

# Literature Review of Policy Implications From Findings of the Center for Work, Health, and Well-being

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**Objective:** To review the publications of a Total Worker Health Center<sup>®</sup> of Excellence, the Harvard T.H. Chan School of Public Health Center for Work, Health, and Well-being, in order to identify research findings relevant to either organizational or public policies. **Methods:** Two researchers independently reviewed 57 publications from 2011 to 2019 to identify cross-cutting themes that focus on working conditions or related health outcomes and their organizational and public policy implications. **Results:** Twelve cross-cutting themes were identified with their respective organizational and public policy implications. Several policy implications cut across work-related themes. **Conclusions:** Policy implications of TWH<sup>®</sup> research will aid in setting priorities to translate this from research into practice in future studies and help identify gaps that we and others can use to plan future TWH<sup>®</sup> research.

**Keywords:** evidence-based policy, organizational policy, policy implications, policy making, public policy, working conditions

The health, safety, and well-being of workers and the health and sustainability of the places they work are shaped by policies—both workplace-specific and broadly applicable public policies. Policies may describe or define desirable, expected, or mandatory standards of conduct or behavior. Policy may be regulatory and legally enforceable across workplaces (such as an Occupational Safety and Health Administration (OSHA) or Mine Safety and Health Administration (MSHA) standard), enforceable in a specific organization or enterprise (workplace rules that, if violated, result in some adverse consequence for the violator), and/or advisory (such as are seen in guidelines from professional associations). A large body of literature underscores the central role that policies play in worker health and safety—ranging from long-standing policies specifically designed to reduce or eliminate exposures to physical hazards on the job, to policies related to work benefits such as healthcare coverage and compensation after an injury on the job.<sup>1</sup>

Policies are key in shaping the work environment and consequently workers' health, yet designing policy based on scientific

## Learning Objectives

- Discuss the rationale for the review and analysis of research from the authors' Total Worker Health<sup>®</sup> (TWH) Center for Work, Health, and Wellbeing with implications for organizational or public policy.
- Summarize the 12 cross-cutting themes identified from this body of research, focusing on working conditions or related health outcomes.
- Discuss the implications of the studies in terms of translating research into policy and planning future TWH research.

research can be challenging, as the research itself can be time consuming, expensive, and limited in scope. Collaborations between researchers and policy decision-makers are infrequent, and scientific communications that provide evidence on occupational best practices may not always be accessible or comprehensible to audiences outside of academia.<sup>2</sup> Furthermore, randomized-control trials (RCTs), frequently considered the “gold standard” for the analysis of policy effectiveness, can be difficult or unethical to conduct in workplaces, as they require long periods of time to assess effectiveness, a counterfactual group may not always be possible or ethical to assemble, and context and individual changes may influence the results even when a control group is available.<sup>3</sup> These obstacles exacerbate the disconnect between evidence-informed policy design and decisions made by policy-makers. Nevertheless, we can (and should) consider the policy implications of all research studies, even those that are not RCTs, provided we understand the limitations and generalizability of the work. In many research papers, authors discuss their findings in relation to the broader body of literature, and at times, even the policy implications of the work. This paper seeks to go beyond what may normally be included in a discussion section of many papers, by identifying cross-cutting themes related to policy across the Harvard T.H. Chan School of Public Health Center for Work, Health, and Well-being (the Center) body of work. The Center is one of six Total Worker Health<sup>®</sup> (TWH) Centers of Excellence funded by the National Institute for Occupational Safety and Health. This initiative recognizes the central role of work-related factors in workers' safety and health, and specifically attends to “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.”<sup>4</sup>

The Center has conducted a range of studies focused on the different pathways that determine workers' health, safety, and well-being outcomes. These studies gave rise to and have been informed by the Center's conceptual model, which focuses on how policies, programs and practices impact working conditions and how these conditions determine workers' health, safety and well-being, and mediate workers' health behaviors.<sup>5</sup> The research also takes into account these relationships with respect to enterprise outcomes such as turnover rates and absenteeism. The Center's priorities include understanding the policy implications of its research, in part through the work of its Policy Working Group (PWG). The PWG has conducted an in-depth review of the Center's body of work, summarized here. The Center's research investigating the relationships between conditions of work and health outcomes

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**Clinical Significance:** Total Worker Health<sup>®</sup> (TWH) focuses on improving workforce well-being by integrating protection from work-related safety and health hazards with promotion of injury and illness prevention efforts. The policy implications of TWH<sup>®</sup> will aid in informing future efforts to translate research into practice and help identify gaps to plan future TWH<sup>®</sup> research.

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provides a foundation for potential policy applications. Explicating the relationship between “exposures” and “outcomes” can inform the translation of our research findings into policies at the organizational- and public-policy domains.

The purpose of this paper is to conduct a detailed and comprehensive review of the publications of one TWH Center of Excellence, to identify policy implications for this research relevant to both organizational and public policies. We conducted this review in order to identify core policy implications that will inform current policy decisions and identify priorities for future research. Additionally, we also hope that this work can serve as a roadmap for other groups who want to examine their research from a policy implications lens.

## METHODS

With the aim of providing a comprehensive review of the Center publications, we included all peer-reviewed articles based on Center work funded by NIOSH TWH<sup>®</sup>. These articles were published between 2011 (when the first Center-funded research was published) and mid-2019 when the review was submitted for publication. To be included in the review, a publication must involve analysis of an association between aspects of the work environment and health outcomes, meaning case studies, creation and/or validation of measurement tools, or literature summaries were excluded from this analysis.

To initiate the review, two policy working group members (MALG and ESF) independently reviewed each publication, following a standardized protocol for data extraction and review. The two reviewers independently extracted details about each manuscript using a standard form, to record the following information: policy implications, study methods, and results, whether or not policy implications were explicitly or implicitly discussed, at which level the policy was focused (eg, organizational or public), generalizability, key limitations, and scientific gaps. For a full list of extracted details, see Appendix A (<http://links.lww.com/JOM/A604>). Findings from these reviews were examined by each publication’s authors for additional input on policy implications.

The reviewers then conducted an iterative, detailed, and rigorous review of the extracted policy implications and grouped them by cross-cutting themes. In the case of varying assessment of policy implications between reviewers and the author, all identified implications were included in the results presented here. The cross-cutting themes fit under two umbrella topics, that reflect the majority of the center’s research: working conditions (eg, job demands and decision latitude, and social support) or related health outcomes (eg, physical activity and psychological distress). However, it should be noted that the themes often cut across these two categories, as often one working condition is associated with several health outcomes and one health outcome is associated with several working conditions.

## RESULTS

This review included 32 out of the 57 publications that covered the Center’s work and affiliated projects from 2011 to 2019 (Table 1). Twenty-five publications were excluded from this analysis because they did not meet inclusion criteria. All authors generally concurred with the reviewers’ initial assessment or added comments that further expanded the reviewer conclusions. The final framing of policy implications is a combination of the conclusions of the two reviewers and primary author of each publication.

### Review Findings

As summarized in Table 2, we identified 12 cross-cutting themes among the reviewed publications, focusing on either working conditions or related health outcomes that in turn have policy implications at the organizational and/or public policy levels.

**TABLE 1.** Industry Type and Study Design of Reviewed Studies

	Number of Papers N (%)
Industry	
Healthcare	29 (91)
Construction	3 (9)
Study design	
Cross-sectional	13 (41)
Cross-sectional with a longitudinal component	13 (41)
Case-control	2 (6)
Clustered randomized controlled trial	1 (3)
Longitudinal administrative data only	1 (3)
Intervention	2 (6)

## Working Conditions

### Ergonomic Practices

Several Center studies involved examining the relationship between ergonomic practices and various health outcomes. Ergonomic practices were measured using a modified version of the Organizational Policies and Practices questionnaire developed by Amick et al.<sup>6</sup> Questions focused on workers’ perceptions of the design of the physical work environment and the promotion of the use of tools for reducing biomechanical workload. Results from Center studies found that decreased ergonomic practices were associated with increased levels of self-reported musculoskeletal pain in four body areas (low back, neck/shoulder, arms, and lower extremity) in the past 3-months.<sup>7</sup> Additionally, increased ergonomic practices were found to be associated with increased preventive care utilization<sup>8</sup> and decreased work limitations (a measure of the degree to which someone experiences limitations at work due to health problems and health-related productivity loss).<sup>9</sup>

The findings from the Center’s studies on ergonomic practices demonstrate the importance of strong ergonomic practices at the workplace.<sup>10</sup> Implementation of clear policies that support positive ergonomic practices, at the organizational and/or public policy level, could help to improve working conditions and in turn, impact a range of outcomes, including non-occupational outcomes such as preventive care utilization. These findings also strengthen the case for engaging employees in improving ergonomic practices.<sup>7</sup> Although there are no federal regulations that explicitly focus on ergonomics, data from the Center demonstrate the importance of ergonomic practices and policies at multiple levels.

### Harassment and Abuse

Workplace harassment was associated with obesity,<sup>11</sup> injuries,<sup>12,13</sup> and sleep deficiency.<sup>12</sup> Workers who reported incivility or bullying also reported higher rates of mental health claims.<sup>14</sup> In their discussions, authors integrated policy-relevant evidence of potential factors that may reduce or eliminate harassment and verbal abuse at work for patient-care workers. These conclusions were summarized by Sabbath et al<sup>13</sup>: “Intervention efforts could be deployed at the organizational, interpersonal and individual levels in order to reduce prevalence of abuse and its associated risk of injury.” Policy implications emphasized an integrated organizational approach towards creating a culture and climate that protects against abuse, but also supports workers at different levels.<sup>11–13</sup> This emphasizes the responsibility of leaders and managers to promote awareness about physical and verbal abuse. Furthermore, as described by Sabbath et al<sup>13</sup>, “administrative efforts to reduce workplace verbal abuse may be most effective if they simultaneously address the overall social context of the unit and specific interactions between a worker and a workplace abuse perpetrator.” This statement highlights the fact that

**TABLE 2.** Examples of Policy Implications From Findings of the Center for Work, Health, and Well-being

Center Papers Focus on these Topics		Implications Based on the Center's Work	
Working Conditions	Research Findings	Organizational Policy	Public Policy
Ergonomic practices	<p>Decreased ergonomic practices were associated with reported increased levels musculoskeletal pain in four body areas (low back, neck/shoulder, arms, and lower extremity) in the past 3-months.<sup>7</sup></p> <p>Decreased ergonomic practices were also associated with symptom severity and limitations in completing activities of daily living in the past week.<sup>7</sup></p> <p>Implementation of a construction ergonomics program was associated with an increase in ergonomic practices, and a reduction of musculoskeletal pain and injury reports.<sup>10</sup></p> <p>Increased ergonomic practices was associated with increased preventative care utilization<sup>8</sup> and decreased work limitations<sup>9</sup></p>	<p>Policies to improve ergonomic practices</p>	<p>Policies to improve ergonomic practices</p>
Harassment and abuse	<p>Higher levels of workplace harassment were associated with obesity,<sup>11</sup> injuries (especially musculoskeletal injuries),<sup>12,13</sup> and sleep deficiency<sup>12</sup></p> <p>Workers who reported incivility or bullying had increased odds of mental health related claims.<sup>14</sup></p>	<p>Policies to prevent abuse, harassment, discrimination, and violence (this also applies to patients and family members, in the example of healthcare)</p> <p>Policies to build respect for the ideas, values, and beliefs of others</p> <p>Building shared responsibility of violent acts through restorative circle processes where workers who were actively and passively involved in bullying discuss constructive strategies to change the situation and prevent future occurrences</p>	<p>Zero-tolerance policy towards workplace harassment and abuse by agencies at the local, state, and federal levels</p>
Safety practices	<p>Positive safety practices were associated with decreased self-reported sharps injuries (but not administrative records of these injuries)<sup>17</sup> and positive measures of job satisfaction.<sup>16</sup></p> <p>A safe patient handling and mobilization program that uses an integrated systems approach was associated with improved work practices and a reduction in recordable worker injuries.<sup>18</sup></p>	<p>Policies that support positive safety practices (and improve communication surrounding safety practices)</p>	<p>Policies to support positive safety practices</p>
Social support (supervisor and/or coworker)	<p>Increased supervisor support was associated with lower injury rates<sup>19,20</sup> and supervisor's support for meal breaks also increased amount of meal breaks<sup>21</sup> taken by workers which in turn was associated with lower psychological distress.</p> <p>Low social support was associated with increases in musculoskeletal pain,<sup>22</sup> low back pain,<sup>7</sup> and sleep deficiency.<sup>12</sup></p>	<p>Policies that hold supervisors accountable for taking actions that support their employees (eg, encouraging breaks)</p> <p>Policies and trainings to be implemented that aim to prevent abuse, harassment discrimination, and violence, and that encourage employees and supervisors to build respect for the ideas, values, and beliefs of others</p>	<p>Regulations and/or standards for psychosocial factors</p>
Staffing level	<p>Perceived inadequate staffing may be associated with higher prevalence of back pain.<sup>26</sup></p>	<p>Regular assessment of staffing adequacy</p> <p>Policies (that include staffing levels) to evaluate and address the extent to which job demands are aligned with resources</p>	<p>Staffing ratio regulations</p>
Work–family conflict	<p>Increased levels of work family conflict was associated with increased sleep deficiency<sup>30</sup> and musculoskeletal pain<sup>31</sup></p>	<p>Scheduling policies to reduce work–family conflict</p> <p>Discourage stigmatization and/or sanctioning of workers for enabling their right to schedule control</p>	<p>Scheduling regulations</p>
Work schedules	<p>Increased job flexibility was associated with increased physical activity,<sup>11</sup> lower levels psychological distress,<sup>32</sup> increased preventative care utilization,<sup>8</sup> and job satisfaction<sup>33</sup></p> <p>Shift characteristics were associated with lower injury rates.<sup>34</sup></p> <p>Meal breaks were associated with lower levels of psychological distress.<sup>21</sup></p>	<p>Scheduling policies (eg, related to flexibility)</p> <p>Break policy consistently enforced</p>	<p>Scheduling regulations</p>

TABLE 2. (Continued)

Center Papers Focus on these Topics		Implications Based on the Center's Work	
Working Conditions	Research Findings	Organizational Policy	Public Policy
Work stress/Job Demands/ Decision making	Increased psychosocial demands and low decision latitude were associated with increased musculoskeletal pain <sup>7,29</sup> and reduced physical activity <sup>11,35</sup>	Regular review of job responsibilities to ensure appropriate work load Changes in job demands and shift scheduling	Scheduling regulations and/or standards Healthcare example: regulations requiring measurement of nurse-to-patient ratio to assess job demands
Health Outcomes	Research Findings	Organizational Policy	Public Policy
Injuries and injury reporting	Positive safety practices were associated with self-reported sharps injuries but not administrative records of these injuries. <sup>17</sup> The undercount of occupational injuries in administrative versus self-report data may be greater among black compared with white workers, leading to underestimates of racial disparities in workplace injury. <sup>36</sup> Injury rates within the same hospitals differ by occupation and type of unit. <sup>39</sup> Work-related injuries were associated with increased odds in having medical expenditures at both 3 and 6 months after injury. <sup>37</sup> The effect of an intervention aimed at reducing injuries among a diverse group of workers may have differential effects, which could widen disparities. <sup>38</sup>	Procedures that allow for easy reporting of injuries and that also prohibit retaliation of injury reports Data-driven surveillance systems that can capture distribution and disparities of injuries within the workplace to be able to design and implement appropriate interventions Implementation of policies in diverse populations should be responsive to disparities present in the targeted population	Reporting regulations and/or standards Create surveillance systems for occupational injuries that segregate by occupation, type of work and context
Mental health	Mental distress was associated with increased self-reporting of injury, <sup>40</sup> musculoskeletal pain, <sup>40</sup> and pain interference with work. <sup>41</sup> Workers who reported incivility or bullying had increased odds of mental health related claims <sup>14</sup>	Policies that contribute to a psychologically safe and healthy environment. Implement an internal monitoring system that is able to capture psychological hazards at the workplace on a continuous basis. Policies that allow for easy access to mental health resources	Policies that protect workers against psychological hazards created by economic changes (eg, unemployment benefits, regulations on types of contracts) Policies that make the employers accountable in the protection of workers against psychological hazards at the workplace
Physical activity	Construction workers obtain a substantial amount of physical activity at work. <sup>44</sup> Vigorous occupational physical activity was significantly and positively associated with self-reported fatigue. <sup>44</sup> Self-reported fatigue and functional limitations were negatively correlated with measured minutes of vigorous activity outside of work. <sup>45</sup> Workers who did not meet physical activity guidelines reported low decision latitude <sup>7</sup> and an increased 10-year cardiometabolic risk. <sup>46</sup>	Policies to evaluate and address the extent to which job demands are aligned with resources Implement integrated worksite interventions that target improvements in physical activity (as well as other outcomes) through shared pathways of working conditions	Policies that support healthy lifestyles habits such as tobacco cessation, healthy diets, reduction of alcohol abuse, and improvements in sleep hygiene
Sleep deficiency	Sleep deficiency was associated with overweight and obesity, <sup>11</sup> as well as increased musculoskeletal pain, work interference, and functional limitation, <sup>47</sup> harassment at work <sup>12</sup> and increased 10-year cardio-metabolic risk. <sup>46</sup>	Scheduling policies designed to protect sleep cycles	Scheduling regulations

while workplace policies may be effective in reducing harassment and abuse, it is critical to account for the intricacies of specific workplace environments.

OSHA has also developed some examples of workplace violence prevention guidelines that include: the establishment of clear policy addressing workplace violence, verbal and nonverbal threats, and related actions; encouraging workers to report any incidents and suggest ways to prevent them, assigning responsibility and authority for the violence prevention program to individuals or teams with appropriate training and skills, and affirming management commitment towards worker health and safety.<sup>15</sup> From a legislative perspective, efforts to establish a zero-tolerance policy towards workplace abuse (that includes abuse from coworkers and supervisors, and in the healthcare setting, patients, and families) may help towards improving the working conditions for workers and in turn, have a positive impact on health outcomes.

In addition, Nelson et al<sup>11</sup> cited a strategy to prevent harassment from the nursing literature that encourages workplaces to build social supports among patient care workers, thereby sharing the responsibility for negative behavior and/or violent acts among all workers. This is consistent with specific actions mentioned by Sabbath et al<sup>13</sup>: promotion of an informative discussion about harassment and abuse in workers' trainings, creation of "procedures for reporting and investigating incidents in a swift and anonymous manner" and eliminating or making appropriate changes to situations that may precipitate violence such as receiving bad news, long waiting times, and limited visits. At the interpersonal level, Sabbath et al<sup>13</sup> made recommendations that organizations could provide guidelines for interactions among workers but also between patients and their families with health care providers. These guidelines could focus on workplace social norms against abuse, as well as other organizational factors such as trust and cooperation.

### Safety Practices

Center studies focusing on safety practices were measured by using a modified version of the Organizational Policies and Practices questionnaire by Amick et al.<sup>6</sup> The safety practice subscale focused on questions around workers' perception of safety leadership, safety training, and safety diligence. Results showed that positive safety practices, characterized by the identification and control of occupational hazards, are associated with higher job satisfaction<sup>16</sup> and a decrease of self-reported sharps injuries<sup>17</sup> (but not administrative records of these injuries). An intervention study in a hospital setting observed positive perceived safety practices and a reduction in recordable worker injuries when the focus of the intervention was on integrated efforts at a system level to improve safe patient handling by patient-care workers.<sup>18</sup> The intervention focused on earlier and more frequent mobilization of patients using lifts and slings. Without proper and systematic use of this equipment, lifting patients has the potential to increase workers' physical demands.<sup>18</sup> Furthermore, program was successful due in large part to the system-wide policy implemented in the context of an improvement in patient safety. The multi-component program included training, clear communication of the policy, coordination across departments, and engaging leadership in support of the program.<sup>18</sup>

Organizational policies that identify and manage safety hazards through a systems level approach that includes engagement of leadership, coordination across multiple departments, and fostering system-wide communications can align the goals of worker safety with patient safety<sup>18</sup> and job satisfaction.<sup>16</sup>

### Social Support

Two studies conducted with a sample of patient-care workers found that social support was associated with lower injury rates.<sup>19,20</sup>

Tveito et al<sup>19</sup> found that coworkers' support was associated with lower injury rates in bivariate analyses; this association was found among registered nurses, but not among patient-care associates, and was not found for the relationship between supervisor support and injury rates. However, a study by Reme et al,<sup>20</sup> which controlled for additional working conditions and job title, found that supervisor support, but not coworkers support, was associated with lower injury rates and that rates were significantly lower for workers with musculoskeletal injuries than for workers with other types of injuries. In both studies, the authors underscored the importance of looking at musculoskeletal injury from a multi-causal perspective that would suggest the need for organizational policies that support several factors, one of them being social support.

In other studies, supervisor support was found to be associated with increased frequency of meal breaks, which in turn related to lower psychological distress.<sup>21</sup> Low social support has also been associated with musculoskeletal pain<sup>22</sup> and sleep deficiency.<sup>12</sup>

Policy implications related to social support include the importance of holding supervisors accountable for taking actions that support their employees. This accountability could be promoted by offering trainings to build skills and providing supervisors resources for supporting employees. Policies and trainings aimed at preventing abuse, harassment, discrimination, and violence, as described above, and that encourage employees and supervisors to build respect of the ideas, values, and beliefs of others also support a thriving environment for social support.

Results from the Center's work support the importance of creating psychosocial standards at the public policy level. Currently, OSHA in the United States does not explicitly include regulations on psychosocial factors or mental stress at work,<sup>23</sup> but does provide some voluntary guidance. Nonetheless, examples of such standards exist elsewhere. For example, the European Agency for Safety and Health at Work (EU-OSHA) has published guidelines on identifying, preventing and managing psychosocial risks, as well as setting a legal imperative with the Framework Directive 89/391/ECC that sets minimum standards on technical safety but also on prevention of ill-health.<sup>24</sup> Canada also has a voluntary standard, "Psychological Health and Safety in the Workplace," that aims to promote worker psychological health and prevent psychological harm resulting from workplace factors.<sup>25</sup>

### Staffing Levels

Kim et al found that perceived inadequate staffing from patient-care workers in a hospital setting is associated with musculoskeletal pain even after controlling for demographic variables and physical work factors that measure time spent doing different types of physical effort during a shift.<sup>26</sup> Results suggest that at the organizational level two activities could reduce musculoskeletal injury as follows: (i) assessing regularly whether staffing level is sufficient among hospital workers, and (ii) providing adequate staffing. The authors suggested that assessing perceived inadequate staffing from workers themselves might be a better approach to align job demands with available resources than merely considering administrative data on number of patients per nurse.

An example of a proposed federal regulation intended to address this issue is HR5052/S2446 - Safe Staffing for Nurse and Patient Safety Act of 2018, which was introduced in Congress in February of 2018 and is currently under committee review. Another example was the 2018 ballot initiative in Massachusetts (the Initiative Petition For A Law Relative To Patient Safety And Hospital Transparency). While it did not pass, the proposed initiative would have required that hospitals have mandated nurse-staffing levels. Although the Center's papers do not explicitly evaluate specific staffing ratios, they support scheduling shifts and tasks to optimize the work experiences of nurses, which might be accomplished through regulation of staffing ratios.

## Work–Family conflict

Work–family conflict arises when time, participation, and behaviors required for one role (work role) make it difficult to fulfill requirements for another role (non-work role).<sup>27</sup> In the past century, the composition of the workforce has changed significantly with increased participation of women, single-parent households, and an ageing population, but little has been done on policies on work organization and social benefits supportive of achieving work-life balance that allows workers to fulfill other non-work roles such as caregiving for children and older adults.<sup>28,29</sup> Evidence from studies conducted with the Boston Hospital Worker Health Study (BHWHS) shows that higher levels of work–family conflict are associated with sleep deficiency<sup>30</sup> and with musculoskeletal pain<sup>31</sup> in several parts of the body, even after controlling for relevant factors such as job stress and psychological distress.<sup>31</sup>

Work–family conflict and related ill outcomes may be attenuated and prevented by designing policies and interventions that prioritize job flexibility and discourage stigmatization and/or sanctioning of workers for enabling their right to schedule control, urging employees to prioritize sleep and attain work–family time balance. The aim of this organizational policy would be to nurture long-term well-being and effectiveness of employees. In the public policy arena, policies that establish minimum and maximum shift hours and a minimum amount of hours between shifts may be able to influence work-life balance in a positive way.

## Work Schedules

Our review included multiple papers that generated research findings related to work schedules. For example, four papers examined job flexibility among patient care workers, finding associations between job flexibility and increased physical activity<sup>11</sup> as well as lower levels of psychological distress<sup>32</sup> increased preventive care utilization,<sup>8</sup> and increased job satisfaction.<sup>33</sup> Another paper found that shift characteristics (eg, longer shifts, more consecutive days worked, longer total hours worked, more night shifts, and more frequent overtime) were associated with higher injury rates.<sup>34</sup> A fourth paper found a positive association between the frequency of meal breaks and lower levels of psychological distress.<sup>31</sup>

These research findings support organizational policies intended to improve work schedules, such as scheduling policies that encourage flexibility in task scheduling and working hours, and a break policy that is consistently enforced. For example, Hoppia et al,<sup>34</sup> found that consecutive shifts of 2 or more days, as well as cumulative shifts over a week and month (especially night shifts) were associated with increased odds of an injury. Hoppia et al<sup>34</sup> noted in the paper: “Occupational health nurses should assess, when possible, whether policies address details such as minimum number of days or weeks on a specific shift, how shifts rotate, number of days that can be worked consecutively without a day off, the maximum length of a shift, or the amount of overtime in a given shift or week.” This is a reminder that an important organizational policy involves regularly reviewing shift characteristics. Similarly, another related policy example relates to breaks within a work day as important organizational policy, as Hurtado et al<sup>21</sup> notes: “Meal breaks should provide daily opportunities for fatigue recovery; for access to healthier, more enjoyable meals; to enjoy meals and leisure or personal time, factors that explain the positive effect of meal breaks on mental health.”

## Work Stress, Job Demands, and Decision-making

Evidence from the Center’s studies showed that psychological demands and decision latitude have implications for physical health outcomes and workers’ health behaviors. The combination of high psychological demands and low decision latitude were associated with increased musculoskeletal pain among patient-care workers.<sup>12,22</sup> On the other hand, greater decision latitude and job

flexibility were associated with greater physical activity.<sup>11</sup> A study by Arias et al<sup>35</sup> with patient-care workers found that workers reporting moderate and vigorous levels of physical activity at work actually spent 99% of their work time below moderate and vigorous activity as measured by an accelerometer. Authors suggested that this perceived differential may be due to the fatigue created by high job demands related to trunk flexion and bends, also measured with tri-axial accelerometer, but not by actual physical activity (same reference).

Evidence from these studies demonstrates the importance of modifying organizational policies to support adequate job demands and increased job flexibility. Organizations may be able to modify job demands by regular reviews of job responsibilities to ensure that workers have manageable workloads. Public policies that could support adequate job demands include the creation of scheduling regulations and well-designed patient-to-nurse ratios.

## Health Outcomes

### Injuries and Injury Reporting

The Center also conducted research that focused on factors that were related to injury reporting, along with the distribution of injuries in the workplace. For example safety practices were found to be associated with self-reported sharps injuries but not administrative records of these injuries.<sup>17</sup> Additionally, Center work found that the undercount of occupational injuries in an administrative dataset was greater among black workers when compared with white workers.<sup>36</sup> Another Center paper found that workers with an injury reported increased medical expenditures at both 3 and 6 months post-injury.<sup>37</sup>

Organizational and public policy implications that relate to such findings include policies that seek to reduce barriers to injury reporting or reward reporting of adverse events and near misses, or policies that seek to prohibit and punish retaliation following an injury report.

In a recent paper by Dennerlein et al<sup>18</sup>, authors re-analyzed the results of a Center intervention evaluation and found that while the intervention had a positive impact overall, this effect did not benefit all populations equally and may in fact have contributed to widening disparities.<sup>38</sup> Thus, these results underscore the importance of tailoring interventions, as well as policies, to the group of workers who are most at risk and often have the least amount of agency. These results also reiterate the need to account for diverse populations in a workplace.

Center research on occupational injury also examined the distribution of injuries within the workplace. For example, one study found that injury rates within the same hospital differed by occupation and type of unit.<sup>39</sup> The policy implications of this work suggest that data-driven surveillance systems put in place at the organizational and/or public policy levels may be able to capture the distribution of injuries within an organization, and thus can be used to help target preventive workplace interventions. Additionally, the research suggests that policies should seek to provide consistent definitions of injury and exposure terms.

### Mental Health

Research from the Center indicated that mental distress was associated with increased self-reported injury and musculoskeletal pain<sup>40</sup> as well as with increased pain interference with work.<sup>41</sup> Additionally, increased levels of mental health related claims were associated with workers who reported incivility or bullying.<sup>12</sup>

These findings support policies at both the organizational and public policy level. For example, the finding that psychological distress is closely associated with injury and pain outcomes provides evidence of the importance of creating policies that contribute to a psychologically safe and healthy environment. The authors point to

the need for more research on the topic, noting that: “an intervention targeting psychological factors that has the potential to prevent disability, reduce injuries, alleviate mental distress, and reduce health-care costs in more than 11 million [construction] workers, certainly warrants a rigorously designed large-scale study.”<sup>40</sup>

Improvements to psychological environments may include implementing an internal monitoring program that records psychological hazards in addition to physical hazards and facilitates regular updates to this system.

The Center’s findings also provide supporting evidence for many public policies, such as those that hold employers accountable in the protection of workers against psychological hazards. Some countries are beginning to include psychological hazards under the umbrella of their occupational safety and health administrations (eg, Australia and Canada).<sup>25</sup> Other public policies, such as unemployment benefits, regulations on types of work contracts, or even minimum wage policies may prevent exposure to psychological hazards created by economic challenges.<sup>42,43</sup>

### Physical Activity

Several studies from the Center focused on physical activity, specifically aiming to investigate the relationship between work-factors and occupational and/or recreational physical activity. For example, research in the construction industry indicated that construction workers have a substantial amount of physical activity at work, and that this was positively associated with self-reported fatigue.<sup>44</sup> A related finding from a study in the health care industry found that self-reported fatigue and functional limitations were negatively correlated with measured minutes of vigorous activity outside of work.<sup>45</sup> Another paper found that workers who did not meet physical activity guidelines reported lower levels of decision latitude and an increased 10-year cardiometabolic risk.<sup>46</sup> The Center’s findings imply that policies designed to evaluate and address job demands may provide more time for workers’ physical activity outside of work, which in turn may have a number of health benefits.

### Sleep Deficiency

Studies found associations between increased sleep deficiency and higher rates of overweight and obesity among health care workers,<sup>11</sup> as well as between increased sleep deficiency and increased musculoskeletal pain, work interference, and functional limitations.<sup>11</sup> Another study found that health care workers who reported higher levels of sleep deficiency had an increased 10-year cardio-metabolic risk.<sup>46</sup>

The findings from these studies imply that policies, at the organizational or public policy level, that are designed to protect sleep cycles are recommended. For example Buxton et al<sup>47</sup> notes that multi-level interventions for workers that acknowledge how individuals fit into the overall work context may be effective at reducing sleep deficiency. Buxton notes that: “policies that provide increased flexibility on shift length and timing may contribute to a supportive work environment that acknowledges the pivotal role of sleep in worker health outcomes. In tandem, educational programs to inform workers of the important associations between sleep, musculoskeletal disorders and pain may motivate workers to consider improved sleep hygiene practices.”<sup>47</sup>

## DISCUSSION

Our goal was to provide a thorough review the publications of our TWH® Center of Excellence, the Harvard T.H. Chan School of Public Health Center for Work, Health, and Well-being to identify policy implications of this research that would be relevant to both organizational and public policies. Our review extended beyond the policy implications of individual articles in order to extract cross-cutting themes. The definition of TWH® and the approaches

involved in developing and implementing TWH® programs are still relatively new, only taking shape in the last few years. We hope that this review can help lead the way for additional consideration of the policy implications of TWH research and serve as a model for other groups considering the policy implications of their own work, thus facilitating the translation of TWH® research to practice.

The review involved extracting research findings from the Center’s body of work, organizing them into 12 policy-related themes that fell into two categories: working conditions (eg, social support, safety practices) and related health outcomes (eg, mental health, physical activity). These categories and the themes align with the Center’s conceptual framework.<sup>5</sup>

Results show that policy implications related to the TWH® framework cut across work-related themes. This underscores that working conditions interact with one another; that is, characteristics of one working condition may generate changes in other working conditions that at the same time may have an impact on workers’ health and behavior. For example, the policy implications of research findings from the themes of work schedules, sleep deficiency, and work–family conflict all support scheduling policies at the organizational level and scheduling regulations at the public policy level. Similarly, the research for both social support and harassment/abuse implies that organizational policies should aim to prevent abuse, harassment, discrimination, and violence. These multiple shared pathways reflect one of the core components of TWH®—that shared pathways of certain working conditions can affect multiple health outcomes.

This review has several benefits. First, it allows us to understand the potential impact of our research and helps set priorities for translating this work from research to practice. Second, we were able to demonstrate the feasibility and utility of conducting a review that draws out relevant policy implications of TWH® research and can serve as an exemplar for other groups seeking to understand their own body of work. Third, this review allows us to identify gaps in our own work that we and others can use to plan future research priorities.

It is worth mentioning that from the 57 articles reviewed, 25 of them did not study associations between the work environment and health outcomes, and thus did not include implications related to organizational and public policy. These 25 articles included pilot studies, case studies, creation and/or validation of measurement tools, commentaries summarizing the literature, and/or providing relevant information for future research and the Center’s conceptual framework which summarizes a research agenda that addresses disease prevention by integrating health protection and health promotion in the workplace. Our approach in this study involved extracting policy implications based on results from the study of working conditions and health outcomes, thus, the above-mentioned articles were not included in the results of this review. Nevertheless, they could potentially contribute to the design and study of policies that impact the workplace. Validated tools may aid in measuring the effectiveness of organizational policies and practices and conceptual frameworks can help guide the design and analysis of policies.

Although policy implication reviews have been conducted in other aspects of occupational health,<sup>48–50</sup> to our knowledge, this is the first time such review has taken place within TWH® research framework, but limitations should be addressed. First, our review highlighted a few scientific gaps that should be addressed in future research. For the most part, the Center’s body of work only includes a limited number of working populations, and thus the policy implications described may only be generalized to these populations. The study populations were relatively homogeneous, consisting mostly of women in the health care sector and men in the construction industry, as well as a predominantly white population, although some work covered small to medium sized businesses and two studies focused on racial disparities and injury reporting.<sup>17,36</sup>

Most of the studies were also cross-sectional and/or involved retrospective and self-reported data where exposure and/or outcome misclassification may be a concern.

This review of policy implications is not the study of policy effectiveness; for this, we would need to include review of the broader scientific literature. Literature published by authors outside of the Center was beyond the scope of this analysis. While the entire body of scientific literature on a given topic should be consulted when developing policies for organizations or the public, here we aimed to only focus on the implications of the research generated by the Center.

Despite these limitations, the strengths of this process are noteworthy. While a challenging and iterative process that required the knowledge and collaboration of authors and reviewers, this innovative method aimed to set a policy lens on TWH® research. We conducted a detailed and comprehensive review by two independent reviewers that was checked by study authors, all of which increases the robustness of this study. We believe that the results described here will aid in setting research priorities that will in turn translate findings to inform policy.

## CONCLUSIONS

In this paper, we considered the policy implications emerging from a comprehensive review of one TWH® Center's scientific output and the value of the review in identifying policy gaps to assist in setting future research priorities. Ultimately, policies can either advance or impede the potential of TWH® to make a difference in the lives of workers and the success of employers. We identified cross-cutting themes from our research findings and the associated policy implications at both the organizational and public policy levels.

This review process can serve as a model for other research groups who seek to examine the TWH® policy implications of their own work and identify future areas of focus. By reviewing our research to date, we have identified common themes and related policy recommendations, along with some important scientific gaps for future research. We were able to demonstrate the feasibility and utility of conducting a review that draws out relevant policy implications of TWH® research. We hope that this review can serve as a model for other groups and can lead to an increased focus on policy discussions in manuscripts.

## REFERENCES

- Wagner G, Spieler E. The roles of government in protecting and promoting occupational and environmental health. In: Levy BS, Baron SL, Sokas RK, eds. *Occupational and Environmental Health*. 7th ed. United States of America by Oxford University Press, 2017.
- Bornstein S, Baker R, Navarro P, Mackey S, Speed D, Sullivan M. Putting research in place: an innovative approach to providing contextualized evidence synthesis for decision makers. *Syst Rev*. 2017;6:218.
- Nielsen K, Miraglia M. What works for whom in which circumstances? On the need to move beyond the 'what works?' question in organizational intervention research. *Hum Relat*. 2017;70:40–62.
- National Institute for Occupational Safety and Health (NIOSH). What is Total Worker Health? 2018. Available at: <https://www.cdc.gov/niosh/twh/totalhealth.html>. Accessed April 15, 2019.
- Sorensen G, McLellan DL, Sabbath EL, et al. Integrating worksite health protection and health promotion: a conceptual model for intervention and research. *Prev Med*. 2016;91:188–196.
- Amick BC, Habeck RV, Hunt A, et al. Measuring the impact of organizational behaviors on work disability prevention and management. *J Occup Rehabil*. 2000;10:21–38.
- Dennerlein JT, Hopcia K, Sembajwe G, et al. Ergonomic practices within patient care units are associated with musculoskeletal pain and limitations. *Am J Ind Med*. 2012;55:107–116.
- Sabbath EL, Sparer EH, Boden LI, et al. Preventive care utilization: association with individual- and workgroup-level policy and practice perceptions. *Prev Med*. 2018;111:235–240.
- Sparer EH, Boden LI, Sorensen G, et al. The relationship between organizational policies and practices and work limitations among hospital patient care workers. *Am J Ind Med*. 2018;61:691–698.
- Peters S, Grant M, Rodgers J, et al. A cluster randomized controlled trial of a total worker Health® intervention on commercial construction sites. *Int J Environ Res Public Health*. 2018;15:pii:E2354.
- Nelson CC, Wagner GR, Caban-Martinez AJ, et al. Physical activity and body mass index: the contribution of age and workplace characteristics. *Am J Prev Med*. 2014;46:S42–S51.
- Sorensen G, Stoddard AM, Stoffel S, et al. The role of the work context in multiple wellness outcomes for hospital patient care workers. *J Occup Environ Med*. 2011;53:899–910.
- Sabbath EL, Hurtado DA, Okechukwu CA, et al. Occupational injury among hospital patient care workers: what is the association with workplace verbal abuse? *Am J Ind Med*. 2014;57:222–232.
- Sabbath EL, Williams JA, Boden LI, et al. Mental health expenditures: association with workplace incivility and bullying among hospital patient care workers. *J Occup Environ Med*. 2018;60:737–742.
- Occupational Safety and Health Administration (OSHA). Recommendations for Workplace Violence Prevention Programs in Late-Night Retail Establishments; 2009.
- Hurtado DA, Kim SS, Subramanian S, et al. Nurses' but not supervisors' safety practices are linked with job satisfaction. *J Nurs Manag*. 2017;25:491–497.
- Boden LI, Petrofsky YV, Hopcia K, Wagner GR, Hashimoto D. Understanding the hospital sharps injury reporting pathway. *Am J Ind Med*. 2015;58:282–289.
- Dennerlein JT, O'day ET, Mulloy DF, et al. Lifting and exertion injuries decrease after implementation of an integrated hospital-wide safe patient handling and mobilisation programme. *Occup Environ Med*. 2017;74:336–343.
- Tveito T, Sembajwe G, Boden L, et al. Impact of organizational policies and practices on workplace injuries in a hospital setting. *J Occup Environ Med*. 2014;56:802–808.
- Reme SE, Shaw WS, Boden LI, et al. Worker assessments of organizational practices and psychosocial work environment are associated with musculoskeletal injuries in hospital patient care workers. *Am J Ind Med*. 2014;57:810–818.
- Hurtado DA, Nelson CC, Hashimoto D, Sorensen G. Supervisors' support for nurses' meal breaks and mental health. *Workplace Health Saf*. 2015;63:107–115.
- Sembajwe G, Tveito TH, Hopcia K, et al. Psychosocial stress and multi-site musculoskeletal pain: a cross-sectional survey of patient care workers. *Workplace Health Saf*. 2013;61:117–125.
- Occupational Safety and Health Administration (OSHA). Law and Regulations. Available at: <https://www.osha.gov/law-regs.html>. Accessed April 15, 2019.
- European Agency for Safety and Health at Work (EU-OSHA). Framework Directive 89/391/ECC. Available at: <https://osha.europa.eu/en/legislation/directives/the-osh-framework-directive/1>. Accessed April 15, 2019.
- Mental Health Commission of Canada (MHCC). CAN/CSA-Z1003-13/BNQ 9700-803/2013 – Psychological Health and Safety in the Workplace; 2013. Available at: <https://www.csagroup.org/article/can-ca-z1003-13-bnq-9700-803-2013-r2018/>. Accessed April 15, 2019.
- Kim S-S, Okechukwu CA, Dennerlein JT, et al. Association between perceived inadequate staffing and musculoskeletal pain among hospital patient care workers. *Int Arch Occup Environ Health*. 2014;87:323–330.
- Greenhaus JH, Beutell NJ. Sources of conflict between work and family roles. *Acad Manag Rev*. 1985;10:76–88.
- King RB, Karuntzos G, Casper LM, et al. Work–family balance issues and work–leave policies. In: *Handbook of occupational health and wellness*. Springer, Boston, MA, USA; 2012:323–339.
- Kelly EL, Moen P, Oakes JM, et al. Changing work and work-family conflict: Evidence from the work, family, and health network. *Am Soc Rev*. 2014;79:485–516.
- Jacobsen HB, Reme SE, Sembajwe G, et al. Work-family conflict, psychological distress, and sleep deficiency among patient care workers. *Workplace Health Saf*. 2014;62:282–291.
- Kim SS, Okechukwu CA, Buxton OM, et al. Association between work–family conflict and musculoskeletal pain among hospital patient care workers. *Am J Ind Med*. 2013;56:488–495.
- Hurtado DA, Glymour MM, Berkman LF, Hashimoto D, Reme SE, Sorensen G. Schedule control and mental health: the relevance of coworkers' reports. *Commun Work Fam*. 2015;18:416–434.

33. Miller J, Hopcia K, Wagner GR, et al. Job satisfaction and the psychosocial work environment: Does the relationship vary by hospital patient care workers' age? *J Workplace Behav Health*. 2018;33:3–4. 221–240.
34. Hopcia K, Dennerlein JT, Hashimoto D, Orechia T, Sorensen G. Occupational injuries for consecutive and cumulative shifts among hospital registered nurses and patient care associates: a case-control study. *Workplace Health Saf*. 2012;60:437–444.
35. Arias OE, Umukoro PE, Stoffel SD, Hopcia K, Sorensen G, Dennerlein JT. Associations between trunk flexion and physical activity of patient care workers for a single shift: a pilot study. *Work*. 2017;56:247–255.
36. Sabbath EL, Boden LI, Williams JA, Hashimoto D, Hopcia K, Sorensen G. Obscured by administrative data? Racial disparities in occupational injury. *Scand J Work Environ Health*. 2017;43:155–162.
37. Williams JA, Sorensen G, Hashimoto D, et al. Impact of occupational injuries on non-workers' compensation medical costs of patient-care workers. *J Occup Environ Med*. 2017;59:e119–e124.
38. Sabbath EL, Yang J, Dennerlein JT, et al. Paradoxical impact of a patient-handling intervention on injury rate disparity among hospital workers. *Am J Public Health*. 2019;109:618–625.
39. Boden LI, Sembajwe G, Tveito TH, et al. Occupational injuries among nurses and aides in a hospital setting. *Am J Ind Med*. 2012;55:117–126.
40. Jacobsen HB, Caban-Martinez A, Onyebeke LC, Sorensen G, Dennerlein JT, Reme SE. Construction workers struggle with a high prevalence of mental distress and this is associated with their pain and injuries. *J Occup Environ Med*. 2013;55:1197–1204.
41. Reme SE, Dennerlein JT, Hashimoto D, Sorensen G. Musculoskeletal pain and psychological distress in hospital patient care workers. *J Occup Rehabil*. 2012;22:503–510.
42. Kim I-H, Muntaner C, Shahidi FV, Vives A, Vanroelen C, Benach J. Welfare states, flexible employment, and health: a critical review. *Health Policy*. 2012;104:99–127.
43. Vives A, Vanroelen C, Amable M, et al. Employment precariousness in Spain: prevalence, social distribution, and population-attributable risk percent of poor mental health. *Int J Health Serv*. 2011;41:625–646.
44. Arias OE, Caban-Martinez AJ, Umukoro PE, Okechukwu CA, Dennerlein JT. Physical activity levels at work and outside of work among commercial construction workers. *J Occup Environ Med*. 2015;57:73–78.
45. Umukoro PE, Arias OE, Stoffel SD, Hopcia K, Sorensen G, Dennerlein JT. Physical activity at work contributes little to patient care workers' weekly totals. *J Occup Environ Med*. 2013;55:S63–S68.
46. Jacobsen HB, Reme SE, Sembajwe G, et al. Work stress, sleep deficiency, and predicted 10-year cardiometabolic risk in a female patient care worker population. *Am J Ind Med*. 2014;57:940–949.
47. Buxton OM, Karen Hopcia N, Sembajwe G, et al. Relationship of sleep deficiency to perceived pain and functional limitations in hospital patient care workers. *J Occup Environ Med*. 2012;54:851.
48. Mona GG, Chimbari MJ, Hongoro C. A systematic review on occupational hazards, injuries and diseases among police officers worldwide: Policy implications for the South African Police Service. *J Occup Med Toxicol*. 2019;14:2.
49. Melillo KD. Cognitive health and older workers: Policy implications. *J Gerontol Nurs*. 2013;39:13–18.
50. Heijbel B, Josephson M, Jensen I, Vingård E. Employer, insurance, and health system response to long-term sick leave in the public sector: policy implications. *J Occup Rehabil*. 2005;15:167–176.