

# Effect of Mindfulness-Based Stress Reduction Training on Health Care Worker Safety

## *A Randomized Waitlist Controlled Trial*

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**Objective:** The study assessed the impact of mindfulness training on occupational safety of hospital health care workers. **Methods:** The study used a randomized waitlist-controlled trial design to test the effect of an 8-week mindfulness-based stress reduction (MBSR) course on self-reported health care worker safety outcomes, measured at baseline, postintervention, and 6 months later. **Results:** Twenty-three hospital health care workers participated in the study (11 in immediate intervention group; 12 in waitlist control group). The MBSR training decreased workplace cognitive failures ( $F [1, 20] = 7.44, P = 0.013, \eta_p^2 = 0.27$ ) and increased safety compliance behaviors ( $F [1, 20] = 7.79, P = 0.011, \eta_p^2 = 0.28$ ) among hospital health care workers. Effects were stable 6 months following the training. The MBSR intervention did not significantly affect participants' promotion of safety in the workplace ( $F [1, 20] = 0.40, P = 0.54, \eta_p^2 = 0.02$ ). **Conclusions:** Mindfulness training may potentially decrease occupational injuries of health care workers.

Hospital health care workers have a high occupational injury rate. In the United States, hospital health care workers had an annual incidence rate of 6.0 recordable non-fatal injuries per 100 full-time equivalent (FTE) employees in 2015, which represents a rate higher than the all-industry non-fatal occupational injury and illness incidence rate (3.3/100 FTE).<sup>1</sup> Research has suggested that in addition to the physical pain and damage caused by an injury incident, occupational injuries affect mental and social well-being through increased stress, family conflict, and decreased daily functioning.<sup>2</sup> Protecting and promoting occupational safety and health among health care professionals is especially important, as evidence suggests that improving aspects of health care worker well-being and safety not only predicts health care worker injuries and clinician job satisfaction, but also reduces medical errors and increases patient satisfaction.<sup>3–5</sup>

Given the far reaching impact of health care worker safety and health, researchers, practitioners, and government organizations have called for the creation and evaluation of practical interventions that promote both health care worker occupational safety and overall well-being.<sup>6</sup> These scholars and practitioners hope that such interventions will also ultimately improve patient safety and quality of care. The current study responds to this call by testing mindfulness training, generally used as a stress reduction and wellness promotion program among health care providers,<sup>7</sup> as an intervention intended to impact health care worker safety outcomes.

Mindfulness is defined as “a receptive attention to and awareness of present events and experience.”<sup>8</sup> While normal functioning involves awareness and attention, mindfulness, entails heightened, nonjudgmental awareness, and attention.<sup>8</sup> Mindfulness training, which involves increasing a person's ability to attain nonjudgmental awareness in the present moment,<sup>9</sup> has been increasingly incorporated into workplace wellness programs leading to positive outcomes among workers.<sup>10–13</sup> Mindfulness-based stress reduction (MBSR) interventions in particular have had success in reducing negative outcomes among health care workers including anxiety, depression, and perceived stress levels.<sup>7,14–19</sup> The MBSR program, developed at University of Massachusetts Medical School, trains participants to incorporate mindfulness into their daily lives.<sup>20</sup> The well-validated program consists of eight 2.5- to 3.5-hour weekly group sessions and one longer (typically 6 to 8 hours) silent retreat session. The sessions consist of training and practice in mindfulness meditation, informational presentations on topics such as stress physiology, group discussions, and home assignments that promote practicing the skills learned in the program.<sup>21</sup>

A recent review of the role of mindfulness in the workplace found that a growing body of evidence supports a positive association between mindfulness and attention stability, control, and efficiency, which in turn impacts cognition, emotion, behavior, and physiology.<sup>11</sup> These impacts have implications for workplace safety outcomes, including workplace cognitive failure and safety performance. Workplace cognitive failure refers to cognitively-based errors that occur during the performance of a work task that an individual can normally successfully complete.<sup>22</sup> A decline in workplace cognitive failure can lead to a decline in safety performance and an increase in workplace injuries.

Safety performance consists of two factors: safety compliance and safety participation.<sup>23</sup> Safety compliance refers to personal safety behaviors including adherence to established workplace safety procedures and rules. Safety participation refers to safety behaviors that are external to an employee's role, such as offering suggestions on how to improve workplace safety and promoting overall safety within the workplace. A longitudinal study of hospital employees found that as health care workers' self-reported safety performance increased, the number of injuries in the workplace decreased.<sup>24</sup> The reduction in injuries occurred at the group level, presumably because the increase in safety compliance and participation, such as identifying and reporting hazards and following safety procedures, created a less hazardous work environment.

Cross-sectional research has found a relationship between self-reported mindfulness and both workplace cognitive failure<sup>25–27</sup> and safety performance.<sup>28,29</sup> However, the effect of mindfulness training on workplace cognitive failure and workplace safety has not been tested.

### STUDY PURPOSE

The current study used a waitlist controlled trial design to test a MBSR intervention strategy to decrease workplace cognitive failure and improve safety compliance and participation among health care workers. The study aimed to determine: (1) the MBSR

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intervention results in a greater decrease in cognitive failure from baseline to postintervention time points among study participants in the intervention group compared with the waitlist control group; (2) the MBSR intervention results in a greater increase in safety compliance from baseline to postintervention time points among study participants in the intervention group compared with the waitlist control group; (3) the MBSR intervention results in a greater increase in safety participation from baseline to postintervention time points among study participants in the intervention group compared with the waitlist control group; and (4) if the MBSR program leads to a sustained decrease in self-reported workplace cognitive failure and safety compliance and participation among hospital care workers 6 months after completing the intervention.

This study contributes to the novel theoretical understanding of the relationship between mindfulness, workplace cognitive failure, and worker safety performance in the hospital healthcare setting.

## METHODS

### Study Design and Participants

The study used a randomized waitlist controlled trial with a 1:1 ratio. The intervention consisted of an 8-week MBSR course taught by an experienced physician instructor. Following the MBSR guidelines established by the University of Massachusetts Medical School,<sup>21</sup> the course included eight 2.5-hour weekly sessions and one 7-hour session, which involved guided instruction in mindfulness meditation focusing on breathing, gentle stretching and yoga, and group discussions about improving awareness. Participants were asked to complete weekly home assignments including daily formal meditation practice, readings, and journaling their experiences. On average the home assignments were intended to take approximately an hour a day. Participants were asked to report their participation in any mindfulness trainings outside of the study.

Participants were recruited from a hospital healthcare system in Colorado. Study eligibility included health care workers involved in direct patient care at the participating two hospitals who did not have post-traumatic stress disorder or untreated clinical depression. Individuals receiving treatment for clinical depression were eligible to participate. Using a computer-generated list of random numbers, participants were randomly assigned to participate in the first 8-week MBSR course (immediate intervention group) or the waitlist control group. The waitlist control group started the 8-week MBSR course after the first group completed the course. The study was reviewed and approved by the university and hospital Institutional Review Boards.

### Data Collection

Participants randomized to the immediate MBSR group were asked to complete a study questionnaire before they began the MBSR course (baseline; July 2014), once they completed the course (immediate postintervention; September 2014), and 6 months after they completed the MBSR course (March 2015). Participants randomized to the waitlist control group also completed questionnaires at the baseline and post-immediate intervention time points as well as after they completed the MBSR course (waitlist postintervention; November 2014) and 6 months after they completed the course (May 2015). Participants completed questionnaires through a secure online survey site.

### Measures

Demographic variables including sex, race and ethnicity, and job characteristics such as provider type, years worked in healthcare, typical hours worked, and shift worker status were assessed at baseline. Mindfulness, cognitive failure, safety performance, and covariates including subjective work stress, self-reported global

physical, and psychological health were assessed at all time points. We calculated coefficient alphas using baseline data and imputed mean composites for seven instances of missing data. In each of these instances, respondents had completed at least 75% of the items for the scale. There were no scale-level missing data.

### Outcome Measures

As a manipulation check, we measured mindfulness using the 15-item Mindfulness Attention Awareness Scale (MAAS),<sup>30</sup> which measures trait mindfulness among a general adult population on a 6-point Likert frequency scale ranging from “Almost Never” to “Almost Always.” Among the current study’s sample, the MAAS demonstrated adequate internal consistency ( $\alpha = 0.88$ ).

We used 13 items from Wallace and Chen’s measure of workplace cognitive failure<sup>22</sup> on a 5-point Likert frequency scale ranging from “Never” to “Very Often.” One item from the cognitive failures questionnaire<sup>31</sup> was used in place of a workplace cognitive failure item that is geared toward industry and was not appropriate in the healthcare setting. The adapted workplace cognitive scale demonstrated adequate internal consistency among this study’s sample ( $\alpha = 0.86$ ).

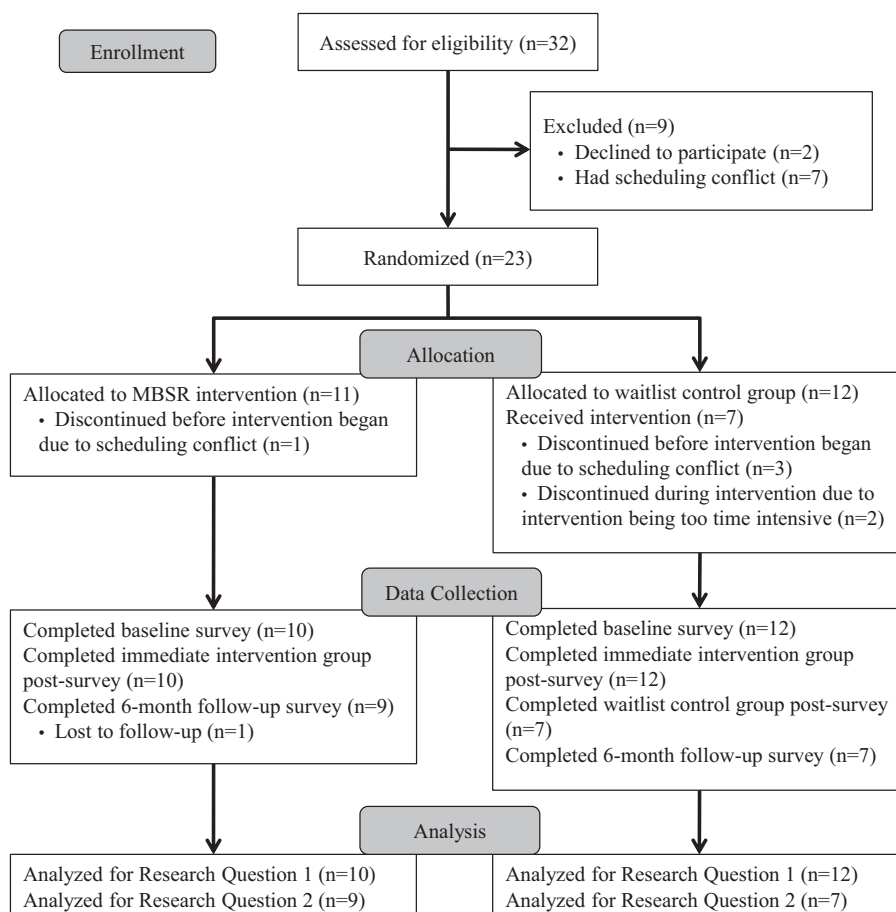
Finally, we used Neal, Griffin, and Hart’s measure of workplace safety performance<sup>23</sup> that assesses safety compliance with a 4-item subscale and safety participation with a 4-item subscale on a 5-point Likert agreement scale ranging from “Strongly Disagree” to “Strongly Agree.” In the current study’s sample, the safety compliance subscale demonstrated high internal consistency ( $\alpha = 0.90$ ), and the safety participation subscale demonstrated adequate internal consistency ( $\alpha = 0.77$ ).

### Statistical Analysis

Data analysis occurred in four steps. First, demographic characteristics of participants and their responses were summarized using means and standard deviations or medians and ranges for continuous variables and proportions for categorical variables. Mean scores were calculated for each participant on the study variables at both time points. Second, we tested for differences in participant characteristics by treatment group at baseline using Pearson’s chi squared test for categorical variables and independent samples *t* test for continuous variables. To perform the manipulation check and test the study hypotheses, we used four univariate repeated measures analyses of variance (RM ANOVA) time by group interaction effects to compare the baseline and immediate postintervention scores between groups for mindfulness, workplace cognitive failure, and the two facets of safety performance. Effect sizes were estimated using partial eta squared ( $\eta_p^2$ ) and interpreted following Cohen guidelines<sup>32</sup> for small effect sizes ( $\eta_p^2 = 0.01$ ), moderate effect sizes ( $\eta_p^2 = 0.06$ ), and large effect sizes ( $\eta_p^2 = 0.14$ ). Finally, we conducted paired-samples *t* tests to answer the question about the stability of the intervention effects from both groups’ postintervention time point to the 6-month follow-up data collection on the significant outcomes for all participants. We used SPSS version 22 (IBM, Armonk, NY) to analyze the data.

## RESULTS

A small sample of 23 hospital health care workers from a university hospital system in Colorado volunteered to participate and were randomized to the MBSR intervention ( $n = 11$ ) or waitlist control group ( $n = 12$ ). One participant in the intervention group withdrew from the study before the first session due to changes in her job and was not included in analyses. The remaining 22 participants completed the baseline and first postintervention surveys and were included in the analyses comparing the change in outcomes from baseline to post-immediate intervention across groups. Three participants within the waitlist control group dropped out of the study during the wait period and another two quit during



**FIGURE 1.** Consolidated standards of reporting trials (CONSORT) participant flow diagram.

the MBSR course. Additionally, one participant from the immediate intervention group did not complete the 6-month follow-up survey; 16 participants were included in the analysis testing the stability of the intervention's effects from postintervention to the 6-month follow-up on both groups. Participant attrition is depicted in Fig. 1.

Most (91%) of the initial 22 participants were female. The participants included nurses (86%), a nurse practitioner (5%), and two paramedics (9%). The distribution of participant sex, ethnicity, previous experience with practicing meditation or yoga, clinician type, clinician years of experience, shift worked, hours per week worked, self-rated physical health, self-rated psychological health, or subjective work stress at baseline did not significantly differ by treatment group, as determined by Pearson's chi-squared test for categorical variables and independent samples *t* test for continuous variables (see Table 1 for the description of participants by treatment group). Therefore, the demographic variables and other covariates were not included in subsequent analyses. None of the participants reported participating in mindfulness trainings outside of the study.

Independent samples *t* tests indicated that baseline mean mindfulness ( $t[20] = -0.66$ ,  $P = 0.52$ ), mean workplace cognitive failure ( $t[20] = -0.34$ ,  $P = 0.73$ ), mean safety compliance ( $t[20] = 0.76$ ,  $P = 0.46$ ), and mean safety participation ( $t[20] = -0.63$ ,  $P = 0.54$ ) scores did not differ by treatment group. Table 2 depicts baseline and immediate postintervention mean scores and 95% confidence intervals for the means for mindfulness, workplace cognitive failure, and safety performance by treatment group.

RM ANOVA tests revealed a significant time by treatment group interaction effect for mindfulness ( $F[1, 20] = 7.24$ ,  $P = 0.014$ ,  $\eta_p^2 = 0.27$ ) with a significantly greater increase in mindfulness scores

from baseline to immediate postintervention time points among the immediate intervention group than among the waitlist control group. This analysis, done as a manipulation check, indicates that the MBSR intervention resulted in changes in mindfulness scores in the expected direction. There was a significant time by treatment group interaction effect for workplace cognitive failure ( $F[1, 20] = 7.44$ ,  $P = 0.013$ ,  $\eta_p^2 = 0.27$ ) with the immediate intervention group experiencing a greater decrease in workplace cognitive failure from baseline to immediate postintervention time points than the waitlist control group. There was a significant time by treatment group interaction effect for safety compliance ( $F[1, 20] = 7.79$ ,  $P = 0.011$ ,  $\eta_p^2 = 0.28$ ) with the immediate intervention group having a greater increase in safety compliance from baseline to immediate postintervention time points than the waitlist control group. The interaction effect between treatment group and time for safety participation was not significant ( $F[1, 20] = 0.40$ ,  $P = 0.54$ ,  $\eta_p^2 = 0.02$ ). This indicates that the MBSR intervention did not significantly impact safety participation or promotion of safety in the workplace.

Paired-samples *t* test results revealed no significant differences between each groups' postintervention mean scores (September 2014 for the immediate intervention group and November 2014 for the waitlist control group) and 6-month follow-up mean scores (March 2015 for the immediate intervention group and May 2015 for the waitlist control group) for workplace cognitive failure (postintervention mean = 2.04; 6-month follow-up mean = 2.05;  $t[15] = -0.16$ ,  $P = 0.88$ ) or safety compliance (postintervention mean = 4.50; 6-month follow-up mean = 4.42;  $t[15] = 0.70$ ,  $P = 0.50$ ) among the 16 participants who completed the questionnaires at those time points. The 16 participants who were included in the analysis testing the

**TABLE 1.** Participant Characteristics at Baseline by Treatment Group

Variable	Waitlist Control Group (n = 12)	Immediate MBSR Intervention Group (n = 10)	Statistical Comparison of Groups
	n (%)	n (%)	
Female	12 (100%)	8 (80%)	( $\chi^2[1] = 2.64, P = 0.10$ )
Ethnicity			( $\chi^2[1] = 1.26, P = 0.26$ )
Hispanic	0 (0%)	1 (10%)	
Non-Hispanic White	12 (100%)	9 (90%)	
Previous experience practicing meditation	3 (25%)	4 (40%)	( $\chi^2[1] = 0.57, P = 0.45$ )
Previous experience practicing yoga	5 (41.7%)	5 (50%)	( $\chi^2[1] = 0.15, P = 0.70$ )
Clinician type			( $\chi^2[3] = 4.17, P = 0.24$ )
Registered nurse	12 (100%)	7 (70%)	
Nurse practitioner	0 (0%)	1 (10%)	
Paramedic	0 (0%)	2 (20%)	
Years as clinician			( $\chi^2[4] = 8.39, P = 0.08$ )
Less than 5	2 (16.7%)	1 (10%)	
6–10	0 (0%)	3 (30%)	
11–20	5 (41.7%)	3 (30%)	
21–30	5 (41.7%)	1 (10%)	
More than 30	0 (0%)	2 (20%)	
Work night shift	1 (8.3%)	1 (10%)	( $\chi^2[2] = 2.02, P = 0.37$ )
Hours worked per week			( $\chi^2[4] = 5.62, P = 0.23$ )
12–23	1 (8.3%)	0 (0%)	
24–35	5 (41.7%)	1 (10%)	
36–44	5 (41.7%)	6 (60%)	
45–54	0 (0%)	2 (20%)	
55 or more	1 (8.3%)	1 (10%)	
Self-rated physical health			( $\chi^2[3] = 3.65, P = 0.30$ )
Excellent	1 (9.1%)	3 (30.0%)	
Very good	4 (33.3%)	1 (10%)	
Good	6 (50%)	6 (60%)	
Fair	1 (8.3%)	0 (0%)	
Poor	0 (0%)	0 (0%)	
Mean self-rated psychological health (SD)	2.93 (1.03)	3.23 (0.91)	( $t[20] = -0.70, P = 0.49$ )
Mean subjective work stress (SD)	3.56 (0.87)	4.04 (0.58)	( $t[20] = -1.49, P = 0.15$ )

Psychological health was measured using Kristensen et al<sup>33</sup> 5-item scale on a 6-point scale with higher score representing decreased psychological health. Subjective work stress was measured using Motowidlo et al<sup>34</sup> 4-item on a 5-point scale with higher score representing higher levels of work stress.

MBSR, mindfulness-based stress reduction, SD, standard deviation.

stability of effects did not significantly differ from the six that dropped out of the study on baseline self-reported mindfulness (completed study mean [SD] = 3.11 [0.75]; dropped out mean [SD] = 3.00 [0.65];  $t[20] = 0.35, P = 0.73$ ), workplace cognitive failure (completed study mean [SD] = 2.75 [0.53]; dropped out mean [SD] = 2.94 [0.38];  $t[20] = -0.79, P = 0.44$ ), safety participation (completed study mean

[SD] = 3.67 [0.51]; dropped out mean [SD] = 3.54 [0.93];  $t[20] = 0.43, P = 0.67$ ), or safety compliance (completed study mean [SD] = 4.02 [0.63]; dropped out mean [SD] = 3.88 [0.41];  $t[20] = 0.51, P = 0.62$ ). These results support the stability of effects of the MBSR intervention on workplace cognitive failure and safety compliance 6 months following the program.

**TABLE 2.** Means and 95% Confidence Intervals of Baseline (July 2014) and Immediate Postintervention (September 2014) Mindfulness, Workplace Cognitive Failure, and Safety Performance by Treatment Group

	Waitlist Control Group (n = 12)		Immediate MBSR Intervention Group (n = 10)	
	Baseline M [95% CI]	Immediate Postintervention M [95% CI]	Baseline M [95% CI]	Immediate Postintervention M [95% CI]
Mindfulness	3.17 [2.85, 3.49]	3.36 [2.96, 3.76]	2.97 [2.30, 3.63]	4.14 [3.75, 4.53]
Workplace cognitive failure	2.77 [2.50, 3.03]	2.49 [2.20, 2.78]	2.84 [2.41, 3.27]	1.93 [1.69, 2.17]
Safety compliance	4.06 [3.78, 4.34]	4.10 [3.93, 4.28]	3.88 [3.37, 4.38]	4.60 [4.31, 4.89]
Safety participation	3.67 [3.25, 4.09]	4.10 [3.81, 4.40]	3.60 [3.16, 4.04]	4.23 [3.93, 4.52]

Mindfulness was measured on a 6-point scale with higher scores representing more mindful. Workplace cognitive failure was measured on a 5-point scale<sup>22</sup> with higher score representing more errors. Safety performance (including safety compliance and participation) was measured on a 5-point scale<sup>23</sup> with higher score representing increased safety compliance or participation.

CI, confidence interval; M, mean; MBSR, mindfulness-based stress reduction.



## DISCUSSION

This study used a randomized waitlist controlled trial to examine the effect of a mindfulness-based stress reduction course on workplace cognitive failure and safety compliance and participation among hospital health care workers. The findings suggest that mindfulness training can significantly decrease workplace cognitive failures and increase the safety compliance aspect of safety performance among hospital health care workers. Estimated effect sizes for each of the significant relationships were large ( $\eta_p^2$  values ranging from 0.27 to 0.28). These effects were stable 6 months after participants completed the MBSR intervention.

The significant impact of the MBSR intervention on workplace cognitive failure in the present study aligns with previous cross-sectional research that has demonstrated a negative relationship between mindfulness and cognitive failure both in general<sup>25,26</sup> and within the workplace.<sup>27</sup> The current study's findings only partially support the findings of previous research examining the relationship between mindfulness and workplace safety performance. While the present study found that the MBSR course led to a significant increase in safety compliance, the MBSR course did not significantly impact the safety participation aspect of safety performance. The latter finding conflicts with the cross-sectional research conducted by Zhang et al,<sup>28</sup> which found a positive correlation between self-reported mindfulness and both the safety compliance and safety participation aspects of safety performance among workers completing high-complexity tasks and those with more experience and higher levels of intelligence.<sup>29</sup> While all of the present study's participants were complex task-holders in their roles as clinicians, the study was not designed to test potential moderators such as intelligence or level of experience. It is possible that these untested moderators may have contributed to the inconsistency between the current study's findings and those of Zhang et al. Cultural or industry differences might also account for the discrepancies between the current study's findings on US health care workers and those of Zhang et al, who focused on Chinese power plant workers. Although no known studies examine the impact of culture or industry on the effectiveness of mindfulness training, it is possible that Chinese workers, who may have more familiarity with the centuries-old Buddhist-based mindfulness concepts taught in MBSR that originated in Asia,<sup>20</sup> incorporate aspects of the MBSR training into their lives differently than their American counterparts. Similarly, previous research suggests that safety behaviors and their antecedents are influenced by industry and national culture.<sup>35,36</sup>

Another possible explanation for the failure of the MBSR intervention to increase safety participation may stem from distinct psychological processes in the two components of safety performance. Safety compliance involves following rules and regulations, and therefore naturally follows a decrease in lapses in attention or perception, memory or retrieval of information, and action or motor function discussed in previous literature on cognitive failure and more specifically workplace cognitive failure.<sup>22,31,37</sup> In a conceptual review of mindfulness at work, Good et al<sup>11</sup> explain how mindfulness likely impacts the broader concept of workplace task performance, under which safety performance falls. They argue that mindfulness increases the stability and control individuals have over their attention. This allows individuals to focus on task-relevant information more efficiently and have fewer attention lapses, which in turn can reduce errors. Good et al describe how mindfulness may also increase individuals' cognitive resources to buffer against distractions and interruptions that can lead to errors in demanding environments, such as in hospital settings. The impact of mindfulness on workplace cognitive failure and the safety compliance aspect of safety performance seen in the current study logically follows this conceptualization of the role mindfulness plays in task performance.

Safety participation, on the other hand, requires active advocacy of safety in the workplace and doesn't flow from such errors or mental lapses as safety compliance does. The safety participation aspect of safety performance may be better enhanced by interventions that target organizational safety culture or by mindfulness interventions that engage whole work groups to improve teamwork and communication. In the current study, the lack of the mindfulness training impact on safety participation could be due to its inclusion of health care providers from a variety of work groups rather than whole work groups and due to the small sample size. Research findings indicate that mindfulness training that targets health care provider teams can increase teamwork and collaboration.<sup>38</sup> Such collaboration could possibly lead to greater safety participation among team members, as evidence suggests that work-group processes are powerful contextual factors that influence safety behaviors and contribute to occupational injuries.<sup>39</sup> This is especially important within the healthcare setting, where effective teamwork also impacts patient safety and quality of care.<sup>40,41</sup>

## STRENGTHS AND LIMITATIONS

This study has several important limitations. It included a small sample of hospital health care workers from a single health care system, and its conclusions should be viewed within this limited context. The small sample size may have limited the ability to detect significant differences in covariates between the two groups. Random assignment of participants to the two groups should have led to covariate balance between groups, and most of the potential covariates tested appeared similar across the two groups. However, clinician experience seemed to differ slightly between the groups, although there were not statistically significant differences between the two groups. Larger studies are needed to explore the role of covariates in the effect of mindfulness training and health care worker safety outcomes. Similarly, the findings related to the stability of the effects of the intervention should be taken with caution due to the attrition that occurred within the waitlist control group. The attrition occurred within the waitlist control group both during the wait period due to changes in the participants' schedules and during the MBSR course due to the time intensiveness of the course. The participants in the present study volunteered their time outside of their workday to complete the MBSR training, because the hospital organization could not feasibly incorporate the training into the clinicians' work schedule. It is important for future research to assess the feasibility of abbreviated or modified mindfulness training programs that conform to the needs and schedules of health care workers as well as health care organizations.

Another limitation of the present study relates to the measurement of its outcome variables. Due to its scope, the study relied on self-reported measures of workplace cognitive failure and safety compliance and participation as proximal outcomes for occupational injuries among hospital health care workers, which is the ultimate outcome of interest. Studies provide validity evidence for these measures and their link to objective measures of workplace injuries.<sup>22,24</sup> Nevertheless, future studies can improve upon the current study by using objective measures of safety outcomes, such as hospital records of workplace injuries that result in time away from work, in addition to subjective outcomes.

The study is the first to describe the effect of MBSR training on workplace cognitive failure and safety performance among health care workers. With its randomized waitlist controlled trial design, the present study provides causal evidence that contributes to the novel understanding of the role mindfulness training plays in worker safety.

## Future Research

Future research should examine possible moderating variables, such as clinician experience, that might impact the

effectiveness of the mindfulness training on health care worker safety so that practitioners can understand the contextual and participant characteristics that enhance or limit the effect of MBSR training among health care workers. Additional intervention research can build on the findings of this study to test the longer-term relationships between mindfulness, workplace cognitive failure, safety compliance, and ultimately occupational injuries. Given the link between health care worker safety and well-being and patient safety and care,<sup>5</sup> future research could extend on the present study's findings by investigating the longer-term effects of the mindfulness training among health care workers and their patients' safety and quality of care, adding to the growing field of research on mindfulness training's impact on health care safety.

## CONCLUSION

This study found that mindfulness training improves workplace outcomes among hospital health care workers including workplace cognitive failure and safety compliance, or following safety rules and regulations at work. The findings contribute to the growing body of literature on the impact of mindfulness training on health care workers, indicating that the training can affect previously examined worker well-being outcomes<sup>7,18</sup> as well as safety outcomes, which in turn may impact occupational injuries. These findings are important given the public health significance of occupational injuries among health care workers, which have far reaching consequences for the health and well-being of health care workers and their patients.

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