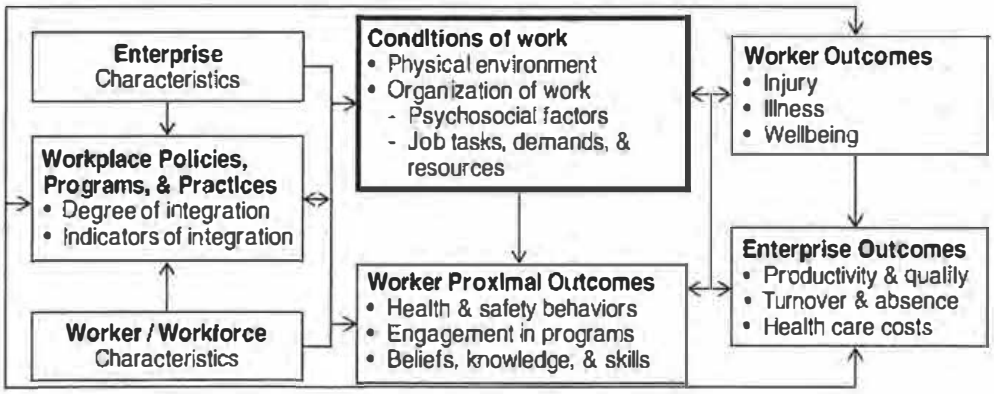
This conceptual model was developed by the Center for Work, Health and Well-being at the Harvard T. H. Chan School of Public Health, a Center for Excellence within NIOSH's *Total Worker Health* (TWH) program. Based on the Center's previous research and to guide future research, investigators developed, used, and

updated this conceptual model to specify the causal pathways through which integrated policies, programs, and practices are expected to influence worker safety and health outcomes (see Figure 5.1).

This conceptual model is based on the premise that addressing multiple pathways in an integrated manner with a focus on the conditions of work will contribute to greater improvements in worker health and enterprise outcomes than addressing each pathway separately. Critical to the model are workplace policies, programs, and practices that may concurrently operate through multiple pathways, including the physical work environment and the organization of work. These conditions of work, centrally located in the model as determinants of worker safety, health, and well-being outcomes, also mediate the effects of enterprise characteristics, workplace policies, programs and practices, and worker/workforce characteristics on worker proximal outcomes (e.g., health and safety behaviors). Integrated policies, programs, and practices may also contribute to improvements in enterprise outcomes such as turnover and health-care costs. At the same time, enterprise and worker outcomes may influence workplace policies, programs, and practices, creating a loop of integrated influence within the organization. It is important to recognize, in addition, that these relationships occur within the context of labor market and economic trends; legal and political forces; and social mores, norms, and influences.

This conceptual model represents diverse theoretical perspectives, including the social ecological model (Stokols, 1996), social contextual model of health behavior change (Sorensen et al., 2003), hierarchy of controls (Levy, Wegman, Baron, & Sokas, 2006), organizational ergonomics (Hendrick & Kleiner, 2002), participatory frameworks (Rivilis et al., 2008), job strain (Karasek & Theorell, 1990), and sociotechnical systems theory (Cooper & Foster, 1971). These theoretical foundations underscore the complex interplay of factors involving

FIGURE 5.1. Conceptual Model for Integrated Approaches to Worker Safety and Health



From "Integrating Worksite Health Protection and Health Promotion: A Conceptual Model for Intervention and Research," by G. Sorensen, D. L. McLellan, E. L. Sabbath, J. T. Dennerlein, E. M. Nagler, D. A. Hurtado, N. P. Pronk, and G. R. Wagner, 2016, *Preventive Medicine*, 91, p. 189. Copyright 2016 by Elsevier. Adapted with permission.

individual workers and the immediate work environment, characteristics of the larger contexts in which both the worker and the worksite are embedded, and proximal outcomes, such as individual health and safety behaviors and related factors of self-efficacy and risk perceptions that support improvements in these behaviors. Examples of feedback pathways are included in Figure 5.1, which underscore the complexity of the system and interrelationships across multiple dimensions. Each of the model's components is presented following discussion of indicators of integrated workplace policies, programs, and practices.

Indicators of Integrated Workplace Policies, Programs, and Practices

Implementation of integrated approaches operates on a continuum rather than as an all-or-none adoption of this approach. Organizations may implement change in varying sequences and may respond differently by industry sector, size of workplace, and extent of leadership and labor engagement (D. L. McLellan, Cabán-Martinez, et al., 2015). We have defined a set of indicators of integrated policies, programs, and practices that may directly or indirectly affect the conditions of work (see Table 5.1). First, leadership commitment, a necessary foundation for an integrated approach, reflects the key roles that senior leadership and middle management play in articulating the vision for worker and worksite health and ensuring availability of resources (i.e., human, financial, physical; IOM, 2005). Second, further reflecting the centrality of the conditions of work within this model, the indicators include policies, programs, and practices that foster working conditions that contribute to worker health, safety, and well-being, including the physical work environment and the

TABLE 5.1. Indicators of Integrated Policies, Programs, and Practices

Indicator domain	Definition
Leadership commitment	Leadership makes worker safety, health, and well-being a clear priority for the entire organization. They drive accountability and provide the necessary resources and environment to create positive working conditions.
Participation	Stakeholders at every level of an organization, including organized labor, help plan and carry out efforts to protect and promote worker safety and health.
Policies, programs, and practices focused on positive working conditions.	The organization enhances worker safety, health, and well-being with policies and practices that improve working conditions.
Comprehensive and collaborative strategies	Employees from across the organization work together to develop comprehensive health and safety initiatives.
Adherence	The organization adheres to federal and state regulations, as well as ethical norms, that advance worker safety, health, and well-being.
Data-driven change	Regular evaluation guides an organization's priority setting; decision making; and continuous improvement of worker safety, health, and well-being initiatives.

organization of work. These conditions of work are further described next. Fourth, integrated strategies are both comprehensive and collaborative. Rather than functioning independently, coordination and collaboration among occupational safety and health, worksite health promotion, employee benefits, and other workplace functions is needed to optimize benefits for worker safety and health (IOM, 2005). Fifth, integrated approaches ensure that organizations adhere to federal and state regulations and ethical norms that contribute to protecting and promoting safety, health, and well-being at worksites and for employees (Occupational Safety and Health Administration, 2008). Finally, workplace programs, policies, and practices are monitored and evaluated for both occupational health exposures and health-related behaviors and the relationships of exposures and behaviors to health outcomes, and these data are used in setting priorities for improvement (IOM, 2005).

Conditions of Work

This model illustrates the potential impact that these integrated policies, programs, and practices may have on worker safety and health outcomes through several pathways based primarily within the conditions of work. First, integrated policies and practices have a direct impact on the *physical work environment*, including on potential exposures on the job. For example, policies may impact physical demands related to biomechanical sources of strain, or may include purchasing policies that influence selection of safer versus more hazardous chemicals or equipment used in some work processes. The work environment may also support healthy behaviors among workers, for example, through worksite tobacco control policies or availability of healthy foods in cafeterias and vending machines. Second, the *organization of work* has been consistently shown to influence worker health and safety outcomes (Lipscomb, Trinkoff, Brady, & Geiger-Brown, 2004; Tullar et al., 2010) as well as health behaviors (Albertsen, Borg, & Oldenburg, 2006; Choi et al., 2010). *Psychosocial factors*, part of the organization of work, broadly include job strain, psychological demands and control (Karasek & Theorell, 1990), rewards (Siegrist, 1996), social support, harassment, and discrimination (NIOSH, 2008). For example, supervisor and coworker support and social norms that support health and safety behaviors are associated with improved health behaviors, such as physical activity and sleep quality (Choi et al., 2010; Nishitani & Sakakibara, 2010) and reduced risk of musculoskeletal disorders (Macfarlane et al., 2009). *Job tasks, demand*, and *resources*, including the extent to which high physical exertion is a requirement of the job, work hours and shift, and the pace of work, have been shown consistently to influence a range of safety and health outcomes (Lipscomb, Trinkoff, Geiger-Brown, & Brady, 2002). Changes in the conditions of work may ultimately contribute to transformational change in the organization toward a culture of worker safety, health, and well-being (Sorensen et al., 2013), by which we mean one that anticipates and mitigates potential workplace health risks; encourages worker identification and reporting

of health and safety concerns without fear of reprisal; and provides health supportive programs, policies, and practices.

Enterprise Characteristics

Enterprise characteristics, such as industry sector and size, influence the conditions of work and the types of exposures that workers face and are likely to play significant roles in the uptake of integrated approaches (Harris, Hannon, Beresford, Linnan, & McLellan, 2014; Krieger, 2010). Employers also set pay scales and work hours, further shaping the resources and health outcomes that workers experience (Baron et al., 2014; Krieger et al., 2008).

Workforce-Worker Characteristics

It is also important to understand, for example, the changing needs of an aging workforce, the potentially differing work–family intersections for men compared to women workers, and potential vulnerabilities of immigrant workers compared to U.S.-born workers. Similarly, for example, young workers are twice as likely as older workers to be injured on the job (Estes, Jackson, Castillo, & Centers for Disease Control and Prevention, 2010) and often lack sufficient training in workplace safety practices and legal rights on the job (Rohlman, Parish, Elliot, Montgomery, & Hanson, 2013).

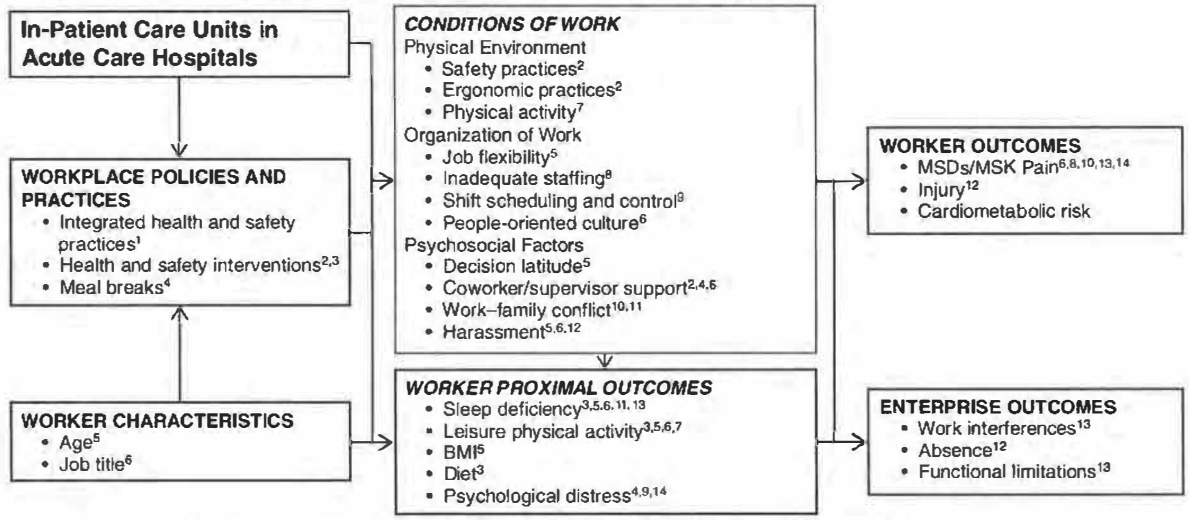
Outcomes (Including Worker Proximal Outcomes, Worker Outcomes, and Enterprise Outcomes)

Both individual- and organization-level outcomes are included in the model. The conditions of work contribute directly to risk of injury and illness as well as well-being. In addition, the conditions of work contribute to quality of life and health- and safety-related behaviors (e.g., job stress is associated with increased tobacco and alcohol use; Hammer & Sauter, 2013), as well as other proximal outcomes such as participation in safety or smoking cessation programs. At the organizational level, enterprise outcomes can include financial and economic outcomes, such as absenteeism, turnover, employer expenditures on health care, and intervention return on investment. Given that worksite interventions require employer support and commitment of resources, consideration of enterprise outcomes can help make the business case for integrated interventions.

APPLICATION OF THE CONCEPTUAL MODEL IN RESEARCH AND INTERVENTION DESIGN

We used this model to guide social epidemiological research in a study of hospital patient care workers in the Be Well, Work Well Study, conducted by the Center for Work, Health and Well-being. Findings from this research illustrate the roles of the conditions of work as critical pathways shaping worker health and safety outcomes (see Figure 5.2; Caspi et al., 2013; Sorensen et al., 2013;

FIGURE 5.2. Application of the Conceptual Model in the Be Well, Work Well Study



[1]Sorensen et al., 2013
[2]Caspi et al., 2013
[3]Sorensen, Nagler, et al., 2016
[4]Hurtado, Nelson, et al., 2015
[5]Nelson et al., 2014
[6]Sorensen, Stoddard, et al., 2011
[7]Umukoro et al., 2013
[8]Kim et al., 2014
[9]Hurtado, Glymour, et al., 2015
[10]Kim et al., 2013
[11]Jacobsen, Reme, Sembajwe, Hopcia, Stoddard, et al., 2014
[12]Sabbath et al., 2014
[13]Buxton et al., 2012
[14]Reme et al., 2012

MSDs = musculoskeletal disorders; MSK = musculoskeletal; BMI = body mass index. From "Integrating Worksite Health Protection and Health Promotion: A Conceptual Model for Intervention and Research," by G. Sorensen, D. L. McLellan, E. L. Sabbath, J. T. Dennerlein, E. M. Nagler, D. A. Hurtado, N. P. Pronk, and G. R. Wagner, 2016, *Preventive Medicine, 91*, p. 191. Copyright 2016 by Elsevier. Adapted with permission.

Sorensen, McLellan, et al., 2016; Sorensen, Nagler, et al., 2016). We found that injury, musculoskeletal pain, and health behaviors share diverse determinants within the work environment and vary by the socioeconomic status of workers (Jacobsen, Reme, Sembajwe, Hopcia, Stoddard, et al., 2014; Kim et al., 2013). For example, several dimensions of the organization of work and the psychosocial work environment were associated with injury risk, including staffing adequacy (Kim et al., 2014), schedule control (Hurtado, Glymour, et al., 2015), supervisor support, and related organizational policies and practices (Hurtado, Nelson, Hashimoto, & Sorensen, 2015; Tveito et al., 2014). Similarly, we found that workplace culture reflected in policies and practices, such as effective ergonomic and other safety practices, jointly predicted lower back pain; improved sleep; and, to a lesser extent, physical activity (Buxton et al., 2012; Reme, Dennerlein, Hashimoto, & Sorensen, 2012; Sorensen, Stoddard, et al., 2011). In addition, these findings document the role of work organization and the psychosocial work environment in shaping safety and health behaviors and health outcomes (Nelson et al., 2014; Sorensen, Stoddard, et al., 2011; Umukoro et al., 2013). For example, nurses working on units with more shift flexibility had relatively less depression and anxiety (Hurtado, Glymour, et al., 2015). Higher levels of work–family conflict were also significantly associated with sleep deficiency in the short term and nearly two years later (Jacobsen, Reme, Sembajwe, Hopcia, Stiles, et al., 2014), and with multiple types of musculoskeletal pain (Kim et al., 2013). Also, harassment at work was associated with increased risk of chronic injury (Sabbath et al., 2014), obesity, and low levels of physical activity (Sorensen, Stoddard, et al., 2011). Collectively, these findings underscore the need for a comprehensive approach to safety and health interventions, consistent with our integrated model.

We also used the conceptual model to design an integrated intervention in response to specific settings and conditions of work, based on a systematic assessment, including input from employees (Pronk et al., 2016). We tested the feasibility of the intervention in three small- and medium-sized manufacturing businesses in Minnesota. As part of planning, we used the conceptual model to guide assessment of employee health indicators and the physical and organizational environment, and we provided feedback on the assessments to the sites. This intervention focused particularly on changes in working conditions, such as environmental supports for ergonomic and health promotion practices. For example, participating sites used technology to address ergonomic and physical hazards related to back pain, including improved lifting or moving devices on factory floors and sit-to-stand devices in some office spaces. Consultation and training with midlevel and upper management, including committees comprising those responsible for protecting and promoting worker health and safety, provided a further means of influencing working conditions. In addition, telephone health coaching and web-based resources that included integrated messages on back pain and safe movement were available for employees as part of this comprehensive integrated program. We identified factors critical to successful implementation of policies, programs, and practices, including multilevel

management support and articulation of that support throughout the worksite; allocation of dedicated staff, budgets, and committees; collaborative organizational cultures that prioritized employee health and safety; engaging existing organizational processes, such as continual improvement, that could be leveraged for new approaches; and realistic implementation time lines to account for organizational changes (D. McLellan, Pronk, & Pember, 2015; Pronk et al., 2016). When these factors were not in place, implementation efforts lagged.

DISCUSSION

This model responds to the ongoing dialogue on the importance of a conceptual framework to guide research and intervention design related to worker health (Bradley, Grossman, Hubbard, Ortega, & Curry, 2016; Punnett, Cherniack, Henning, Morse, & Faghri, 2009; Schulte, Pandalai, Wulsin, & Chun, 2012). It provides a framework for research and interventions by specifying how the conditions of work can shape worker safety and health. The model serves as an evidence-based guide for prioritizing research questions, framing a standard approach to interventions, and steering practical applications toward effective processes to protect and improve worker health. Specifying the pathways through which the intervention is intended to affect worker safety and health can clarify the priorities for both the intervention and evaluation. A conceptual model can also guide mediation analyses for testing specific pathways (Anger et al., 2015).

This model highlights priorities for ongoing research that explores, for example, the extent to which integrated workplace policies, programs, and practices determine safety and health outcomes; the ways in which these policies, programs, and practices may shape physical and psychosocial work exposures; and the roles that worker and enterprise factors play in influencing these pathways. Research presented by others further illustrates the applicability of this model. For example, Schulte et al. (2012) emphasized how shared pathways focusing on conditions of work could impact enterprise and worker outcomes such as occupational hazards and obesity. Although prior research has examined ways in which the conditions of work influence chronic disease and its behavioral antecedents and risks associated with hazards on the job, as described earlier, additional research is needed to examine the synergies and interactions in these relationships, as well as their associations with improved enterprise outcomes. Responding to recommendations from a recent workshop with NIOSH and the National Institutes of Health (Bradley et al., 2016), this model can also guide further development of measures to assess the effects of an integrated approach, inform the design and testing of future integrated approaches to worker health, and offer a framework for increased attention to organizational change, central to the TWH approach yet underrepresented within research findings reported to date (Lax, 2016; R. K. McLellan, 2016). Use of a common conceptual model offers a platform

for bridging these diverse perspectives and suggests shared vocabularies for understanding the influences on worker health (Sorensen et al., 2003).

In this model, improvements in the conditions of work—in the physical and psychosocial work environment, as well as the work organization—provide the foundation for protecting and promoting worker safety, health, and well-being. This focus builds on the hierarchy of controls approach, which the TWH program has employed to underscore the importance of elimination or control of workplace hazards, including the physical work environment and the organization of work (NIOSH, 2016). Interventions targeting changes in the conditions of work have been hypothesized to produce more sustainable benefits for worker health than those focusing solely on individual factors (Montano et al., 2014).

This model also informs translation from research to practice by outlining key components of effective implementation of TWH approaches. Although a growing array of guidelines and tools are available to support adoption of TWH approaches (Burton, 2010; Center for the Promotion of Health in the New England Workplace, 2013; D. McLellan, Moore, Nagler, & Sorensen, 2017; Velazquez, Baker, Dewey, Andrews, & Stock, 2010), implementation of these integrated policies, programs, and practices remains concentrated primarily among a select group of vanguard employers (Loeppke et al., 2015). There is urgent need for effective dissemination of evidence-based best practices and resources to build capacity in worksites across size and sector to improve the conditions of work and transform the work organization, thus improving worker health. Our work has shown, however, that employers often turn first to providing programs for individual workers rather than tackling system-level policies and practices, a tendency we have labeled "regression to the individual" (Sorensen, McLellan, et al., 2016). Effective implementation of TWH interventions requires that employers have the capacity to recognize and modify features of the work organization that are a risk to worker health (Mellor & Webster, 2013). This conceptual model provides a framework for employers to identify, develop, and implement interventions and strategies that will enable system-level changes in the conditions of work.

CONCLUSION

Traditionally, a focus on the conditions of work has been the domain of occupational safety and health; here, we aim to underscore the central role of the conditions of work, not only for classic occupational safety and health outcomes but also for chronic disease risk. An increasing number of workplaces are adopting integrated approaches to worker health that should be carefully evaluated. This chapter proposes a conceptual model to guide this inquiry and to frame the focus on the conditions of work as central to building a culture of safety, health, and well-being. This model further illustrates the potential for synergy in integrated approaches to worker health, offering opportunities for

improvements in the conditions of work as well as for multiple worker health outcomes. Thus, this conceptual model may provide a valuable tool for future research aimed at testing the effectiveness of integrated approaches to worker safety, health, and well-being, as well as a framework for translating research to practice.

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Total Worker Health

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