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RESEARCH ARTICLE

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Participatory design of a sleep intervention with correctional supervisors using a root causes approach

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Abstract

Background: After a Design Team (DT) conducted a workforce health assessment of correctional supervisors, they selected sleep as an intervention priority, given its numerous health and work consequences. Existing workplace sleep interventions are designed with little worker input, but participatory solutions that incorporate workers' lived experiences and root causes of poor sleep may be more relevant, appropriate, and acceptable to end-users, resulting in better uptake.

Methods: The DT met bi-monthly to complete the Intervention Design and Analysis Scorecard (IDEAS) tool to brainstorm interventions that address root causes of poor sleep, and evaluate, rank, and select interventions for implementation. We conducted a qualitative review of meeting notes and worksheets from each IDEAS step, and present our findings on root causes and prioritized solutions.

Results: The DT consisted of two university researchers and seven members of a correctional supervisors' union, with 5–9 participants attending each meeting. IDEAS Steps 1–5 were completed in eight meetings over six months. Root causes of poor sleep included mind/body and environmental disruptions, and insufficient time. Three solutions were proposed: training on sleep hygiene, meditation, and sleep debt management; a sleep-tracking smartphone app; and a shared overtime policy based on splitting one 8-hour shift between two supervisors.

Conclusions: This is the first known application of IDEAS to address sleep, and targeting root causes may result in more efficacious interventions for sleep improvement. Moreover, because IDEAS guides DTs in selecting solutions with the greatest perceived health benefits, reach, cost-effectiveness, and feasibility, it may result in more successful implementation.

KEYWORDS

community-based participatory research, correctional supervisors, healthy workplace participatory program, intervention design and analysis scorecard, intervention planning, root causes analysis, sleep

1 | INTRODUCTION

Poor sleep has been identified as an unmet and critical public health need, and the role of workplace factors in poor sleep health has been studied for decades.[1] Poor sleep is linked to a number of health consequences, such as cardiovascular disease,[2] depression, and anxiety disorders, alcohol abuse, suicide, and chronic pain.[1,3] Workplace factors associated with poor sleep health include high job demands,[4] extended and irregular work hours,[5] poor interpersonal relationships, lack of social support from colleagues/supervisors, and effort-reward imbalance.[6] Poor sleep can also profoundly impact workplaces, leading to adverse work outcomes including absenteeism, reduced productivity,[6] fatigue-related decisions and errors on the job,[7] and increased injuries.[8]

In general, sleep interventions have been applied almost exclusively to populations seeking treatment for chronic sleep disorders (e.g., insomnia and sleep apnea) and available diagnostic tools have been delivered within clinical settings or using physical monitoring (e.g., overnight sleep studies assessing physiological aspects of sleep patterns, at-home sleep apnea tests with wearable devices, sensors, and probes).[9] Yet not all people who experience sleep difficulties have chronic sleep disorders; many have difficulties that are less severe and do not reach the threshold for a diagnosable sleep disorder.

Workplace interventions to improve employee sleep commonly include education on sleep hygiene or fatigue management[10]; however some concepts in these educational programs lack relevance for workers with non-daytime shifts or long overtime hours. For example, a typical sleep hygiene recommendation is to go to bed and awaken at the same time every day, yet it is not possible for such workers to establish a consistent daily sleep-wake cycle, a reality which may in fact be distressing to them.[11] The wording of recommendations and related measures to evaluate sleep are also often insensitive to shiftworkers' situation, using language referring to the number of hours of sleep you get *at night*, or what time you wake up *in the morning*.[12] These examples illustrate the limitations of top-down administratively-driven interventions (the most common type) that are developed or selected with no input from workers themselves about their lived experiences or the root causes of their poor sleep. In addition to affecting uptake, this can pose challenges to implementation, particularly if workers do not perceive interventions to be relevant, appropriate, or acceptable.

Correctional supervisors (i.e., lieutenants, captains, and counselor supervisors) are the middle managers working in prisons and jails.[13] Similar to other public safety workers (i.e., police officers, firefighters, and correctional officers), correctional supervisors are shift workers who provide around-the-clock supervision and care for an incarcerated population. Correctional supervisors can also be mandated or volunteer to work overtime, and some report working a sum of overtime hours that equates to holding secondary employment.[13] Among correctional supervisors, having precarious work schedules—characterized by long shifts, non-daytime hours, inadequate rest time between shifts, and unsocial work hours—has indirect effects on fatigue and depressive symptoms through sleep quantity (number of sleep hours per day).[14] Furthermore, a supervisor's job can be described as psychologically demanding as it requires continuous vigilance and interaction with their subordinates and inmates to ensure the safe operations of the prisons and jails that they oversee. Poor sleep quality and duration is particularly salient because of the intersection of inherent job dangers with long work hours due to the 24/7 nature of the corrections operational schedule, which results in extended exposure to stressful work conditions.[14,15]

Large-scale national studies in the United States examined sleep duration by industry and found that blue collar occupations similar to corrections, such as transportation, warehouse industry workers, and protective service occupations, reported shorter sleep duration as compared to other occupations (e.g., public administration).[16,17] Public safety workers such as correctional supervisors commonly experience poor sleep health and sleep disorders[18,19] which can adversely affect their health and pose a risk to their on-the-job safety as well as the safety of their peers and the public they protect. There are few studies of corrections workers' sleep, and all examine the association of sleep with occupational factors. A cross-sectional survey study of prison staff in France found that 41.8% of the sample had sleep disorders, which were associated with difficult schedules, job dissatisfaction, and a negative professional image.[20] A similar study of correctional officers in Brazil found that 58% of the sample had poor sleep quality, associated with higher mental demands, exposure to psychological violence at work, rumination about work during nonwork time, and work dissatisfaction.[21] In a US-based study, 28% of the sample reported having sleep apnea, 45% reported having insomnia, more than half slept less than 2 h between shifts and were constantly fatigued; sleep problems were associated with exposure to critical incidents.[22]

Despite the occupational health hazards associated with poor sleep health, interventions and policies designed to help correctional supervisors improve their sleep health are limited.[19] Moreover, the health and well-being of correctional employees has not received the same level of research and policy attention as other public safety workers, such as police officers and firefighters, despite having one of the poorest health profiles of any occupation.[23,24]

1.1 | A community-based participatory research project

Health Improvement Through Employee Control (HITEC) is a research study of the Center for the Promotion of Health in the New England Workplace (CPH-NEW), a Center of Excellence for *Total Worker Health*® funded by the National Institute for Occupational Safety and Health (NIOSH). NIOSH's *Total Worker Health* (TWH) concept is based on the principle that worker safety and health is best addressed with a holistic approach that integrates traditional worker protection programs with preventative health promotion programs, and assesses both work and nonwork exposures.[25] A key TWH practice is the participatory engagement of workers in developing

interventions that aim to improve health by targeting organizational workplace-level change (in addition to individual worker-level change).[26] NIOSH's TWH concept highlights the important role that work plays as a determinant of health that can impact all aspects of a worker's life.[27]

HITEC has conducted participatory research in corrections for over 15 years, by partnering with unions, supervisory-level staff, front-line workers, and administrative staff from the Department of Correction (DOC) in a Northeastern US state. Our participatory methods apply TWH principles and practices, and emphasize worker engagement in designing, implementing, and evaluating interventions that incorporate workers' lived experiences both inside and outside of work.[23,24] Participatory methods with grassroots involvement of workers is a TWH practice that has enabled us to develop and deliver bottom-up, worker-driven interventions with better health outcomes and implementation success (e.g., higher participation rates, greater acceptability, appropriateness, credibility, and compatibility with organizational culture) than conventional top-down, administratively-driven interventions.[23,24,28]

In 2014, the union bargaining unit for correctional supervisors initiated a new study idea with research staff from the HITEC project, recognizing that most correctional health and intervention research focuses on correctional officers (CO) rather than supervisors. Although they have common background experience (supervisors are typically promoted from CO ranks), a supervisor's role is substantively different from that of a CO in important ways. Correctional supervisors, who have paramilitary job titles (i.e., lieutenant, captain), are the middle managers in prisons and jails, playing a key role in the chain-of-command between CO and upper management (i.e., deputy wardens, wardens). They have greater responsibility for administrative tasks and facility security, and fewer peers within the organization. This may place them at increased health risk due to exposure to stress and lower levels of support.

Correctional supervisor union members and CPH-NEW research staff formed a "Design Team" (a team that is tasked with developing interventions) to work together equitability to improve the health of correctional supervisors using community-based participatory research (CBPR) methods. To fully understand the health, safety, and well-being concerns of correctional supervisors, the Design Team (DT) began its work together by developing a workforce health needs assessment survey and administering it to supervisor union members within the DOC. Full details of the participatory survey design process, survey findings, and the selection of workforce health intervention priorities are provided in prior publications by Dugan and colleagues.[29,30]

In summary, the DT identified three health priorities for intervention after reviewing workforce health assessment survey results: (1) improving sleep quality/quantity (i.e., 71% of correctional supervisors reported in the survey that they were interested in improving their sleep), (2) improving mental health/stress management (i.e., 80% indicated that they were interested in reducing stress), and (3) weight loss/healthy eating/physical activity (i.e., 59% were interested in losing weight). Through a consensus-building and voting process used to prioritize three issues for intervention, improving sleep quality and quantity was chosen as the first topic for intervention development. Mental health/stress was voted on as an equivalent priority, but due to a general reluctance among corrections workers to acknowledge and address their psychological challenges, sleep was considered a less personally invasive and more acceptable starting point. It was also an especially salient health topic given the number of supervisors affected, as the workforce health assessment survey showed that 57% of supervisors reported getting 6 or fewer hours of sleep per day, and 41% reported typically having poor-quality sleep.[30] The survey also showed that insufficient hours of sleep, poor quality sleep, and difficulty sleeping, were all correlated with worse overall health.

1.2 | The current study

In this article, we describe the work that followed the union-based DT's identification of health intervention priorities. Specifically, we explain the root causes of poor sleep quantity and quality based on the actual lived experiences of correctional supervisors, which were revealed by the systematic, stepwise process used to develop sleep interventions. We describe how the process to evaluate, rank, and select interventions for implementation was based on meeting key performance criteria (i.e., effectiveness, reach, cost, and feasibility) known to be associated with implementation success.[28] To guide the current study and highlight new insights, the DT posed two research questions:

Research Question 1: What are the root causes of poor sleep quantity and quality among correctional supervisors in our state, and what interventions can potentially remediate these root causes?

Research Question 2: What sleep interventions have the highest potential for implementation success among correctional supervisors in our state, based on them having the greatest perceived health benefits, reach, cost-effectiveness, and feasibility?

2 | METHODS

In this study, the DT that conducted the comprehensive workforce health assessment and process of selecting intervention priorities, used a planning tool to systematically brainstorm interventions that address root causes of poor health, and then evaluate, rank, and select interventions for implementation. The planning tool, titled the Intervention Design and Analysis Scorecard (IDEAS), is an evidence-based tool developed by researchers at the Center for the Promotion of Health in the New England Workplace (CPH-NEW). IDEAS consists of a 7-step planning process that DTs can use to identify root causes to health and safety concerns in the workplace and come up with actionable solutions.[31] The IDEAS tool is part of the CPH-NEW Health Workplace Participatory (HWPP) toolkit which is described in greater detail in the next section of this article.

In the current study, the DT consisted of nine core members, including two academic university researchers, a CPH-NEW researcher (AD) trained in facilitating the IDEAS process, and a graduate assistant (SN) who served as note-taker and point of contact. The seven other DT members (i.e., lieutenants, captains, and supervisory counselors) were elected union leaders and all but one had worked for the state's Department of Correction (DOC) for at least 15 years. Their union leadership roles facilitated the DT's work as a sponsored activity.

2.1 | Participatory process and tools

As previously mentioned, the DT used CPH-NEW's HWPP toolkit,[27] which is free and publicly available online. The toolkit was designed and field tested by CPH-NEW investigators to help workplaces develop solutions for a range of occupational safety and health concerns that occur as a result of organizational factors (e.g., environmental characteristics, work hours, interpersonal interactions, and work-family conflict).[32] The HWPP toolkit includes instructive materials for starting up a DT, a group of frontline employees that identifies workplace health and safety challenges and designs solutions tailored to their work environments.[33] The engagement of front-line workers is essential to understanding the multiple underlying contributors of poor health because they are subject matter experts of their occupations, jobs, and work environments. The toolkit also provides direction for forming a Steering Committee (SC) of organizational leaders and other key personnel who are responsible for overseeing DT activities, and who work in partnership with the DT to select, implement, and evaluate health and safety interventions.[34] Because an organization of workforce members, even one of supervisors, requires the engagement and financial support of senior administrators, the formation and high-level functioning of a SC has proven to be a central component of workforce-based interventions.

All DT members committed to participating in 2-h bi-monthly meetings that were held offsite at the labor union office, rather than within a corrections facility. DT members also participated in monthly SC meetings. Other SC attendees included members of the HITEC research team, union leaders from non-supervisory bargaining units, and DOC senior administrators (e.g., the Director of Human Resources, Deputy Commissioner, and Commissioner). The SC was kept abreast of the DT's interventions and implementation plans, to provide support, if needed.[34] Support included organizational assistance, such as coordinating schedules and distribution of educational materials, and financial support.

The particular HWPP tool used by the DT in the current study was the IDEAS.[31] The IDEAS tool is a structured seven-step planning process used to develop, implement, and evaluate interventions addressing a specific health and safety concern. At the beginning of each step, DT members were provided three printed handouts: instructions for completing the step, a blank worksheet to be completed by the group before moving on to the next step, and a worksheet completed with an example health topic (i.e., overheating among maintenance workers). The blank worksheets were not filled out by individual members but were distributed to provide the group a full overview of each step's process (Appendix A provides the blank IDEAS Worksheets that were used). Blank worksheets were recreated on a flipchart in the front of the room so that the DT could view and complete each sheet with all members' providing input together through shared decision-making. A graduate assistant who served as DT note-taker filled in the blank sheets for the group, and verified with the group the accuracy of the information she wrote down before proceeding to the next step. The DT decided not to audio-record and transcribe the group activity, as the correctional supervisor workforce and union are cautious about worker privacy. In this study, two researchers (AD and SN) conducted a qualitative review of the meeting notes and worksheets from each IDEAS step, including meeting dates and number of participants attending each meeting, as well as the process and outcomes of each step (see Table 1).

In IDEAS Step 1, a trained facilitator guides the DT to use a root causes analysis technique to first identify three sub-issues affecting the primary health and safety problem (i.e., poor sleep) and then brainstorm factors contributing to each sub-issue. In Step 2, the DT sets a measurable health and safety goal (i.e., improved sleep) and is prompted to brainstorm three solutions (corresponding to the sub-issues and contributing factors identified in Step 1) with specific activities for achieving each solution. In Step 3, the DT is instructed to generate a set of mutually agreed-upon selection criteria (i.e., four "key performance indicators")—regarding desired scope, health benefits/effectiveness, resource considerations, and obstacles/feasibility—to use in Step 4 to evaluate the favorability of each proposed solution activity in terms of its potential success in achieving desired health and implementation outcomes. In Step 4, the facilitator instructs the DT to evaluate all activities brainstormed in Step 2 with the selection criteria created in Step 3 (i.e., for scope, benefits/effectiveness, resources/costs, and obstacles/barriers), then to group activities together into three intervention options. In Step 5, the DT is instructed to compare the intervention options and evaluate how well they fulfill the selection criteria, rating each one High (H), Medium (M), or Low (L); these ratings are then used to rank the intervention options in order of priority for implementation, via discussion and consensus. (See Table 1 for an overview of the purpose and activities of each of the five steps. Appendix A provides IDEAS Step 1–5 Worksheets.)

This paper details the activities associated with completing IDEAS Steps 1–5. The process of completing IDEAS Steps 6 and 7, which details the sleep intervention that was implemented, evaluated, and monitored, will be documented in a forthcoming article. All study protocols were approved by the University's Institutional Review Board.

3 | RESULTS

We present findings from the qualitative review of meeting notes and completed IDEAS worksheets that correspond with each of the five IDEAS steps. Table 1 provides the timeline of DT meetings, and

TABLE 1 Design team meeting activities and outcomes for IDEAS Steps 1–5

Step #	Purpose	Meeting dates	# of meetings	# of participants	Outcome of step
Step 1	Identify Health and Safety Problems and Contributing Factors	April 2015	2	7	**Health and safety problem: Poor sleep quantity and quality.** Contributing factors (root causes) are: – Internal (mind/body) disruptions – External (environmental) disruptions – Not enough time to sleep due to work hours
Step 2	Set Measurable Objectives and Brainstorm Solution Activities	June 2015	2	5	**Health and safety goal: Increase reported sleep hours and ratings of sleep quality.** Solution activities include: – Mind/body solutions (e.g., teach meditation, leisure downtime, exercise) – Environmental solutions (e.g., teach sleep hygiene practices) – Decrease work hours (e.g., track/manage sleep debt, change overtime policy)
Step 3	Set Selection Criteria for Evaluating Solution Activities	July 2015	2	6	**Criteria required for a favorable evaluation of intervention: *Impact/Scope*** – Intervention will impact – all supervisors who have poor sleep quality (~50% based on survey findings) ***Benefits/Effectiveness*** – Intervention will improve physical, mental, behavioral health – Intervention will improve work outcomes ***Resources/Costs*** – Intervention will ideally be free, but no more than $200 ***Obstacles/Barriers*** – Inability to participate in intervention during work time – Time required for intervention participation (should be ~20 min) – Lack of convenient location/time for intervention delivery – Interference of work and nonwork demands with attending scheduled interventions (i.e., mandated overtime, – facility codes/lockdowns, child care coverage)
Step 4	Apply Selection Criteria and Create 3 Intervention Alternatives	August 2015	1	9	**Intervention A: Mind/body Training Session** – Provide training on meditation to improve sleep (medium scope, high benefits, low resources, medium obstacles) **Intervention B: Environmental Training Session** – Provide training on sleep hygiene to improve sleep (medium scope, high benefits, low resources, medium obstacles) – **Intervention C: Increase Sleep Hours/Decrease Work Hours** – Provide training on managing sleep debt

(Continues)

TABLE 1 (Continued)

Step #	Purpose	Meeting dates	# of meetings	# of participants	Outcome of step
					– Offer tool to track sleep hours and provide feedback to build awareness of sleep habits/ self-regulate sleep debt – Institute shared overtime policy permitting 2 supervisors to split an 8-hour overtime shift (low scope, high benefits, high resources, high obstacles)
Step 5	Rate Interventions	September 2015	1	5	**Interventions A and B are first priority (equally prioritized)** – Design Team will combine the two interventions into one training session that teaches meditation and sleep hygiene practices; it will also incorporate training on managing sleep debt from Intervention C. **Intervention C activities are second priority** – Design Team will offer smartphone app to track sleep hours/provide feedback; will require additional funding. – Shared overtime idea could become topic of contract negotiations; it is being discussed by union executive board

summarizes the activities and outcomes that were discussed during IDEAS Steps 1–5. It required eight meetings over 6 months for the DT to complete Steps 1–5. Participant attendance was stable with 5–9 participants attending each meeting.

Step 1 was completed over two meetings. The DT generated a list of three sub-issues with contributing factors (root causes) associated with poor sleep quality and quantity. The list (see Table 1) included mind/body sleep disruptions (e.g., caffeine use, liquid intake/need to urinate, cognitive rumination, lack of exercise, and poor diet/eating habits), environmental sleep disruptions (e.g., stimuli such as ambient noise, light exposure, and use of TV and electronic devices), and work scheduling practices and policies (e.g., sleep disruption due to shift work and lack of time for sleep due to overtime hours).

In Step 2, which required two meetings to complete, the DT set a measurable health and safety goal of increasing correctional supervisors' reported number of sleep hours and improving ratings of sleep quality. The DT identified the following solutions for meeting this goal (see Table 1): (1) mind and body solutions to improve sleep (e.g., a training on strategies to psychologically disengage the mind and relax the body, such as meditation using guided imagery, leisure downtime, and physical exercise), (2) environmental solutions to improve sleep (e.g., a training on strategies to improve sleep hygiene, customized for shiftworkers), and (3) increasing sleep hours by decreasing work hours and creating awareness about sleep debt (e.g., a training session on managing sleep debt, tools to track and self-monitor sleep hours, and a shared overtime policy based on splitting one 8-h shift between two supervisors).

In Step 3, which took two meetings to complete, the DT generated selection criteria for scope, benefits/effectiveness, resource considerations, and obstacles (see Table 1). Scope, also known as reach, was defined as the number of people within the organization whom the interventions should be disseminated to. The DT determined that their intervention would be successful if it reached at least 50% of the correctional supervisors working at DOC. This percentage was estimated based on the number of correctional supervisors who reported experiencing poor sleep in the initial workforce health assessment survey (57% poor sleep quantity and 41% poor sleep quality).

Anticipated effectiveness, defined as any perceived short-term and long-term health benefits that interventions should provide to individual workers, were identified (e.g., improved attitudes and health), and included physical and mental health improvements and better health behaviors (i.e., healthier diet and more exercise; decreased use of sleep medication, alcohol, and coffee). Anticipated benefits for the organization were improved job performance, fewer injuries, and fewer sickness absences.

Resource considerations are defined as the financial or other types of short-term and long-term resources needed for the intervention. To quantify cost-effectiveness, the DT decided that the ideal intervention would be free, but an acceptable cost for the intervention would be less than $200 dollars. This estimate was based on the dollar amount that the DT considered affordable from

union discretionary funds, in the event that DOC or other funding was unavailable.

Finally, the DT assessed feasibility, and identified the following potential obstacles and barriers to the intervention (i.e., anything that is likely to work against the implementation of the intervention): inability to get DOC permission for supervisors to participate in the intervention during work time, the length of time required for intervention participation (if over 20 min), the lack of a convenient location or time for 423 supervisors working across 19 statewide facilities and three shifts to attend intervention sessions, and work and nonwork demands interfering with attendance at scheduled intervention sessions. Examples of work and nonwork demands included mandated overtime, facility codes and lockdowns, and childcare coverage.

In Step 4, which took one meeting to complete (see Table 1), the DT created the following three intervention options: (1) a training session on meditation/guided imagery to improve sleep through mind/body strategies (Intervention A), (2) a training session on sleep hygiene practices for shiftworkers to improve sleep through environmental strategies (Intervention B), and (3) initiatives that decrease work hours and increase sleep hours (Intervention C). The third option consisted of solutions including a training session on strategies to manage sleep debt, a tool to track sleep hours and provide simple feedback to create awareness of personal sleep habits and help self-regulate sleep debt, and a new work-scheduling policy based on shared overtime in which two supervisors are permitted to split their overtime shifts.

In terms of scope, Interventions A and B (and the training session activity from Intervention C) were all estimated as obtaining participation/engagement of 50% or more of supervisors, having desired individual and organizational benefits, and requiring minimal resources. Training sessions faced a major technical implementation obstacle, which was finding a convenient training time/location for all supervisors. The remainder of the Intervention C solution activities were evaluated as potentially impacting 25% or fewer supervisors and having desired individual and organizational benefits. These activities were perceived to face greater barriers due to them requiring extensive financial, time, and effort resources. For example, the preferred format for the tool to track sleep hours and provide feedback was a smartphone application (app). However, the purchase or development of a smartphone app would require financial resources; moreover, not all supervisors have up-to-date smartphones, and DOC employees are not permitted to have cell phones at work. The shared overtime policy also had the potential obstacle of requiring union contract negotiations. The underlying contradiction of overtime work also came into play, as our previous research found that not all supervisors would support initiatives to limit overtime that reduced income, even if it meant better sleep health.[29,30] The DT decided to tackle sleep habits due to the fact that it was a more agreeable topic to approach.

In Step 5, which took one meeting to complete, the DT applied a tripartite rating—high, medium, and low—to compare how each intervention in Step 4 fared in terms of meeting the selection criteria for scope, benefits/effectiveness, resources and obstacles (See Table 1). Further, the DT ranked interventions for implementation priority. Applying this rating system, both Interventions A and B were given a medium-to-high rating in terms of their ability to reach and impact large numbers of correctional supervisors. They were rated favorably in terms of delivering anticipated maximum (medium-to-high) benefits with minimal (low) resources, and rated as medium in terms of anticipated obstacles (i.e., feasibility). Intervention C activities were rated high in benefits, but less favorably in terms of scope (low), resources needed (medium-to-high), and anticipated obstacles (high). After comparing and discussing the ratings, the DT ranked Interventions A and B equally as the first priority for implementation. The DT decided they would develop a 1-h training session that combined elements from both Intervention A and B (meditation and sleep hygiene), and after further discussion they also opted to incorporate the sleep debt training activity listed under Intervention C. The 1-h training session also included information about where to go to get evaluated and treated for a potential sleep disorder. Intervention C's remaining activities (sleep-tracking smartphone app, shared overtime policy) were ranked as a secondary priority due to feasibility concerns but will be revisited for possible implementation in the future.

4 | DISCUSSION

Few studies address corrections workers' sleep, and still fewer offer effective sleep interventions,[20–22] particularly for people whose sleep difficulties do not reach the severity of a diagnosable sleep disorder. Workplace interventions on sleep hygiene and fatigue management are often grounded in the experiences of workers with standard 9–5 weekday schedules, and are not wholly relevant to workers with nighttime shifts, extended hours, or irregular schedules. In this study, the first known application of IDEAS to address the topic of sleep, a DT identified multiple underlying causes of poor sleep among correctional supervisors in the state, based on their own lived experiences, especially as it relates to shiftwork and overtime, as well as job-related strain. Answering Research Question 1, the DT identified specific root causes including mind/body sleep disruptions (i.e., rumination and urination), environmental sleep disruptions (i.e., light and noise), and work schedules that interfere with sleep time (nonday shifts and overtime). These findings are similar to research conducted with other shift working populations (e.g., police officers).[35] They point to the need for corrections workers to learn and adopt better sleep habits, but also the ability to psychologically detach from work and suppress intrusive thoughts to curb rumination.[36,37]

Various options exist to diagnose and resolve sleep problems, but conventional approaches in the form of infeasible polysomnography (overnight sleep studies), or even more convenient at-home sleep apnea tests (HSATs),[38] or streamlined screening tools (e.g., STOP-Bang)[39] are not wholly appropriate for resolving the sleep problems of this study population, which are more cognitive-behavioral in nature. The sleep difficulties identified by supervisors were related to poor sleep quality

and quantity, a less severe problem that a diagnosable sleep disorder, but one that affects a larger portion of the workforce. Using the participatory intervention approach, the DT proposed what it perceived to be relevant, acceptable, and appropriate solutions to the specified root causes of poor sleep, targeting the improvement of sleep behaviors with mind/body solutions (e.g., meditation, exercise), environmental solutions (e.g., sleep hygiene), and decreased work hours (e.g., sleep debt management).

The sleep hygiene intervention proposed by the DT is similar to those used and found to be effective in other workplaces (although requiring some adaptation for use with a shift-working occupation).[10] Workplace mindfulness and meditation interventions have been found to reduce rumination,[40] decrease psychological distress,[41] and improve sleep,[42,43] and but none that we are aware of targets the deliberate suppression of unwanted thoughts through guided imagery as a mechanism to improve sleep, as the DT proposed.[36,37] Although research has shown the association of sleep debt with poor sleep and health outcomes, as well as work performance decrements,[44,45] we were unable to find any interventions that provide education specifically on managing sleep debt.

The worker-driven participatory approach we used may produce interventions that are more successfully implemented, as it guides DTs to select interventions that meet their own prespecified criteria—for health benefits, reach, cost-effectiveness, and feasibility—which are known to have stronger associations with implementation outcomes.[28] Answering Research Question 2, the priority intervention was a 1-h training session that educates supervisors to improve sleep with strategies including good sleep hygiene, meditation using guided imagery, and sleep debt management. This intervention was prioritized because it passed a threshold for meeting the criteria (specified by the DT in Step 3) necessary to move directly ahead into the implementation phase. That is, the DT thought the training would result in better sleep, health, and work outcomes, that they would obtain engagement from at least 50% of the DOC supervisors, and that it would cost less than $200 to develop and deliver. They felt it was feasible—for this initial intervention—to find a large-enough space and convenient location (likely the DOC training academy), and get DOC's permission for supervisors to attend the training during paid work time. The lower-priority interventions (sleep tracking smartphone app, shared overtime policy) were tabled for future consideration due to the greater resources required and obstacles to overcome. (It is noteworthy that although the DT decided it was feasible to move ahead with the training at this time, they expected that future interventions would face greater obstacles and thus made the decision that in upcoming union negotiations, they would seek an annual "wellness day" that would permit all supervisors a paid day to use for participating in union-delivered health interventions, as well as funds for developing and delivering those interventions).

It should be noted that the training sessions (Intervention A + B) were aimed at improving sleep health at the individual level, targeting worker behavior change. The DT simultaneously developed an intervention targeting organization-level change using the IDEAS tool (Intervention C), which was also considered a priority intervention, though perceived to be less feasible. That intervention focused on creating a DOC policy for changes in work schedule practices which would permit shared overtime shifts between two correctional supervisors (each working 4 h). However, the DT recognized that it was beyond the jurisdiction of the group to approve this intervention. As such, it was forwarded to union management to become a possible topic for future contract negotiation. Changes in work schedules also required considerable discussion within the union bargaining unit, because many supervisors value their overtime income and would resist any organizational changes that would reduce those opportunities.[29,30] The DT acknowledged that such an innovative intervention would require some education of the workforce on the consequences of long work hours for sleep and health, and needed more support from the ranks to move forward.

NIOSH's TWH approach encourages the integration of traditional worker protection programs with health promotion programs. It recognizes that many aspects of the work environment (e.g., compensation, job security, job demands, interpersonal interactions, work schedule demands) can adversely impact worker health, safety, and well-being if left unaddressed.[46] The HWPP program applies TWH principles in allowing employees to design integrated workplace interventions that target changes of both individual- and organizational-level factors impacting employee health, safety, and well-being. However, making changes at the organizational level remains a challenge, despite their great potential for improving worker health.

4.1 | Strengths and limitations

There are several strengths to this study. Using participatory methods and HWPP tools to conduct a comprehensive workforce health assessment and to systematically select intervention priorities before engaging in intervention design, allowed the DT to customize interventions based on lived supervisor experiences so that they have key innovation characteristics known to predict implementation success such as acceptability, appropriateness, credibility, and compatibility with organizational culture.[28] These key characteristics are more likely to be present in interventions that had end-user input during their early design phase. Furthermore, these characteristics can prompt later diffusion, the passive and unplanned process by which members of social networks spread information about an intervention in an appealing way that encourages potential adopters to become drawn to it or interested in trying it.[47,48]

Part of the HWPP toolkit, the IDEAS tool provided a practical structure for systemically uncovering the root causes of problems and allowed the DT to generate highly-relevant, well-thought-out solutions to root causes, which improves the likelihood of an intervention's efficacy in improving health outcomes.[31] Moreover, by specifying evaluation criteria for expected health benefits, reach, cost-effectiveness, and feasibility, IDEAS enabled the DT to compare interventions and consider important trade-offs that have implications for implementation success, potentially affecting later adoption, fidelity, and sustainability.[28,49]

To prevent monopolization by researchers of DT efforts to design and implement interventions, the HWPP and IDEAS tool has a built-in-mechanism (e.g., group decision-making and voting processes) to engage all stakeholders fully and democratically in the design, implementation, and continued evaluation of interventions. IDEAS facilitators are trained to ensure that all voices are invited and heard throughout the process. There was also an explicitly-stated understanding at the outset of the DT's work that the roles and contributions of the researchers and workforce/union members are of equal and necessary value; members of the workforce/union provide subject matter expertise and researchers provide technical and scientific expertise.[50]

DT members were selected for the team due to their investment in the health and well-being of their union membership and were in positions of leadership at DOC, which supported the process and its success. The use of CBPR ensured that the DT members were treated as equal partners and content experts in all stages of the IDEAS process. All meetings were either held at the union office or at the University. The DT felt that the meeting locations were convenient and accessible and preferred the separation from at-work activity at the DOC. About half of DT members attended all of the scheduled meetings during IDEAS Steps 1–5, and their engagement was essential. Compared with DTs composed of line-level correctional officers, the supervisors' DT had more autonomy due to their job tenure and experience with administrative processes. While often critical of senior administrative DOC policy, they recognized their own roles in administration as supervisors, rather than as union opposition.

The study also had limitations. It is important to note that the HITEC research staff considered the necessary time period for intervention development to be short, considering the complexity of customizing interventions and the use of democratic consensus and an iterative process. However, the DT members were critical of the slow pace of weighing contingency and decision-making inherent in the IDEAS process, preferring immediate action and outcomes. Striking a balance between group process and quick action remains a developmental challenge for HITEC and other applications of participatory action research. Further, the IDEAS process required heavy involvement of the academic facilitator to explain the IDEAS process at each step. The IDEAS instructions and worksheets were not sufficiently intuitive for the DT members to walk through the process more independently. This poses a challenge for sustainability. Currently, the supervisors' union is working to develop an ongoing program beyond the research grant period to provide their own facilitators. The DT took note of these challenges during the IDEAS process and has provided feedback to the larger HITEC study team for continuous quality improvement purposes.

4.2 | Next steps and conclusion

Following the intervention design phase documented in this article, the DT went on to complete IDEAS Steps 6 (plan and implement interventions) and 7 (monitor and evaluate interventions). The DT worked in partnership with the HITEC research team to conduct an evaluation study using a quasi-experimental research design to test the efficacy of the sleep intervention, and also assessed the dissemination and implementation outcomes of the intervention (e.g., adoption, sustainability, and diffusion).[28,49] All findings will be reported in future publications.

This article describes participatory interventions designed by and for correctional supervisors working in a Northeastern US state. To our knowledge, these are the first sleep improvement interventions designed for correctional middle managers in which the responsibility for intervention development and implementation rests on the managers themselves. The interventions selected for implementation are promising in their potential for improving health and safety outcomes due to their grounding in the lived experience of supervisors and concentration on multiple underlying root causes. This allowed us to address a targeted sleep problem with solutions that were not generic, but suited to the specific social ecology of supervisors' work and personal lives, making solutions more relevant, appropriate, and acceptable by users. They also have built-in qualities favorable for implementation success, having met the DT's own criteria for anticipated health benefits, reach, cost-effectiveness, and feasibility. Interventions designed to address the sleep needs of the correctional middle manager population may also be applicable to the correctional officer population who have similar work hours and schedules. Because correctional supervisors play a vital role in ensuring the safety of their peers, inmates, and the public they serve, as well as the security of the facilities they oversee, addressing their insufficient sleep should be regarded as an important public health priority.

AUTHOR CONTRIBUTIONS

Sara Namazi, Alicia G. Dugan, Jennifer M. Cavallari, Mazen El Ghaziri, Robert D. Rinker, Julius C. Preston, and Vincent L. Steele contributed to the conception of the scientific questions, design of the work, and interpretation of results. Alicia G. Dugan and Sara Namazi contributed to the methods and results sections. Sara Namazi, Alicia G. Dugan, Jennifer M. Cavallari, and Martin G. Cherniack contributed to manuscript preparation and revisions, and interpretation of results.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

DISCLOSURE BY AJIM EDITOR OF RECORD

Paul Landsbergis declares that he has no conflict of interest in the review and publication decision regarding this article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS APPROVAL AND INFORMED CONSENT

The Institutional Review Board at the University of Connecticut's School of Medicine approved the study protocol, and written informed consent was obtained. IRB Protocol number: IE-13-033S-2.

DISCLAIMER

Total Worker Health® *is* a registered trademark of the U.S. Department of Health and Human Services (HHS). Participation by the University of Connecticut does not imply endorsement by HHS, the Centers for Disease Control and Prevention, or the National Institute for Occupational Safety and Health. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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