DISSERTATION

FEASIBILITY OF A MINDFULNESS-BASED STRESS REDUCTION INTERVENTION ON

HEALTH CARE SAFETY

Submitted by

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ABSTRACT

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Occupational injuries represent a significant and costly social and public health problem, especially among health care workers, whose well-being impacts patient safety and quality of care. Mindfulness training, which teaches individuals to bring awareness and acceptance to the present moment, could decrease occupational injury rates while improving worker well-being. Mindfulness training has been proven effective in improving the health and well-being of clinical and healthy populations, but it has not yet been tested as an intervention to improve worker safety. Using a randomized waitlist controlled trial design with a mixed methods approach, the current study sought to: 1) conceptualize hospital health care workers' experiences in adopting mindfulness practices within the context of an established health behavior theory; and 2) assess the impact of mindfulness training on safety outcomes among hospital health care workers.

Hospital health care workers involved in direct patient care at two hospitals in Colorado were recruited to participate in the study. Participants were randomly assigned to a group that participated in an 8-week Mindfulness-Based Stress Reduction (MBSR) course first or to a waitlist control group, which completed the MBSR training after the first group completed the course. The MBSR intervention included eight 2.5-hour group sessions of meditation, yoga, and group discussion and one 7-hour silent session to train participants to incorporate the skills in their daily lives. All participants completed questionnaires measuring covariates and safety outcomes at baseline, post-intervention, and six months after they completed the training.

Participants also answered open-ended questions about their experiences when adopting mindfulness practices taught in the course. In the qualitative portion of the study, a theory-driven thematic analysis approach was used to analyze the qualitative data with the key constructs of the Health Belief Model acting as the framework for the analysis. In the quantitative portion of the study, mean scores were calculated for each participant on the study variables at each time point. Univariate repeated measures analyses of variance (RM ANOVA) time X group interaction effects with alpha level .05 were used to compare the baseline and post-intervention scores on the outcome variables between groups. Paired-samples t-tests were used to examine the stability of the intervention effects from both groups' post-intervention time point to the 6-month follow-up data collection on the significant outcomes for all participants.

Hospital health care workers from a university hospital system in Colorado volunteered to participate and were randomized to the immediate MBSR intervention (n=11) or waitlist control group (n=12). The majority of participants were female and nurses. Qualitative results highlighted the benefits of mindfulness practice among health care workers, which included enhanced awareness and improvements in social relationships and interactions with patients and colleagues. Participants described the lack of healthcare-specific recommendations for incorporating mindfulness practices at work and minimal discussion of evidence supporting mindfulness training as barriers to adopting and adhering to mindfulness practices. Viewed within the context of the Health Belief Model, these qualitative findings may help practitioners design and tailor workplace mindfulness programs to fit the needs of health care workers. Quantitative results of the study indicated that mindfulness training can decrease workplace cognitive failures and increase safety compliance behaviors among hospital health care workers. The qualitative and quantitative results contribute to the novel understanding of the role

mindfulness practice plays in health care worker occupational safety and health and can support

future larger-scale studies testing the longer-term impacts of mindfulness on health care safety.

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CHAPTER 1: INTRODUCTION

Occupational injuries represent a significant, costly social and public health problem, especially among health care workers, who have a high non-fatal occupational injury rate (6.2 non-fatal injuries per 100 full-time equivalent employees in 2014; Bureau of Labor Statistics, 2015). The National Institute for Occupational Safety and Health (NIOSH) identifies the health care sector as a high-risk industry (NIOSH, 2009). 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, including safety climate and safety performance, not only predicts health care worker injuries and clinician job satisfaction, but also reduces medical errors and increases patient satisfaction (NIOSH, 2009; Singer, Lin, Falwell, Gaba, & Baker, 2009; Yassi & Hancock, 2005).

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 (NIOSH, 2013). These scholars and practitioners hope that such interventions will also ultimately improve patient safety and quality of care. The current study attempts to answer this call by evaluating the feasibility of mindfulness training as an intervention intended to reduce cognitive failures and improve safety performance among health care workers. Mindfulness training, previously used as a stress reduction and wellness promotion program among health care providers (Irving, Dobkin, & Park, 2009), has not yet been tested as an intervention for health care worker safety. The current project tests the novel application of a mindfulness intervention on health care worker and patient safety. This project expands on previous research

through its examination of cognitive failure and safety performance as potential constructs in the causal path between mindfulness training and health care safety.

In this introduction, I will describe occupational health and safety issues among health care workers and the role that health care worker well-being plays in patient care and safety. Given the importance of health care worker injury as an initial key point of impact in the overall integral relationship between health care worker safety and well-being as well as the link between provider well-being and patient safety, I will focus on health care worker injury. Next, I will examine the role that two individual-level factors, workplace cognitive failures and safety performance, play in workplace injury. I will then review the literature on mindfulness training, which has the potential to impact both cognitive failure and safety performance. The need for an assessment of the feasibility and impact of mindfulness training as an intervention to promote safety and well-being in the healthcare sector will be established. Next, I will illustrate the current project's implications for practitioners who aim to use mindfulness training as an intervention to improve health care worker well-being and the significance for researchers who hope to understand the relationship between mindfulness training and antecedents of worker injury and well-being. Finally, I will state the research questions and hypotheses and outline the present study's mixed-methods approach and use of two journal articles to disseminate the findings of the project.

The findings of the project contribute to knowledge about the role of mindfulness in improving worker safety and identify factors that lead to the successful adoption of practical and sustainable mindfulness practices as part of employee safety and wellness initiatives to reduce health care worker injuries and improve the well-being of clinicians and their patients. Without an assessment of the feasibility of mindfulness training in health care and its impact on

psychosocial factors that contribute to workplace injury and medical errors, the understanding of the role that mindfulness plays on health care worker safety and patient safety remains limited. This study aims to begin to fill this gap in the occupational health and safety literature by addressing this question among hospital health care workers while determining the feasibility of using an established mindfulness training program in healthcare settings.

Health Care Worker Injury and Well-being

Hospital health care workers have a high occupational injury rate. In the United States, hospital health care workers had an annual incidence rate of 6.2 recordable non-fatal injuries per 100 full-time equivalent (FTE) employees in 2014, which represents a higher rate than other high-risk industries such as construction (incidence rate 3.6/100 FTE) or manufacturing (4.0/100 FTE; Bureau of Labor Statistics, 2015a). Musculoskeletal disorders including sprains, strains and tears, from overexertion due to lifting patients or equipment, and slips, trips, and falls make up the majority of injuries within the healthcare setting (Bureau of Labor Statistics, 2015b). The rate of musculoskeletal disorders is higher among health care workers than the rate for all private industries and is second only to the warehousing and transportation industries (Bureau of Labor Statistics, 2015b). In addition to musculoskeletal disorders, health care workers face occupational injury risks from exposures to needle sticks and other sharp instruments and workplace violence (NIOSH, 2009).

Research has shown 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 (Dembe, 2001). Occupational injuries can also decrease workers' job satisfaction and increase their intentions to leave their organizations (McCaughey, DelliFraine, McGhan, & Bruning, 2013). Workplace injuries among health care

workers carry significant financial costs for workers, employers, and society due to medical expenses, lost wages and productivity, and high-priced insurance including workers' compensation (Waehrer, Leigh, & Miller, 2005). Research indicates that the significant and costly burdens of occupational injuries are often underestimated due to underreporting (Schulte, 2005). One study examined underreporting of health care worker occupational injuries and found that only two-thirds of serious occupational injuries were reported (Galizzi, Miesmaa, Punnett, & Slatin, 2010). Health care workers cited time pressure, concerns about reputation, income loss, and career prospects as reasons for not reporting workplace injuries.

The impact and significance of occupational safety and health among health care workers extends far beyond their well-being and safety. Protecting and promoting the safety and well-being of health care workers also leads to improved patient care and safety (Charney & Schirmer, 2007; Yassi & Hancock, 2005). Much focus and many resources have been devoted to the improvement of patient safety since the promotion and adoption of evidence-based patient safety practices recommended in the Agency for Healthcare Research and Quality's Making Health Care Safer: A Critical Analysis of Patient Safety Practices report (Shojania, Duncan, McDonald, & Wachter, 2001). Despite this, recent reports show that medical errors and serious adverse events still occur too often, and recent improvements in patient safety do not match the investments that have been made (Classen et al., 2011; Landrigan et al., 2010; Levinson, 2010). Precise estimates of the prevalence of medical errors have been debated since a galvanizing report from the Institute of Medicine declared that between 44,000 and 98,000 patient deaths occurred each year in the United States from preventable adverse events (Kohn, Corrigan, & Donaldson, 2000). Despite controversy, the evidence of the significant human and monetary

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costs of these events is clear (Carter, Motao, Jun, & Porell, 2014; Kohn, Corrigan, & Donaldson, 2000; Shekelle et al., 2012; Van Den Bos et al., 2011; Zhan & Miller, 2003).

While numerous underlying factors influence quality of care and patient safety, one promising area that remains insufficiently researched is the link between health care worker safety and well-being and patient safety and care. Landrigan and colleagues conducted a landmark study in 2004 that showed that serious medical errors dropped significantly after an intervention reducing the number of hours interns work per week was conducted. In 2005, Yassi and Hancock provided additional qualitative evidence to establish a conceptual link between the safety and well-being of health care workers and the safety and care of their patients (Yassi & Hancock, 2005). When testing this relationship, the authors emphasized the importance of implementing and evaluating interventions that promote aspects of health care worker psychological health and safety beyond reduced shift length. Since then several studies have further established associations between components of health care worker psychological well-being such as stress, burnout, self-perceived medical errors, and suboptimal patient care and adverse events (Cimiotti, Aiken, Sloane, & Wu, 2012; Prins et al., 2009; Wallace, Lemaire, & Ghali, 2009; West, Tan, Habermann, Sloan, & Shanafelt, 2009; Williams, Manwell, Konrad, & Linzer, 2007). Similarly, research has provided additional evidence that aspects of health care worker occupational safety including safety climate and safety performance not only predict health care worker injuries and clinician job satisfaction but also impact medical errors and patient satisfaction (Hofmann & Mark, 2006; Singer et al., 2009).

Despite the call for rigorous intervention research to test the positive impact of promoting health care worker safety and well-being on quality of patient care (NIOSH, 2013), more work is

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needed to assess this link and to evaluate the feasibility and effectiveness of health care worker wellness and safety promotion interventions on patient safety.

The Role of Workplace Cognitive Failure and Safety Performance

Numerous organizational and individual factors contribute to workplace injuries among health care workers (McCaughey et al., 2016). Research has identified safety performance as a significant psychosocial factor and proximal antecedent of workplace injuries (Christian, Bradley, Wallace, & Burke, 2009; Clarke, 2006; Neal & Griffin, 2006; Wallace & Vodanovich, 2003). Safety performance, based on the model of job performance by Campbell and colleagues (1993), consists of two factors: safety compliance and safety participation (Neal, Griffin & Hart, 2000). Safety compliance refers to personal safety behaviors including adherence to established 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. In a longitudinal study of hospital employees, Neal and Griffin (2006) found that as health care workers' self-reported safety performance increased, the number of injuries in the workplace decreased. 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.

Researchers have found that factors including the physical work environment, safety climate, occupational stressors, work attitudes, safety knowledge, and safety motivation impact safety behaviors (Clarke, 2010; Clarke, 2012; Nahrgang, Morgeson, & Hofmann, 2011; Neal, Griffin, & Hart, 2000; Oliver, Cheyne, Tomas, & Cox, 2002). There is a logical expectation of a link between safety behaviors and safety performance, through the relationships between

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behaviors related to compliance and participation. Neal, Griffin, and Hart (2000) theorized that organizational factors, such as organizational climate and safety climate, influence safety participation and compliance through individual-level factors including safety knowledge and motivation. While studies using meta-analytic strategies and structural equation modeling have examined and lent some support to these proposed causal pathways (Clarke, 2010; Clarke, 2012; Nahrgang, Morgeson, & Hofmann, 2011; Neal, Griffin, & Hart, 2000; Oliver, Cheyne, Tomas, & Cox, 2002), much of the variance in safety compliance and participation remains unexplained. This warrants an examination of additional individual-level factors that determine safety performance.

One important individual-level factor that impacts safety performance is cognitive failure (Wallace & Vodanovich, 2003; Wallace & Chen, 2005), or cognitively-based errors that occur during the performance of a task that an individual can normally successfully complete (Martin, 1983). At least three types of cognitive failure can occur, involving lapses in attention or perception, memory or retrieval of information, or action or motor function (Broadbent, Cooper, Fitzgerald, & Parks, 1982; Norman, 1981). In 2005, Wallace and Chen examined cognitive failure in the workplace and found that as workplace cognitive failures increased, worker safety performance decreased. They framed their findings in the context of self-regulation, or self-control, and argued that workplace cognitive failure is a component of self-regulation at work. Self-regulation at work consists of task-relevant effort, which facilitates goal achievement, and off-task or task-irrelevant effort that can interfere with goal achievement (Kanfer & Ackerman, 1996; Kanfer & Heggested, 1997). Wallace and Chen (2005) built off of the self-regulation at work framework Kanfer and colleagues presented and argued that workplace cognitive failure is

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a type of task-irrelevant effort that can lead to a decline in safety behavior and an increase in workplace near-misses and injuries.

Research has also linked cognitive failure with patient safety and quality of care. In 2007, Groopman argued that medical errors resulted from cognitive processing errors rather than lack of knowledge. In 2013, Park and Kim examined cognitive failure among hospital nurses and found that as workplace cognitive failures increased, patient safety incidents also increased. Groopman theorized that these cognitive failures could be decreased by mindfulness practices that increase present-moment awareness.

Mindfulness as a Safety and Wellness Intervention Strategy

Mindfulness is defined as "receptive attention to and awareness of present events and experience" (Brown, Ryan, & Creswell, 2007, p. 212). While normal functioning involves awareness and attention, mindfulness, as either a state or trait, entails heightened, nonjudgmental awareness and attention (Brown & Ryan, 2003). State or momentary mindfulness is associated with improved mood and well-being (Lau et al., 2006), and the more stable trait or dispositional mindfulness is associated with a number of positive mental and physical health outcomes (Brown, Ryan, & Creswell, 2007).

As with cognitive failure, mindfulness has been linked to self-regulation processes (Brown & Ryan, 2003; Creswell, Way, Eisenberger, & Lieberman, 2007; Shapiro et al., 2006). Neuroimaging studies have shown that mindfulness relates to amygdala activation and changes in brain structures that suggest more mindful individuals have greater self-awareness and self-regulation ability (Creswell et al., 2007; Fox et al., 2014). Shapiro and colleagues (2006) proposed that mindfulness improves self-regulated functions as individuals attend to information in the present moment and create space between stimuli and reactions to them. In an extensive

review of research on mindfulness and mindfulness-based interventions, Brown, Ryan, and Creswell (2007) found that mindfulness is associated with behavioral control as well as an increased ability to focus attention. This suggests that mindfulness training may decrease workplace cognitive failure, which is supported by cross-sectional studies finding that self-reported cognitive failures are negatively correlated with self-reported mindfulness (Froeliger, Garland, & McClernon, 2012; Herndon, 2008; Klockner & Hicks, 2015).

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 (Good et al., 2015). These impacts have implications for workplace outcomes, including colleague relationship quality, worker well-being, and performance. Consistent with Campbell et al.'s (1993) conceptualization of safety performance within the theories of job performance, Good et al. (2015) include emerging evidence of safety performance in the category of workplace performance outcomes. This evidence is based on Zhang and colleagues' (2013 and 2014) examination of the relationship between self-reported levels of mindfulness and safety performance from a series of cross-sectional studies of Chinese power plant operators. They found that high self-reported levels of mindfulness were associated with high levels of self-reported safety compliance and safety participation among workers who completed complex tasks (Zhang, Ding, Li, & Wu, 2013) and among employees with high intelligence (based on test scores obtained during their training) and advanced experience (Zhang & Wu, 2014).

Mindfulness training, which involves increasing a person's ability to attain nonjudgmental awareness in the present moment (Kabat-Zinn, 1990), can improve individuals' temporary state mindfulness as well as long-term and stable trait mindfulness (Carmody, Reed,

Kristeller, & Merriam, 2008; Chambers & Allen, 2008). Mindfulness training has been incorporated into physical and mental health treatment programs with success (Baer, 2003). Baer's meta-analysis found that mindfulness training programs such as Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy led to decreased pain among patients with chronic pain and fewer depressive relapse episodes among individuals with major depressive disorder. Similarly, many workplace wellness programs have started to include mindfulness training. These programs are associated with positive outcomes among workers (Glomb, Duffy, Bono, & Yang, 2011; Good et al., 2015; Virgili, 2015; Wolever et al., 2012) and have significantly reduced anxiety, depression, and perceived stress among health care workers (Fortney, Luchterhand, Zakletskaia, Zgierska, & Rakel, 2013; Irving, Dobkin, & Park, 2009).

Mindfulness-based stress reduction interventions in particular have been shown to improve brain and immune function (Davidson et al., 2003), reduce stress, and promote positive outcomes among both clinical patients and healthy volunteers (Chiesa & Serretti, 2009; Grossman, Niemann, Schmidt, & Walach, 2004). The MBSR program, developed at the University of Massachusetts School of Medicine, trains participants to incorporate mindfulness into their daily lives (Kabat-Zinn, 2003). The well-validated program consists of eight 2.5- to 3.5-hour weekly group sessions and one longer (typically six to eight hours) silent retreat session. Core components of the course include: informal (e.g. awareness of pleasant and unpleasant sensations) and formal (e.g. hatha yoga, body scans, sitting and walking meditations) mindfulness meditation focusing on bodily sensations; didactic presentations covering the evidence supporting the program as well as instruction on topics such as the physiology of stress; group discussions about the skills learned in the class and their impact on participants' attitudes

and awareness of experiences; and assignments that encourage practicing and applying the course skills outside of class (Santorelli, 2014).

Although the effect of MBSR training on workplace cognitive failure or safety performance has not been tested in a healthcare setting, MBSR programs have had success in reducing other negative outcomes among health care workers including anxiety, depression, and perceived stress levels (Cohen-Katz, Wiley, Capuano, Baker, & Shapiro, 2004; Fortney et al., 2013; Geary & Rosenthal, 2011; Goodman & Schorling, 2012; Irving, Dobkin, & Park, 2009; Lamothe et al., 2016; Shapiro, Astin, Bishop, & Cordova, 2005). While many studies on mindfulness in the healthcare setting conclude with a discussion of the possibility of a positive impact on patient care, thus far few studies have included the assessment of the relationship between health care provider mindfulness and quality of patient care as a research goal.

Beach and colleagues (2013) found that as health care providers' mindfulness increased so did their engagement in patient-centered communication and the satisfaction of their patients. Similarly, Krasner and colleagues (2009) found that health care providers who participated in a mindful communication intervention reported improvements in well-being and attitudes associated with patient-centered care. These findings align with the conceptual link between the well-being of health care workers and patient safety and care. Several limitations exist however within the literature reviewed. Both of the studies that assessed the relationship between mindfulness and outcomes related to patient care contained methodological constraints. The Beach et al. (2013) study was an observational study that had a limited ability to make causal claims in the observed relationship between health care provider mindfulness and the quality of patient-centered communication. Due to a lack of a control group, Krasner and colleagues (2009) used caution when describing the causal nature between the improvements they measured

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in participant attitudes about patient-centered care. The study also used a previously untested mindfulness intervention with limited evidence about the quality of the intervention or its implementation.

Several additional gaps exist in these studies, and these gaps are seen in the broader literature on the effect of mindfulness interventions on health care worker mental and physical health. As reviews of mindfulness studies among health care professionals and within the workplace argue, extant research offers little evidence on possible underlying causal mechanisms and fails to identify contextual factors that are critical for understanding how and why mindfulness interventions work as well as how results may differ by population and setting (Good et al., 2015; Irving, Dobkin, & Park, 2009). These reviews call for studies that use rigorous mixed-methods approaches to help researchers and practitioners understand possible underlying mechanisms that enable mindfulness training to have beneficial outcomes among participants.

Recent qualitative research on mindfulness training among health care workers has begun to examine the process of change experienced by participants and the challenges health care workers face during mindfulness training (Irving, Park-Saltzman, Fitzpatrick, Dobkin, Chen, & Hutchinson, 2014; Morgan, Simpson, & Smith, 2015). Irving et al. (2015) used a grounded theory analysis of health care workers' experiences in mindfulness training and found that the adoption of mindfulness practices led to enhanced awareness, which promoted improvements in participants' level of focus, observation, and acceptance. Health care workers in the study reported experiencing personal and social benefits from these changes, such as feeling more self-compassion and having better communication with others. The participants also experienced some negative reactions to the training, including feeling frustrated by the mindfulness practices,

particularly early in the training. Irving and colleagues noted that participants realized that these frustrations were part of learning the mindfulness practices and lessened over the course of the training.

In a 2015 review of qualitative studies on MBSR training and its modified versions among health care workers, Morgan, Simpson, and Smith (2015) found that participants experienced a variety of positive outcomes to differing degrees based on their reasons for taking the mindfulness training and their ability to overcome barriers to developing a mindfulness practice. Some of the barriers reported in the qualitative studies included logistical issues such as limited time due to demanding work schedules and responsibilities outside of work. Health care workers also reported more psychological challenges to prioritizing self-care because their professional training and work focused on caring for others. Morgan and colleagues found that the group setting of MBSR training often helped health care workers overcome this barrier.

Similar findings were reported in a review of qualitative and quantitative studies that examined reports of barriers and facilitators described by health care workers who participated in mind-body programs, including mindfulness training (Mensah & Anderson, 2015). The review found that health care workers described time and scheduling conflicts as the major barriers to participating in mind-body programs. Key facilitators to increasing health care worker engagement in mind-body programs included presenting the evidence that supports the efficacy of the programs and gaining financial assistance and support from organizational leaders.

These reviews conducted by Mensah and Anderson (2015) and Morgan et al., (2015) offer a useful summary of some of the challenges health care workers experience during mindfulness training. However, the reviews and the studies they examined did not place the findings within the context of established theories of health behavior. Describing the qualitative

findings in terms of a theory of health behavior could help practitioners, who frequently use health behavior theories to guide intervention development and implementation, to tailor mindfulness training to fit the needs of health care providers. This could lead to increased adherence to mindfulness training practices among participants and more effective use of mindfulness training as an occupational safety and health promotion intervention among health care providers that may also impact patient safety and quality of care.

The Present Study

Purpose and Significance

The current study addressed some of the critical limitations and gaps in the existing literature on the effect of mindfulness training on health care workers while assessing the impact of a mindfulness training program on workplace cognitive failure and safety performance among workers. Specifically, the study employed a randomized waitlist controlled trial design that provided evidence about the causal nature between the mindfulness intervention and health care safety. The study used the MBSR course as a well-validated mindfulness intervention. The study examined possible constructs in the causal pathway between mindfulness training and health care safety. It included mixed methods to identify contextual factors that impact the feasibility of the intervention for health care workers to understand what aspects of the MBSR program are most challenging to adherence and which components work well for participants. The present study placed these findings within the context of the Health Belief Model.

By addressing the limitations and gaps in previous research on mindfulness training on health care worker well-being and providing the first steps in examining the link between mindfulness training and health care safety, the findings of this project have implications for both occupational health and safety practitioners and researchers. The current study extended

upon previous research by testing if MBSR training decreased cognitive failure and in turn improved safety performance among health care workers. The study provided estimates of effect sizes and trends in the relationship between mindfulness training and hospital health care worker cognitive failure and safety performance to inform the power calculations of future randomized controlled trials that address the larger questions about the impact of mindfulness training on patient care and safety.

The study explored the feasibility of implementing a mindfulness intervention among health care workers and provided recommendations on how to enable health care workers to incorporate and maintain mindfulness in their daily lives. By placing the qualitative results within the context of an established and commonly used health behavior theory, the Health Belief Model, this study may help practitioners tailor mindfulness training to health care workers and improve their ability to translate the well-established benefits of mindfulness training into applied practice in hospitals to improve health care safety and quality. The findings of this study may help translate mindfulness training into other settings and populations as well as adding to understanding the benefits and limitations of mindfulness interventions.

Research Questions and Hypotheses

The current study examined hospital health care workers' experiences of adopting mindfulness practices and tested a Mindfulness-Based Stress Reduction (MBSR) intervention strategy to decrease cognitive failure and improve safety compliance and participation among health care workers.

Research Question 1: What barriers and facilitators to adherence to mindfulness practice do hospital health care workers face?

Research Question 2: How do the barriers and facilitators to adherence to mindfulness

practice that hospital health care workers face fit within the Health Belief Model?

Research Question 3: Does implementing an MBSR program among hospital health care workers decrease workplace cognitive failure and improve employee self-reported safety performance as measured by safety compliance and safety participation?

Hypothesis 1: The MBSR intervention will result in a greater decrease in cognitive failure from baseline to post-intervention time points among study participants in the intervention group compared with the waitlist control group.

Hypothesis 2: The MBSR intervention will result in a greater increase in safety compliance from baseline to post-intervention time points among study participants in the intervention group compared with the waitlist control group.

Hypothesis 3: The MBSR intervention will result in a greater increase in safety participation from baseline to post-intervention time points among study participants in the intervention group compared with the waitlist control group.

Research Question 4: Does the MBSR program lead to a sustained decrease in self-reported workplace cognitive failure and safety compliance and participation among hospital care workers six months after completing the intervention?

Approach

The target population for the present study was health care workers in a hospital setting who are involved in direct patient care. To obtain a sample of the target population, I recruited 23 health care workers in direct patient care units in two hospitals in Fort Collins and Loveland, Colorado. Twenty (91%) of the participants were female and most (86%) were nurses (RNs or NPs). Participants were recruited through postings and announcements through the hospital intranet and screen savers on the hospital computers. I met with hospital health care workers

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who were interested in participating to go through an informed consent process. Eligibility for this study included health care workers involved in direct patient care at the participating hospitals who did not have post-traumatic stress disorder or untreated clinical depression.

To answer the research questions and test the hypotheses, the present study used a mixed-methods randomized trial with a waitlist control group design with a 1:1 ratio. The intervention consisted of an 8-week MBSR course taught by an experienced physician instructor. The course included eight 2.5-hour weekly sessions and one 7-hour session, which involved meditation focusing on bodily sensations. Using a computer-generated list of random numbers, participants were randomly assigned to participate in the first 8-week MBSR course or the waitlist control group. The waitlist control group started the 8-week MBSR course after the first group completed the course. The participants completed the course at a local yoga and fitness organization outside of work hours. All participants were asked to complete questionnaires that contained open-ended questions and quantitative measures at baseline, after the treatment group completed the 8-week intervention, and six months after their group completed the intervention. The waitlist control group completed an additional questionnaire immediately after they completed the intervention.

The following chapters include two publishable manuscripts. Chapter 2 contains the methods and results of the qualitative analysis that places participants' statements about their experiences of the mindfulness training within the context of the Health Belief Model. It addresses research questions 1 and 2. Chapter 3 consists of a manuscript focusing on the quantitative methods and results of the study that examine the impact of MBSR on workplace cognitive failure and safety performance among hospital health care workers. It addresses research questions 3 and 4 and hypotheses 1 through 3. Finally, I end with a chapter that

provides a discussion of the findings and suggests possible directions for future research on the

role of mindfulness in health care safety.

CHAPTER TWO: A THEMATIC ANALYSIS OF HEALTH CARE WORKERS' ADOPTION

OF MINDFULNESS PRACTICES

Introduction

Occupational health and safety among health care workers is a critical social and public

health issue. The National Institute for Occupational Safety and Health (NIOSH) identifies the

health care sector as a high-risk industry due to numerous job hazards including high levels of

job stress, workplace violence, musculoskeletal disorders, and exposures to needle sticks and

other sharp instruments (NIOSH, 2009). Health care workers have a high non-fatal occupational

injury rate (6.2 non-fatal injuries per 100 full-time equivalent employees in 2014; Bureau of

Labor Statistics, 2015). Additionally, many health care workers experience mental and emotional

distress that can lead to burnout, depression, substance abuse, and suicide (Wallace, Lemaire, &

Ghali, 2009).

The impact and significance of occupational safety and health among health care workers

extends far beyond their well-being and safety. Protecting and promoting the safety and well-

being of health care workers also leads to improved patient care and safety (Charney &

Schirmer, 2007; Wallace, Lemaire, & Ghali, 2009; Yassi & Hancock, 2005). Much focus and

many resources have been devoted to the improvement of patient safety since the promotion and

adoption of evidence-based patient safety practices recommended in the Agency for Healthcare

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Practices report (Shojania, Duncan, McDonald, & Wachter, 2001). Despite this, recent reports

show that medical errors and serious adverse events still occur too often, and recent

improvements in patient safety seen do not match the investments that have been made (Classen et al., 2011; Landrigan et al., 2010; Levinson, 2010).

Precise estimates of the prevalence of medical errors have been debated since a galvanizing report from the Institute of Medicine declared that between 44,000 and 98,000 patient deaths occurred each year in the United States from preventable adverse events (Kohn, Corrigan, & Donaldson, 2000). Despite controversy, the evidence of the significant human and monetary costs of these events is clear (Carter, Motao, Jun, & Porell, 2014; Kohn, Corrigan, & Donaldson, 2000; Shekelle et al., 2012; Van Den Bos et al., 2011; Zhan & Miller, 2003).

While numerous underlying factors influence quality of care and patient safety, one promising area that remains insufficiently researched is the link between health care worker safety and well-being and patient safety and care. Landrigan and colleagues conducted a landmark study in 2004 that showed that serious medical errors dropped significantly after an intervention reducing the number of hours interns work per week was conducted. In 2005, Yassi and Hancock provided additional qualitative evidence to establish a conceptual link between the safety and well-being of health care workers and the safety and care of their patients (Yassi & Hancock, 2005). When testing this relationship, the authors emphasized the importance of implementing and evaluating interventions that promote aspects of health care worker psychological health and safety beyond reduced shift length. Since then several studies have further established associations between components of health care worker psychological well-being such as stress, burnout, self-perceived medical errors, and suboptimal patient care and adverse events (Cimiotti, Aiken, Sloane, & Wu, 2012; Prins et al., 2009; Williams, Manwell, Konrad, & Linzer, 2007; West, Tan, Habermann, Sloan, & Shanafelt, 2009). Similarly, research has provided additional evidence that aspects of health care worker occupational safety including

safety climate and safety performance not only predict health care worker injuries and clinician job satisfaction but also impact medical errors and patient satisfaction (Hofmann & Mark, 2006; Singer, Lin, Falwell, Gaba, & Baker, 2009).

In response to the call for rigorous intervention research to test the positive impact of promoting health care worker safety and well-being on quality of patient care (NIOSH, 2013), more work is needed to assess this link and to evaluate the feasibility and effectiveness of health care worker wellness and safety promotion interventions on patient safety.

Mindfulness Interventions among Health Care Workers

A growing body of evidence suggests that mindfulness training, which involves increasing a participants' ability to attain nonjudgmental awareness in the present moment (Kabat-Zinn, 1990), is an effective workplace wellness promotion intervention strategy that improves attention stability, control, and efficiency (Good et al., 2015). The increases in these qualities of attention positively impact cognition, emotion, behavior, and physiology, which has implications for workplace outcomes, including performance, relationship quality, and worker well-being. As such, mindfulness training is an intervention strategy that may improve health care provider occupational safety and health as well as patient safety.

Research has found that mindfulness training among health care workers leads to significant reductions in perceived stress, anxiety, depression, and burnout (Fortney, Luchterhand, Zakletskaia, Zgierska, & Rakel, 2013; Irving, Dobkin, & Park, 2009). Mindfulness-based stress reduction (MBSR) programs in particular have had success in improving a number of wellness outcomes among health care workers (Cohen-Katz, Wiley, Capuano, Baker, & Shapiro, 2004; Geary & Rosenthal, 2011; Goodman & Schorling, 2012; Irving, Dobkin, & Park, 2009; Lamothe et al., 2016; Shapiro, Astin, Bishop, & Cordova, 2005).

A recent meta-analysis of MBSR and MBSR-based interventions among health care workers found strong evidence of improved mental health among participants (Lamothe et al., 2016). These results echoed the findings of the review Irving and colleagues conducted in 2009, which described how health care workers who attended MBSR training experienced improvements in their physical and mental health.

The MBSR program was created at University of Massachusetts School of Medicine. It was initially used to treat chronic pain patients and since then has been used to train a variety of populations, including health care providers, to incorporate mindfulness into their daily lives (Kabat-Zinn, 1990; 2003). MBSR training typically consists of weekly group sessions and one full-day silent retreat session over the course of eight weeks. Core components of the course include: informal (e.g. awareness of pleasant and unpleasant sensations) and formal (e.g. hatha yoga, body scans, sitting and walking meditations) mindfulness meditation focusing on bodily sensations; didactic presentations on topics such as the physiology of stress; group discussions about the skills learned in the class and their impact on participants' attitudes and awareness of experiences; and assignments that encourage practicing and applying the course skills outside of class (Santorelli, 2014).

Nascent research has found an association between mindfulness and worker safety outcomes (Zhang, Ding, Li, & Wu, 2013; Zhang & Wu, 2014). Additionally, many studies on mindfulness in the healthcare setting conclude with a discussion of the possibility of a positive impact on patient care, and a few studies have started to assess outcomes related to quality of patient care (e.g. Beach et al., 2013; Krasner et al., 2009). For instance, Beach and colleagues (2013) found that as health care providers' mindfulness increased so did their engagement in patient-centered communication and the satisfaction of their patients. Similarly, Krasner and

colleagues (2009) found that health care providers who participated in a mindful communication intervention reported improvements in well-being and attitudes associated with patient-centered care. These findings align with the conceptual link between the well-being of health care workers and patient safety and care.

Several limitations exist however within the literature examining the impact of MBSR programs on health care provider occupational health and safety and ultimately patient care. As reviews of mindfulness studies among health care professionals and within the workplace argue, extant research fails to identify contextual factors that are critical for understanding how and why mindfulness interventions work as well as how results may differ by population and setting (Good et al., 2015; Irving, Dobkin, & Park, 2009). Additionally, mindfulness training, unlike other health promotion practices, has yet to be conceptualized within health behavior theories that can help researchers and practitioners understand how, why and under what circumstances individuals adopt behaviors that improve their well-being.

Recent qualitative research on mindfulness training among health care workers has begun to examine the process of change among participants and the challenges health care workers face during mindfulness training (Irving, Park-Saltzman, Fitzpatrick, Dobkin, Chen, & Hutchinson, 2014; Morgan, Simpson, & Smith, 2015). Irving et al. (2015) used a grounded theory analysis of health care workers' experiences in mindfulness training and found that the adoption of mindfulness practices led to enhanced awareness, which promoted improvements in participants' level of focus, observation, and acceptance. Health care workers in the study reported experiencing personal and social benefits from these changes, such as feeling more self-compassion and having better communication with others. The participants also experienced some negative reactions to the training, including feeling frustrated by the mindfulness practices,

particularly early in the training. Irving and colleagues noted that participants realized that these frustrations were part of learning the mindfulness practices and lessened over the course of the training.

In a 2015 review of qualitative studies on MBSR training and its modified versions among health care workers, Morgan, Simpson, and Smith (2015) found that participants experienced a variety of positive outcomes to differing degrees based on their reasons for taking the mindfulness training and their ability to overcome barriers to developing a mindfulness practice. Some of the barriers reported in the qualitative studies included logistical issues such as limited time due to demanding work schedules and responsibilities outside of work. Health care workers also reported more psychological challenges to prioritizing self-care as their professional training and work focused on caring for others. Morgan and colleagues found that the group setting of MBSR training often helped health care workers overcome this barrier.

Similar findings were reported in a review of qualitative and quantitative studies that examined reports of barriers and facilitators described by health care workers who participated in mind-body programs, including mindfulness training (Mensah & Anderson, 2015). The review found that health care workers described time and scheduling conflicts as the major barrier to participating in mind-body program. Key facilitators to increasing health care worker engagement in mind-body programs included presenting the evidence that supports the efficacy of the programs and gaining financial assistance and support from organizational leaders.

These reviews conducted by Mensah and Anderson (2015) and Morgan et al., (2015) offer a useful summary of some of the challenges health care workers experience during mindfulness training. However, the reviews and the studies they examined did not place the findings within the context of established theories of health behavior. Describing the qualitative

findings in terms of a theory of health behavior could help practitioners, who frequently use health behavior theories to guide intervention development and implementation, to tailor mindfulness training to fit the needs of health care providers. This could lead to increased adherence to mindfulness training practices among participants and more effective use of mindfulness training as an occupational safety and health promotion intervention among health care providers that may also impact patient safety and quality of care.

Health Belief Model

The Health Belief Model (Becker, 1974), developed to understand why certain people did not participate in health prevention practices, has been used to help explain and predict the adoption of a variety of preventive and treatment health behaviors (Glanz, Rimer, & Viswanath, 2008). The Health Belief Model posits that people decide to engage in health behaviors due to a mix of factors including beliefs about: 1) the likelihood of getting a condition (perceived susceptibility); 2) the seriousness of the condition (perceived severity); 3) the benefits of the health behavior (perceived benefits); 4) the barriers to enacting the health behavior or the negative consequences of the behavior (perceived barriers); 5) internal or external factors that prompt behavior change (cues to action); and 6) one's ability to successfully enact the health behavior (self-efficacy). According to the Health Belief Model (see Figure 1), individuals will be prompted to consider adopting a protective health behavior when they perceive a threat of a preventable health condition. The level of the perceived threat of the health condition varies by beliefs about the severity of its consequences and individuals' susceptibility to the condition. The likelihood of adopting the preventive health behavior increases when the perceived benefits of adopting the health behavior outweigh the barriers to adopting it and when the individuals

believe that they can successfully adopt the health behavior. Individual characteristics, such as age, sex, or education, may modify these perceptions that influence behavior change.

The Health Belief Model is one of the most commonly used theories in health behavior research and practice (Painter, Borba, Hynes, Mays, & Glanz, 2008). Evidence regarding the predictive validity of the Health Belief Model is mixed (Linke, Robinson, & Pekmezi, 2014). However, research shows that the model is valuable for explaining the adoption of preventive health behaviors and planning interventions that target specific health behaviors (Harrison, Mullen, & Green, 1992; Janz & Becker, 1984; Linke, Robinson, & Pekmezi, 2014). As such, the Health Belief Model may offer a useful framework for understanding the factors that increase health care workers' likelihood of adopting mindfulness practice as a preventive health behavior. While a recent study suggests the ability of the Health Belief Model's constructs to predict intentions to practice mindfulness meditation as a stress reduction technique among college students (Rizer, Fagan, Kilmon, & Rath, 2016), extant research has not employed the model when assessing mindfulness adoption among health care workers.

The Health Belief Model could be used to frame and expand upon the existing literature describing the process of change that occurs when health care workers adopt mindfulness practices. The barriers and facilitators that health care workers experience when engaging in mindfulness training described by Irving et al. (2014), Mensah and Anderson (2015), and Morgan et al. (2015) may map onto the Health Belief Model constructs of perceived barriers and perceived benefits. Similarly, the experience of overcoming frustrations and gaining confidence in using mindfulness practices, described by Morgan et al. (2015), may fit within the self-efficacy construct of the Health Belief Model. More work is needed to determine if the Health Belief Model can help explain the adoption of mindfulness practices among health care workers.

Purpose

The present study aimed to describe hospital health care workers' adoption and adherence to mindfulness practices during and after a Mindfulness-Based Stress Reduction course. The study explored the participants' experiences of adopting mindfulness practice as a health behavior within the context of the Health Belief Model. The findings may enable health promotion practitioners to tailor mindfulness training to fit the needs of hospital health care workers.

Methods

Participants

Participants included health care workers from direct patient care units in two hospitals in Colorado. I recruited participants by making announcements about the study at staff meetings and posting study flyers on the hospitals' intranet and computer screen savers. Eligibility criteria for this study included health care workers involved in direct patient care at the participating hospitals who were free of post-traumatic stress disorder and untreated clinical depression. Participants received the MBSR course free of charge and received $25 gift cards as a token of appreciation for completing study questionnaires. The hospital and university Institutional Review Boards reviewed and approved the study.

Procedures

Participants were recruited as part of a randomized waitlist controlled trial examining the effects of mindfulness training on health care safety. The participants attended one of two MBSR courses taught by an experienced physician instructor in 2014. Consistent with the MBSR standards of practice (Santorelli, 2014), the course included eight 2.5-hour weekly sessions with informal and formal mindfulness meditation focusing on bodily sensations, presentations on

topics such as the physiology of stress, and group discussions as well as one silent 7-hour retreat. The participants were asked to complete home assignments that included relevant readings and time practicing the skills learned in the course. The participants attended the course at a local yoga and fitness organization outside of work hours.

Participants were surveyed at baseline, upon completion of the MBSR course and again six months after the end of the MBSR course. Participants were also asked to complete weekly logs of their practice and experiences during the 8-week MBSR course. Demographic characteristics including age, sex, and provider type were measured in the baseline survey. Participants reported completion of home assignments in weekly logs and attendance of the nine sessions, including the eight weekly sessions and the silent retreat, at a post-survey. Qualitative data were collected from participants using open-ended questions in the weekly logs, post-survey, and 6-month follow-up survey. Each weekly log included one open-ended question asking participants to describe experiences in the prior week related to the course or their mindfulness practices outside of the class. The open-ended section of the post-survey contained eight open-ended questions, and the 6-month follow-up survey contained nine open-ended questions. These questions asked participants to describe their experiences in the MBSR course, which aspects of the course were most and least effective for them, factors that helped or prevented them from using the mindfulness practices taught in the course, changes in their life and role as a health care worker stemming from mindfulness practices, and intentions to continue to use the mindfulness practices taught in the course. The 6-month follow-up survey asked participants if they had continued to use the mindfulness practices they learned in the course.

Data Analysis

Demographic characteristics of participants were summarized using descriptive statistics. Adherence was described using proportions of the participants who completed home assignments each week, attendance at the nine sessions, including the eight weekly sessions and the silent retreat, and continued practice of the skills learned in the course.

Thematic analysis. The present study used a theory-driven thematic analysis approach to analyze the qualitative data with the key constructs of the Health Belief Model acting as the framework for the analysis. Data were coded by two researchers (the primary author and a research assistant).

The qualitative analysis occurred in six steps, following the guide provided by Braun and Clarke (2006). First, the coders became familiar with the data by compiling the participants' open-ended responses to the weekly logs and surveys. The coders read the responses several times and made preliminary notes about possible relations to the constructs of the Health Belief Model. Second, the research team generated initial codes throughout the data. Third, the codes were reviewed for potential themes under each of the constructs of the Health Belief Model. Fourth, the research team reviewed the themes to ensure that the codes fit within the themes and that the themes fit within the structure of the Health Belief Model. Fifth, the themes were named, defined, and refined. Finally, the primary author related the themes and codes back to the study aims during the process of manuscript preparation.

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Results

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Participants

Nineteen hospital health care workers from a university hospital system in Colorado participated in one of two MBSR courses (10 in the first group and 9 in the second group). Two

participants dropped out of the training during the second MBSR course. Of the initial 19

participants, 17 completed weekly logs and the post-survey (ten from the first group and seven

from the second group), and 16 completed the 6-month follow-up survey (nine from the first

group and seven from the second group).

Of the 17 participants who completed the weekly logs and post-survey, most (88%) were

female and nurses (RNs or NPs). Two of the participants (12%) were paramedics. The

participants ages ranged from 24 years old to 60 years old (median = 46). Less than a third (29%)

of participants had previous experience practicing mindfulness meditation, and of those with

meditation experience, only two participants had practiced mindfulness meditation in the month

prior to beginning the MBSR course.

Adherence and Sustained Use of Mindfulness Skills

Of the 17 participants who completed the post-survey, five (29%) attended all nine

sessions of the MBSR training (eight of the weekly sessions and the silent retreat), six (35%)

attended eight of the nine sessions, four (24%) attended seven of the nine sessions, one (6%)

completed five of the nine sessions, and one (6%) attended only four the of nine sessions.

Although all of the participants reported doing a portion of the home assignments each week,

none of the participants reported that they completed any of the home assignments during the

course. Of the 16 participants who completed the 6-month follow-up survey, 14 (88%) reported

that they still used the skills they learned in the course.

Health Belief Model

The themes derived under the Health Belief Model constructs are listed in Table 1. No

themes emerged from the data related to perceived susceptibility or perceived severity. While

many of the participants described their levels of stress and feelings of being overwhelmed, these

descriptions did not directly relate to beliefs about the likelihood of having stress (perceived susceptibility) or the severity of the consequences of stress (perceived severity). Instead participant responses that described their stress levels seemed more relevant to cues to action themes.

Cues to action. Only internal cues to action and no external cues to action emerged from the data. The participants described internal factors that prompted their decision to adopt mindfulness practices related to stress, distraction, and motivations to increase personal well-being. Participants described seeking out mindfulness practices because of high levels of stress in their lives. For example, one participant said:

I felt I was at the end of my road with overwhelming stress. I have never been so down and stressed in my life.

Other participants described feeling a lack of focus and control that led them to use mindfulness practices. As one participant said;

I found myself multiple times upset, distracted, and thinking about things that I had no control over.

Several participants emphasized the importance of staying healthy and feeling motivated to engage in personal well-being practices as reasons for initiating mindfulness practices. For instance, one participant said:

I desired a path of wellness and calm.

These same internal cues to action emerged from participant responses describing reasons for their continued use of the mindfulness practices six months after the MBSR course concluded. Participants explained that they felt compelled to increase their use of the mindfulness practices they learned in the course during times of heightened stress, moments

when they felt they were especially distracted, and in pursuit of long-term goals related to maintaining their health and well-being. Participants described an additional cue to action six months after the completion of the course, which came from the positive associations they had from their participation in the course and previous experiences with mindfulness practice. For instance, one participant said:

I view my sense of well-being as directly associated with mindfulness and believe I will continue to be compelled to use these skills.

Perceived benefits. Participant responses related to perceived benefits of using mindfulness practices learned in the MBSR course fell under four themes: 1) psychological benefits; 2) physical benefits; 3) interpersonal benefits; and 4) professional benefits.

The psychological benefits participants experienced from the MBSR course and the mindfulness practices included enhanced awareness, increased calm, and an improved ability to focus. Participants described how adopting mindfulness practices caused them to pay more attention to themselves and their surroundings. This increased their awareness of the external environment as well as their physical sensations and internal experiences such as their emotions and reactions. Many participants described how their heightened awareness led to a cascade of positive effects. As one participant said:

I feel that mindfulness practice leads to awareness of those moments that are positive or enjoyable, which leads to more gratitude, which I feel is an important ongoing practice for having overall happiness in life.

Similarly, participants described how their enhanced awareness altered how they perceived stressful events. Participants mentioned experiencing new ways of relating to stress. They described noticing their responses to stressful situations in the moment and feeling

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empowered to change their reactions to stressful situations. This allowed them to feel more calm. One participant described this experience, saying:

> *During class I was more relaxed than I have been in years. I feel less stressed. I feel that I can acknowledge when I feel stress and feel that I can do something about it. I think that this has helped me to sleep better, live in the moment, and live a more peaceful and calm lifestyle.*

Participants described how their ability to focus increased along with their heightened awareness and feelings of increased calm. Many of the participants mentioned how the changes in their stress and focus were related, as one participant said:

> *Being reminded to come back to the breath during stressful times helps me slow down and become in the moment. My stress level decreases at that moment, and I am more able to focus.*

Multiple participants expressed that the psychological benefits of the mindfulness practices led to physical benefits. The increased awareness that participants described in turn impacted their diets. As one participant said:

> *I have been a more mindful eater, and while this takes lots of practice, it has made a difference already in enjoying certain things more or stopping eating something because it really is not enjoyable.*

Similarly, another participant said:

> *My eating habits have improved as I am paying attention to how I feel more.*

Participants also expressed that the reductions in stress levels allowed them to find more relaxation and enjoyment from physical activity.

Many participants described how their increased awareness and feelings of calm resulting from mindfulness practices benefited their social relationships. Participants attributed

improvements in their relationships to feeling more present and less reactive, which allowed them to listen more closely and engage with people who are important in their lives.

As one participant said:

My close relationships are better. I don't let little things get to me, and even the bigger things I can manage better and calmer. Because I am listening to others better, I have less conflict and better understanding of others and their ideas and positions.

The psychological and interpersonal benefits participants described transferred into their professional roles as health care workers. Participants expressed that their reductions in stress enabled them to take pause and prioritize their actions before approaching competing demands at the hospital. One participant said:

The technique of "pausing my mind" (i.e., my conscious thoughts) by focusing on my breathing has been incredible. Within a few breaths, literally, I achieve a sense of calm and a perception that I am in control of myself and of my own values. When applied in the work setting, particularly during meeting discussions where consensus has not yet been achieved, I find that I listen better and can articulate my thoughts and recommendations with fewer words. I think with greater clarity.

Another participant said:

I feel less stressed at work. I am able to focus on tasks and conversations easier.

Many participants described their belief that their conversations with patients and colleagues had improved due to their adoption of mindfulness practices. For instance, one participant said:

With coworkers and patients I am more present, listening when they talk, rather than thinking of how to respond.

Participants agreed that the workplace benefits that they experienced related to increased clarity in focus during crucial conversations and job tasks and more thoughtful communication with patients and colleagues positively impacted the quality of care they provided their patients.

In addition to the benefits from the mindfulness skills learned in the MBSR course, many of the participants mentioned that they benefited from specific aspects of the course structure. Several of the participants described the group environment as the most beneficial aspect of the MBSR course structure. Participants reported feeling support from the group environment of the course, appreciation for sharing the experience with fellow health care providers, and comradery with the other participants.

Perceived barriers. Participants described numerous barriers to their successful adoption of mindfulness practices during the MBSR course and after they completed it. These barriers fell into two major themes: 1) internal barriers; and 2) external barriers, which included course-specific barriers.

Internal barriers to mindfulness practice among participants included difficulties with enhanced attention, high levels of stress, and a lack of prioritization of self-care. Although participants largely agreed that their enhanced attention due to mindfulness practice had positive effects, several participants also described how heightened attention sometimes felt like a barrier to their continued mindfulness practice as well as to their daily functioning. These participants said that they did not always want to have deliberate and focused attention. One participant said:

Paying attention to extreme detail is hard and not always effective. In extremely stressful situations I need to be on automatic pilot.

Similarly, participants mentioned that although mindfulness practices helped reduce the degree to which they felt stressed and overwhelmed, their stress levels sometimes acted as a

barrier to their ability to practice mindfulness. Participants described stress as a barrier during

times when they felt especially busy and overwhelmed. As one participant said:

It was a busy and stressful week. I wish I had been able to meditate more as it likely

would have helped.

Another participant described how this happened at work:

Trying to be mindful and purposeful while working in very complex and stressful

situations is still my biggest challenge at work.

Another major internal barrier to mindfulness practices that participants described was

their struggle to prioritize self-care. Participants often framed their discussion of this barrier in

terms of their lack of discipline or need for greater diligence. One participant described why she

had not continued to use the mindfulness practices as much as she had hoped after she completed

the course. She said:

Sometimes I have trouble disciplining myself to do things that are beneficial for me, even

when those things are also enjoyable to do.

Other participants discussed how they struggled to prioritize self-care and set aside time

for mindfulness practices.   As one participant said:

I wish there was more time in the day! Or rather, that I dedicated more time.

The prioritization and use of time for self-care practices was a major internal barrier that

related to two of the external barriers that the participants faced – responsibilities at home and

demanding work schedules.

Participants explained how responsibilities at home often felt like a barrier to practicing

mindfulness. Many participants also cited home responsibilities when they were unable to attend

the MBSR course sessions. As one participant said:

I am very frustrated I had to miss the past few sessions due to last minute day care issues and home issues.

Others described how their responsibilities at home combined with their work schedules to prevent them from being able to do certain mindfulness practices.

I have learned that trying to practice meditation after work feels like torture as I work to keep myself awake. It is best to do this on my days off or first thing when I wake up when I am more awake. Yoga after work is the better choice. We also had a sleepover with our seven grandchildren over the weekend, so I didn't do any of the practice. Sometimes 'life gets in the way.'

Given the demanding schedules that many of the participants had at the hospital and at home, participants found the scheduling and timing of the course challenging.

As one participant said:

I assume the course was set up more for 9-5 folks. Being that I work at 6:30am, (get up at 5), it was difficult to be at the course in the evening and have to get up so early the next day.

In addition to demanding work schedules and responsibilities at home, participants cited certain course components as barriers. Overall participants agreed that they liked learning most of the formal mindful meditation practices (e.g. mindful walking, sitting meditation, Hatha yoga) taught in the course. However, participants described how other aspects of the course acted as barriers to their successful adoption of mindfulness practices. In particular, participants mentioned course components including the home assignments and some of the content of the class discussions as barriers.

A major external barrier stemming from the course content was the length of the home assignments. While the home assignments varied each week, most assignments asked the

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participants to practice formal mindfulness meditation approximately an hour a day in addition to reading materials and making notes on their experiences throughout the week. The participants did not finish the assignments and described them as conflicting with their demanding work schedules. For instance, one participant said:

I think the homework could have been assigned with our schedules in mind. Most of us work 12 hour shifts and an hour of meditation or body scanning is pretty unfeasible on days that we work. For me it was a bit demoralizing not being able to complete the homework and this affected how I felt during the class.

Other aspects of the course that participants described as a barrier to their successful adoption of mindfulness skills related to the group discussion content. Participants described the lack of emphasis on scientific evidence supporting the efficacy of mindfulness training as a barrier. While the course instructor provided articles reviewing the research on mindfulness during the first session of the MBSR course, the evidence was not discussed in detail with the participants. One participant said:

I tend to be a very concrete person and am very interested in the theory and evidence behind why something works. I didn't find this included in the class and so in some situations I found myself to be less engaged.

Other participants stated that thoroughly presenting supporting evidence is especially important among health care workers given their foundation in evidence-based medical training and health care practices. As one participant said:

Emphasizing the evidence behind mindfulness practices would have been extremely helpful. Health care workers shape many of their decisions on logic and evidence and emphasizing them would have taken away some of the initial reservations we had. We are

naturally skeptical people, and when we hear "new-agey" sounding phrases we put our guard

up. I would have really appreciated a run down of the research done on mindfulness and its

benefits. It would have allowed me to embrace things a bit quicker, and I think I would have got

even more from the class overall.

In addition to wanting to hear more evidence behind the practices taught in the course,

participants described the lack of group discussion on applying mindfulness skills in the

healthcare setting as a barrier to their successful adoption of mindfulness practices. While

participants experienced how mindfulness practice facilitated positive changes in their role as

health care providers, they expressed a desire to learn more concrete ways to incorporate

mindfulness practices in their workplace. One participant said:

We didn't really discuss how we wanted the new skills to improve our time at work or the

ways in which the mindfulness training might be particularly helpful to us in the healthcare

setting.

Another participant agreed, saying:

It would be useful to learn some exercises that help us see how to apply it to the workday.

Self-efficacy. The theme of self-efficacy arose from the data collected in the weekly logs.

The participants' self-efficacy seemed to increase as the MBSR course progressed. Early in the

course, several participants described how they felt that they did not have the ability to

effectively adopt mindfulness practices. For instance, one participant said:

I don't have any skills to accomplish meditation.

Another participant described feeling a lack of self-efficacy in relation to the yoga

practices taught in the course, saying:

While I really enjoyed the yoga, I don't feel I know enough to practice on my own and I

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would like to.

Later in the course participants described how they felt more confident in using the different formal mindfulness meditation practices taught in the MBSR course. They described how they had learned that mindfulness practices are continually accessible, which increased their self-efficacy. As one participant said:

I remember that I will be able to use the mindfulness skills forever, focusing on the breath, which can be done anywhere anytime.

Discussion

The current study examined the adoption of mindfulness practices among hospital health care workers who participated in Mindfulness-Based Stress Reduction training. Less than a third of participants attended all of the MBSR training sessions, and none of the participants were able to complete the weekly home assignments during the course, which they perceived as too time intensive. Nevertheless, most of the participants who completed the 6-month follow-up survey reported that they continued to use the mindfulness practices they learned in the course.

The study employed a theory-driven thematic analysis approach using the constructs of the Health Belief Model to understand the participants' experiences of adopting mindfulness practice as a health behavior. In the current study, themes related to the perceived severity and susceptibility components of the Health Belief Model did not emerge from the data. This may be due to health care workers' use of denial and avoidance as coping strategies as well as their tendency to remain silent about personal health issues that have been well-documented (Arnetz, 2001; Baldisseri, 2007; Firth-Cozens, 2001; Wallace, Lemaire, & Ghali, 2009). It may also be that these constructs within the Health Belief Model do not apply to health practitioners who

adopted mindfulness practices to promote general well-being rather than to prevent a specific health condition.

The thematic analysis showed that the other Health Belief Model constructs, including internal cues to action, perceived benefits and barriers, and self-efficacy, helped portray the participants' experiences and challenges in adopting and adhering to the mindfulness practices taught in the MBSR course. The participants described benefits from mindfulness practice related to enhanced awareness that led to increased calm and focus. Participants discussed how these psychological benefits led to physical benefits, such as improved diet and enjoyment of physical activity, as well as interpersonal and workplace benefits. They described how the mindfulness practices positively changed their interactions with patients and colleagues, which they perceived as an improvement in the quality of care they provided as health care workers. The benefits of mindfulness practice that participants described are similar to the process of change laid out by Irving et al., (2014) and fit within the conceptual model Good et al. (2015) proposed in a review of the role of mindfulness in the workplace. Good et al. theorized that mindfulness training improves attention, which impacts cognition, emotion, behavior, and physiology, and ultimately leads to positive workplace outcomes, including performance, relationship quality, and worker well-being.

Participants described internal barriers to adoption and adherence to mindfulness practice related to their high levels of stress and experiencing minor undesirable reactions to heightened attention. Participants also described struggling to prioritize self-care, which is consistent with the findings of Morgan et al. (2015). Morgan and colleagues explain how health care workers might experience difficulties prioritizing self-care more than the general population as they are trained to focus on caring for others.

Consistent with previous research (Mensah & Anderson, 2015; Morgan, Simpson, & Smith, 2015), other major barriers to adopting mindfulness practice described by the current study's participants included competing demands of work schedules and home responsibilities. The participants felt that the MBSR course home assignments were not tailored to their schedules and were too time intensive. Additional course-related barriers participants cited included limited presentation of the evidence behind the program and a lack of discussion about tactics aimed at incorporating mindfulness at work in health care settings.

These findings suggest that health promotion practitioners who aim to provide mindfulness training to health care workers should tailor the course timing and materials to fit the health care workers' demanding schedules. Didactic materials and group discussions should thoroughly explain the growing body of evidence that supports the use of mindfulness practices in health care and provide practical, health care-specific applications of mindfulness practices.

This study has several important limitations. The sample included a small number of hospital health care workers from a single hospital system. The participants self-selected into the MBSR course as part of a larger study on mindfulness and health care safety. The study's findings on participants' experiences in adopting and adhering to mindfulness practices were shaped by their motivations and willingness to participate in the study and may not generalize to other health care workers.

The qualitative data were collected using open-ended questions in a series of surveys. Although participants were encouraged to provide examples of their experiences, many of the participants kept their responses brief. Their concise statements are valuable in understanding their adoption and adherence to mindfulness practices taught in MBSR training. However, due to the survey methodology used in the present study, the research team did not have an

opportunity to ask participants for additional explanation or narrative examples or probe deeper into themes that emerged as researchers do when using other qualitative methods such as focus groups and in-person interviews.

The present study used the Health Belief Model as a guiding health behavior theory. The Health Belief Model is a psychosocial health behavior model that focuses on individual-level attitudes and beliefs that influence health behavior decisions (Becker, 1974). Given the intrapersonal focus of many mindfulness practices, constructs of the Health Belief Model, particularly the perceived barriers and benefits seen in the present study, offer a useful theoretical starting point to understand health care worker adoption and adherence to mindfulness practices taught in the MBSR course. Reviews of research using the Health Belief Model demonstrate that the model's constructs that best explain health behaviors are the perceived barriers followed by the perceived benefits, especially among preventive health behaviors (Janz & Becker, 1984; Carpenter, 2010), like mindfulness practices. However, the model does not directly address the potentially powerful social and societal determinants of health behaviors, which limits the scope of the present study's findings on the experiences of health care workers as they adopted mindfulness practices.

As research continues to explore the impact that mindfulness training has on health care worker occupational health and safety and ultimately patient care, the field could be advanced by researchers using more complex health behavior models, such as the social-ecological model, that incorporate the interplay of individual, social, organizational, and societal factors that influence health care workers' adoption and sustained use of mindfulness practices. By expanding its use of health behavior models in examining how and why mindfulness interventions work as well as how results may differ by population and setting, future research

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can build off of the present study's findings to help health promotion practitioners tailor

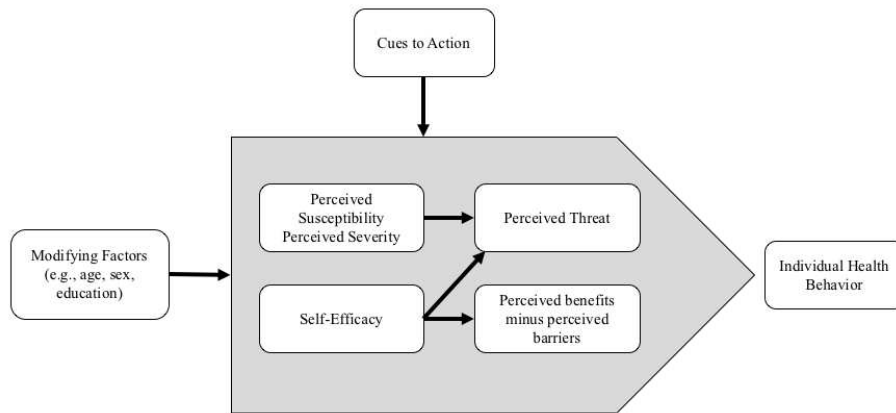mindfulness training to fit the needs and schedules of health care workers.

Figure 1. Relationships between constructs of the Health Belief Model (Glanz, Rimer, & Viswanath, 2008)

Table 1

Qualitative themes within the constructs of the Health Belief Model.

Internal cues to action	Barriers
Feelings of stress and overwhelm	Internal
Feeling distracted	High levels of stress
Motivations to increase personal well-being	Negative effects of heightened attention
	Self-care low priority
Benefits	External
Psychological	Responsibilities at home
Enhanced awareness	Demanding work schedules
Increased calm	Course components
Improved focus	Lengthy home assignments
Physical	Supporting evidence not emphasized
Improved diet	Lack of health care specific recommendations
Increased enjoyment of physical activity	
Interpersonal	
Improvement in close relationships	
Professional	Self-efficacy
Increased task focus	
Improved communication with patients and colleagues	

CHAPTER THREE: EFFECT OF MINDFULNES-BASED STRESS REDUCTION TRAINING

ON HEALTH CARE WORKER SAFETY PERFORMANCE: A RANDOMIZED WAITLIST

CONTROLLED TRIAL

Introduction

Background and Significance

Hospital health care workers have a high occupational injury rate. In the United States, hospital health care workers had an annual incidence rate of 6.2 recordable non-fatal injuries per 100 full-time equivalent (FTE) employees in 2014, which represents a rate higher than other high-risk industries such as construction (incidence rate 3.6/100 FTE) or manufacturing (4.0/100 FTE, Bureau of Labor Statistics, 2015a). Research has suggested that in additional 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 (Dembe, 2001). Occupational injuries can also decrease workers' job satisfaction and increase their intentions to leave their organizations (McCaughey, DelliFraine, McGhan, & Bruning, 2013). Workplace injuries among health care workers carry significant financial costs for workers, employers, and society due to medical expenses, lost wages and productivity, and high-priced insurance including workers' compensation (Waehrer, Leigh, & Miller, 2005). Occupational safety and health among health care workers is especially important, as evidence suggests that improving the safety and well-being of health care workers not only impacts their health, it also leads to improved patient care and safety (Charney & Schirmer, 2007; Yassi & Hancock, 2005).

The role of safety performance and cognitive failure. Numerous organizational and individual factors contribute to workplace injuries among health care workers (McCaughey et al., 2016). Research has identified safety performance as a significant proximal antecedent of workplace injuries (Christian, Bradley, Wallace, & Burke, 2009; Clarke, 2006; Neal & Griffin, 2006; Wallace & Vodanovich, 2003). Safety performance, based on the model of job performance by Campbell and colleagues (1993), consists of two factors: safety compliance and safety participation (Neal, Griffin & Hart, 2000). Safety compliance refers to personal safety behaviors including adherence to established 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. In a longitudinal study of hospital employees, Neal and Griffin (2006) found that as health care workers' self-reported safety performance increased, the number of injuries in the workplace decreased. 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.

Researchers have found that factors including the physical work environment, safety climate, occupational stressors, work attitudes, safety knowledge, and safety motivation impact safety behaviors (Clarke, 2010; Clarke, 2012; Nahrgang, Morgeson, & Hofmann, 2011; Neal, Griffin, & Hart, 2000; Oliver, Cheyne, Tomas, & Cox, 2002). There is a logical expectation of a link between safety behaviors and safety performance, through the relationships between behaviors related to compliance and participation. Neal, Griffin, and Hart (2000) theorized that organizational factors, such as organizational climate and safety climate, influence safety participation and compliance through individual-level factors including safety knowledge and

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motivation. While studies using meta-analytic strategies and structural equation modeling have examined and lent some support to these proposed causal pathways (Clarke, 2010; Clarke, 2012; Nahrgang, Morgeson, & Hofmann, 2011; Neal, Griffin, & Hart, 2000; Oliver et al., 2002), much of the variance in safety compliance and participation remains unexplained. This warrants an examination of additional individual-level factors that determine safety performance.

One important individual-level factor that impacts safety performance is cognitive failure (Wallace & Chen, 2005; Wallace & Vodanovich, 2003), or cognitively-based errors that occur during the performance of a task that an individual can normally successfully complete (Martin, 1983). In 2005, Wallace and Chen examined cognitive failure in the workplace and found that as workplace cognitive failures increased, worker safety performance decreased. They framed their findings in the context of self-regulation, or self-control, and argued that workplace cognitive failure is a component of self-regulation at work. Self-regulation at work consists of task-relevant effort, which facilitates goal achievement, and off-task or task-irrelevant effort that can interfere with goal achievement (Kanfer & Ackerman, 1996; Kanfer & Heggested, 1997). Wallace and Chen (2005) built off of the self-regulation at work framework Kanfer and colleagues presented and argued that workplace cognitive failure is a type of task-irrelevant effort that can lead to a decline in safety performance and an increase in workplace injuries.

Mindfulness as a safety performance intervention strategy. Mindfulness is defined as "a receptive attention to and awareness of present events and experience" (Brown, Ryan, & Creswell, 2007, p. 212). While normal functioning involves awareness and attention, mindfulness, as either a state or trait, entails heightened, nonjudgmental awareness and attention (Brown & Ryan, 2003). State or momentary mindfulness is associated with improved mood and well-being (Lau et al., 2006), and the more stable trait or dispositional mindfulness is associated

with a number of positive mental and physical health outcomes (Brown, Ryan, & Creswell, 2007).

As with cognitive failure, mindfulness has been linked to self-regulation processes (Brown & Ryan, 2003; Creswell, Way, Eisenberger, & Lieberman, 2007; Shapiro et al., 2006). Neuroimaging studies have shown that mindfulness relates to amygdala activation and changes in brain structures that suggest more mindful individuals have greater self-awareness and self-regulation ability (Creswell et al., 2007; Fox et al., 2014). Shapiro and colleagues (2006) propose that mindfulness improves self-regulated functions as individuals attend to information in the present moment and create space between stimuli and reactions to them. In an extensive review of mindfulness and mindfulness-based interventions, Brown, Ryan, and Creswell (2007) found that mindfulness is associated with behavioral control and an increased ability to focus attention. This suggests that mindfulness training may decrease workplace cognitive failure, which is supported by cross-sectional studies finding that self-reported cognitive failures are negatively correlated with self-reported mindfulness (Froeliger, Garland, & McClernon, 2012; Herndon, 2008; Klockner & Hicks, 2015).

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 (Good et al., 2015). These impacts have implications for workplace outcomes, including colleague relationship quality, worker well-being, and performance. Consistent with Campbell et al.'s (1993) conceptualization of safety performance within the theories of job performance, Good et al. (2015) include emerging evidence of safety performance in the category of workplace performance outcomes. This evidence is based on Zhang and colleagues' (2013 and 2014)

examination of the relationship between self-reported levels of mindfulness and safety performance from a series of cross-sectional studies of Chinese power plant operators. They found that high self-reported levels of mindfulness were associated with high levels of self-reported safety compliance and safety participation among workers who completed complex tasks (Zhang, Ding, Li, & Wu, 2013) and among employees with high intelligence (based on test scores obtained during their training) and advanced experience (Zhang & Wu, 2014).

Mindfulness training, which involves increasing a person's ability to attain nonjudgmental awareness in the present moment (Kabat-Zinn, 1990), can improve individuals' temporary state mindfulness as well as long-term and stable trait mindfulness (Carmody, Reed, Kristeller, & Merriam, 2008; Chambers & Allen, 2008). Mindfulness training has been incorporated into physical and mental health treatment programs with success (Baer, 2003). Similarly, many workplace wellness programs have started to include mindfulness training. These programs are associated with positive outcomes among workers (Glomb, Duffy, Bono, & Yang, 2011; Good et al., 2015; Virgili, 2015; Wolever et al., 2012).

Mindfulness-based stress reduction (MBSR) interventions in particular have been shown to improve brain and immune function (Davidson et al., 2003), reduce stress, and promote positive outcomes among both clinical patients and healthy volunteers (Chiesa & Serretti, 2009; Grossman, Niemann, Schmidt, & Walach, 2004). MBSR programs have had success in reducing negative outcomes among health care workers including anxiety, depression, and perceived stress levels (Cohen-Katz, Wiley, Capuano, Baker, & Shapiro, 2004; Fortney, Luchterhand, Zakletskaia, Zgierska, & Rakel, 2013; Geary & Rosenthal, 2011; Goodman & Schorling, 2012; Irving, Dobkin, & Park, 2009; Lamothe et al., 2016; Shapiro, Astin, Bishop, & Cordova, 2005). The MBSR program, developed at University of Massachusetts School of Medicine, trains

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participants to incorporate mindfulness into their daily lives (Kabat-Zinn, 2003). The well-validated program consists of eight 2.5- to 3.5-hour weekly group sessions and one longer (typically six to eight 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 (Santorelli, 2014).

The effect of MBSR training on workplace cognitive failure and workplace safety has not been previously tested in a healthcare setting.

Study Purpose

The current study used a waitlist controlled trial design to test a Mindfulness-Based Stress Reduction (MBSR) intervention strategy to decrease cognitive failure and improve safety compliance and participation among health care workers.

Research Question 1: Does implementing a MBSR intervention among hospital health care workers decrease self-reported workplace cognitive failure and improve safety compliance and participation?

Hypothesis 1: The MBSR intervention will result in a greater decrease in cognitive failure from baseline to post-intervention time points among study participants in the intervention group compared with the waitlist control group.

Hypothesis 2: The MBSR intervention will result in a greater increase in safety compliance from baseline to post-intervention time points among study participants in the intervention group compared with the waitlist control group.

Hypothesis 3: The MBSR intervention will result in a greater increase in safety participation from baseline to post-intervention time points among study participants in the

intervention group compared with the waitlist control group.

Research Question 2: Does the MBSR program lead to a sustained decrease in self-reported workplace cognitive failure and safety compliance and participation among hospital care workers six 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

Target Population

The target population of study for the current research project was health care workers in a hospital setting who are involved in direct patient care. To obtain a sample of the target population, I recruited 23 health care workers from a hospital healthcare system in Colorado. Participants were recruited through postings and announcements through the hospital intranet and hospital computer screensavers. Eligibility for this study included health care workers involved in direct patient care at the participating hospitals who did not have post-traumatic stress disorder or untreated clinical depression. The study was reviewed and approved by the university and hospital Institutional Review Boards.

Study Design

To answer the research questions and test the hypotheses, 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. 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. The MBSR program trains participants to incorporate mindfulness into their daily lives (Kabat-Zinn, 1990).

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.

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 post-intervention; September 2014), and six 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 post-intervention; November 2014) and six months after they completed the course (May 2015). All participants were asked to keep a log of their weekly meditation and yoga practices during the study period. Participants completed questionnaires through a secure online survey site.

Measures

Demographic variables including age, 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. I 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 times for the scale. There were no scale-level missing data.

Outcome measures. As a manipulation check, I measured mindfulness using the 15-item

Mindfulness Attention Awareness Scale (MAAS, Brown & Ryan, 2003), which measures trait

mindfulness among a general adult population. Participants rated items such as "I find myself

preoccupied with the present or the past" 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 ($\alpha = .88$).

I used 13 items from Wallace and Chen's (2005) measure of workplace cognitive failure.

Participants rated items such as **"**I forget where I have put something I use in my job" on a 5-

point Likert frequency scale ranging from "*Never*" to "*Very Often*." One item from the

Cognitive Failures Questionnaire (Broadbent, Cooper, FitzGerald, & Parkes, 1982) 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 ($\alpha = .86$).

Finally, I used Neal, Griffin, and Hart's (2000) 8-item measure of workplace safety

performance that assesses safety compliance (e.g., "I use the correct safety procedures for

carrying out my job") and safety participation (e.g., "I voluntarily carry out tasks or activities

that help to improve workplace safety") on a 5-point scale ranging from "*Strongly Disagree*" to

"*Strongly Agree*." Although many studies have examined safety performance as a

unidimensional composite variable, Griffin and Neal's 2006 research findings suggest that safety

compliance and participation offer distinct facets of safety performance. As such, I assessed the

facets separately. In the current study's sample, the safety compliance subscale demonstrated high internal consistency (α = .90), and the safety participation subscale demonstrated adequate internal consistency (α = .77).

Data 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, I tested for differences in participant characteristics by treatment group at baseline using Pearson's chi square test for categorical variables and independent samples t-test for continuous variables. To perform the manipulation check and test the study hypotheses, I used four univariate repeated measures analyses of variance (RM ANOVA) time by group interaction effects to compare the baseline and immediate post-intervention scores between groups for mindfulness, workplace cognitive failure, and the two facets of safety performance. Effect sizes were estimated using partial eta squared (η_P^2) and interpreted following Cohen's (1988) guidelines for small effect sizes (η_P^2 = .01), moderate effect sizes (η_P^2 = .06), and large effect sizes (η_P^2 = .14). Finally, I conducted paired-samples t-tests to answer the second research question about the stability of the intervention effects from both groups' post-intervention time point to the 6-month follow-up data collection on the significant outcomes for all participants.

<div align="center">Results</div>

Twenty-three 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

<div align="center">56</div>

the first session due to changes in her job and was not included in analyses. The remaining 22

participants completed the baseline and first post-intervention surveys and were included in the

analyses for Research Question 1. Three participants within the waitlist control group dropped

out of the study during the wait period and another two quit during 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 for Research Question 2.

Participant attrition is depicted in Figure 1.

Twenty (91%) of the initial 22 participants were female and a majority (86%) were

nurses. The distribution of participant age, 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 Square

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.

Independent samples t-tests indicated that baseline mean mindfulness, mean workplace

cognitive failure, mean safety compliance, and mean safety participation scores did not differ by

treatment group. Table 2 depicts baseline and immediate post-intervention 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 ($F (1, 20) = 7.24$, $p = .014$, $\eta_P^2 = .27$) with a significantly greater increase in

mindfulness scores from baseline to immediate post-intervention 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 ($F (1, 20) = 7.44$, $p = .013$, $\eta_P^2 = .27$) with the immediate intervention group experiencing a greater decrease in workplace cognitive failure from baseline to immediate post-intervention time points than the waitlist control group, supporting hypothesis one. In support of hypothesis two, there was a significant time by treatment group interaction effect for safety compliance ($F (1, 20) = 7.79$, $p = .011$, $\eta_P^2 = .28$) with the immediate intervention group having a greater increase in safety compliance from baseline to immediate post-intervention time points than the waitlist control group. Hypothesis three was not supported. The interaction effect between treatment group and time for safety participation was not significant ($F (1, 20) = 0.40$, $p = .54$, $\eta_P^2 = .02$). This indicates that the MBSR intervention did not significantly impact safety participation or promotion of safety in the workplace.

In response to the second research question, paired-samples t-test results revealed no significant differences between each groups' post-intervention 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 (post-intervention mean = 2.04; 6-month follow-up mean = 2.05; $p = .88$) or safety compliance (post-intervention mean = 4.50; 6-month follow-up mean = 4.42; $p = .50$) among the 16 participants who completed the questionnaires at those time points. These results support the stability of effects of the MBSR intervention on workplace cognitive failure and safety compliance six months following the program.

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 (η_P^2 values ranging from .27 to .28). These effects were stable six 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 (Froeliger, Garland, & McClernon, 2012; Herndon, 2008) and within the workplace (Klockner & Hicks, 2015). 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 and colleagues, 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 (Zhang, Ding, Li, & Wu, 2013) and those with more experience and higher levels of intelligence (Zhang & Wu, 2014). 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 and colleagues. Cultural or industry differences might also account for the discrepancies between the current study's findings on U.S. health care workers and those of Zhang and colleagues, 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 (Kabat-Zinn, 2003), 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 (Dragano, Lunau, Eikemo, Toch-Marquardt, van der Wel, & Bambra, 2015; Starren, Hornikx, & Luijters, 2013).

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 (Broadbent, Cooper, Fitzgerald, & Parkes, 1982; Norman, 1981; Wallace & Chen, 2005). In a conceptual review of mindfulness at work, Good et al. (2015) 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 and colleagues 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. The lack of the mindfulness training's impact on safety participation in the current study could be due to its inclusion of health care providers from a variety of work groups rather than whole work groups. Research findings indicate that mindfulness training that targets health care provider teams can increase teamwork and collaboration (Singh, Singh, Sabaawi, Myers, and Wahler, 2006). 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 (Clarke, 2010). This is especially important within the healthcare setting, where effective teamwork also impacts patient safety and quality of care (Kalisch, Curley, & Stefanov, 2007; Manser, 2009).

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

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tested seem similar across the two group. However, the clinician experience seemed to differ slightly on face value, although the Pearson's Chi Square test did not indicate a significant difference.

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 (Neal & Griffin, 2006; Wallace & Chen, 2005). 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 present study adds 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 (Irving, Dobkin, & Park, 2009; Lamothe et al., 2016) as well as

safety outcomes, which in turn 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 (Charney & Schirmer, 2007; Yassi & Hancock, 2005).

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. This project's estimates of effect sizes and trends in the relationship between mindfulness training and hospital health care worker cognitive failure and safety performance can inform the power calculations of larger-scale randomized controlled trials that address the larger questions about the intervention's impact on health care safety.

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 hypothesized mediation model 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 (Wallace, Lemaire, & Ghali, 2009), 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.

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Table 1
Participant Characteristics at Baseline by Treatment Group

O	Waitlist Control Group (n=12)	Immediate MBSR Intervention Group (n=10)
	n (%)	*n (%)*
Female	12 (100%)	8 (80%)
Median Age (Range)	49 (24-60)	41 (27-59)
Ethnicity		
Hispanic	0 (0%)	1 (10%)
Non-Hispanic White	12 (100%)	9 (90%)
Previous Experience Practicing Meditation	3 (25%)	4 (40%)
Previous Experience Practicing Yoga	5 (41.7%)	5 (50%)
Clinician Type		
Registered Nurse	12 (100%)	7 (70%)
Nurse Practitioner	0 (0%)	1 (10%)
Paramedic	0 (0%)	2 (20%)
Years as Clinician		
Less than 5	2 (16.7%)	1 (10%)
6 to 10	0 (0%)	3 (30%)
11 to 20	5 (41.7%)	3 (30%)
21 to 30	0 (0%)	1 (10%)
More than 30	5 (41.7%)	2 (20%)
Work Night Shift	1 (8.3%)	1 (10%)
Hours Worked Per Week		
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		
Excellent	3 (25%)	1 (10%)
Very Good	3 (25%)	1 (10%)
Good	5 (41.7%)	8 (80%)
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)
Mean Subjective Work Stress (SD)	3.56 (0.87)	4.04 (0.58)

Note. SD = standard deviation. Psychological health was measured using Kristensen and colleagues' (2005) 5-item scale on a 6-point scale with higher score representing decreased psychological health. Subjective work stress was measured using Motowidlo and colleagues' (1986) 4-item on a 5-point scale with higher score representing higher levels of work stress.

Table 2

Means and 95% Confidence Intervals of Baseline (July 2014) and Immediate Post-Intervention (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 Post-Intervention *M* [95%CI]	Baseline *M* [95%CI]	Immediate Post-Intervention *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]

Note. M = mean. *CI* = confidence interval. Mindfulness was measured on a 6-point scale with higher scores representing more mindful. Workplace cognitive failure was measured on a 5-point scale with higher score representing more errors. Safety performance (including safety compliance and participation) was measured on a 5-point scale with higher score representing increased safety compliance or participation.
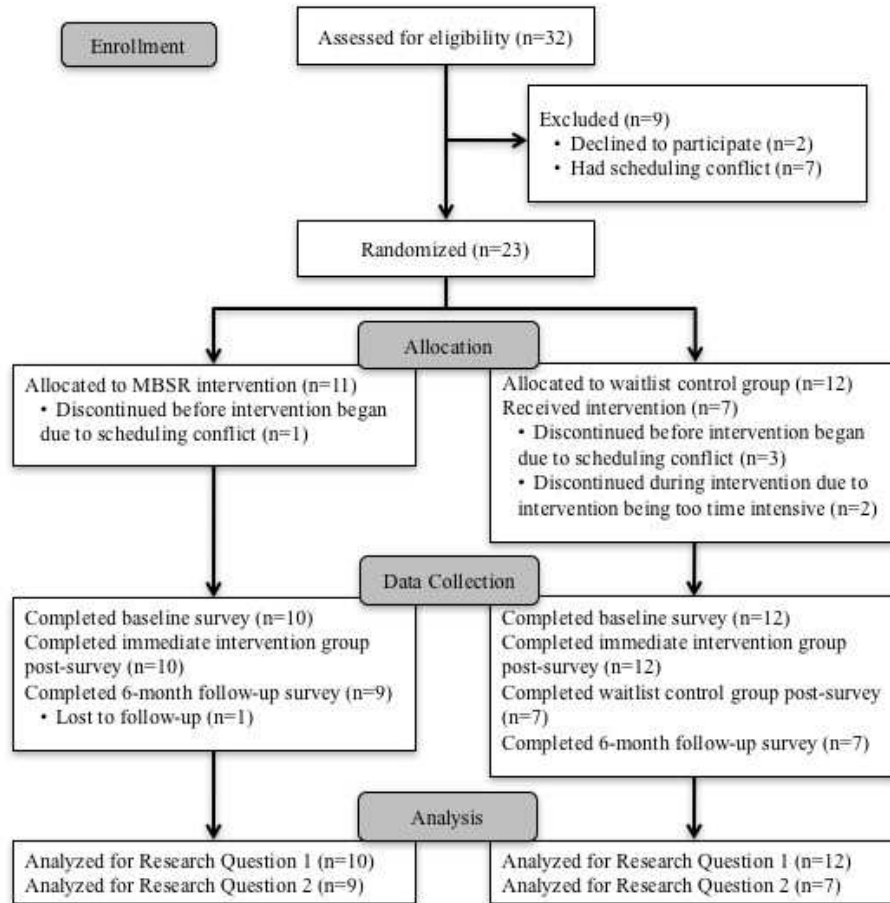
Figure 1. Consolidated Standards of Reporting Trials (CONSORT) participant flow diagram.

CHAPTER IV: DISCUSSION

Considering the significant impact that occupational safety and health has on the lives of health care workers and their patients (Wallace, Lemaire, & Ghali, 2009), evaluation of intervention strategies that promote both health care worker occupational safety and overall well-being is needed (NIOSH, 2013). While previous research has provided substantial evidence that mindfulness training leads to positive improvements in mental health among health care workers (Irving et al., 2009; Lamothe et al., 2016), the feasibility of using mindfulness training as an occupational safety and health intervention strategy that improves health care worker safety, and ultimately patient safety, has not been previously tested. Additionally, previous work on the effect of mindfulness training on health care workers has not examined the adoption of mindfulness practices using theories of health behavior that health promotion practitioners draw on to facilitate intervention design and implementation.

Using a randomized waitlist controlled trial design with a mixed methods approach, the current study sought to: 1) conceptualize hospital health care workers' experiences in adopting mindfulness practices within the context of an established health behavior theory; and 2) assess the impact of mindfulness training on safety outcomes among hospital health care workers. The study examined the effect of a Mindfulness-Based Stress Reduction course on workplace cognitive failure and safety compliance and participation among hospital health care workers. It employed a theory-driven thematic analysis approach using the constructs of the Health Belief Model to understand the participants' experiences of adopting mindfulness practice as a health behavior.

Health Care Workers' Adoption of Mindfulness Skills

The study found that although participants struggled to adhere to some of the components of the MBSR training, many of them adopted the mindfulness practices taught in the course. Less than a third of participants attended all of the MBSR training sessions, and none of the participants were able to complete the weekly home assignments during the course, which they perceived as too time intensive. Nevertheless, most of the participants reported that they continued to use the mindfulness practices they learned in the course six months after they completed the training.

In the qualitative portion of the study, themes related to the perceived severity and susceptibility constructs of the Health Belief Model did not emerge from the data. This may stem from health care workers' use of denial and avoidance as coping strategies as well as their tendency to remain silent about personal health issues that have been well-documented (Arnetz, 2001; Baldisseri, 2007; Firth-Cozens, 2001; Wallace, Lemaire, & Ghali, 2009). It may also be that these constructs within the Health Belief Model do not apply to health care workers who adopted mindfulness practices to promote general well-being rather than to prevent a specific health condition, as several of the participants reported.

The thematic analysis showed that the other Health Belief Model constructs, including internal cues to action, perceived benefits and barriers, and self-efficacy, helped portray the participants' experiences and challenges in adopting and adhering to the mindfulness practices taught in the MBSR course. The participants described benefits from mindfulness practice related to enhanced awareness that led to increased calm and focus. Participants discussed how these psychological benefits led to physical benefits and behavioral changes, such as improved diet and enjoyment of physical activity, as well as interpersonal and workplace benefits. They

described how the mindfulness practices positively changed their interactions with patients and colleagues, which they perceived as an improvement in the quality of care they provided as health care workers. The benefits of mindfulness practice that participants described are similar to the process of change experienced by other health care workers laid out by Irving et al., (2014). The benefits participants described in the present study also fit within the conceptual model Good et al. (2015) proposed in a review of the role of mindfulness within the workplace. Good and colleagues theorized that mindfulness training improves attention, which impacts cognition, emotion, behavior, and physiology, and ultimately leads to positive workplace outcomes, including performance, relationship quality, and worker well-being.

Participants described internal barriers to adoption and adherence to mindfulness practice related to their high levels of stress and experiencing some unpleasant reactions to heightened attention. Participants also described struggling to prioritize self-care, which is consistent the findings of Morgan et al. (2015). Morgan and colleagues explained how health care workers might experience difficulties focusing on self-care more so than the general population as they are trained to prioritize caring for others.

Other major barriers to adopting mindfulness practice described by the current study's participants included competing demands of work schedules and responsibilities outside of work. The participants felt that the MBSR course home assignments were not tailored to their schedules and were too time intensive. These findings align with previous research that highlights the logistical challenges health care workers experience when participating in mindfulness interventions due to limited time and scheduling conflicts (Mensah & Anderson, 2015; Morgan, Simpson, & Smith, 2015).

Additional course-related barriers participants cited included the limited presentation of the evidence behind the program and a lack of discussion about tactics aimed at incorporating mindfulness at work in health care settings. For these reasons, participants stated that they did not feel that the course was designed with their needs in mind. The MBSR program was initially designed for chronic pain patients who received the training in a medical setting (Kabat-Zinn, 2003). The MBSR program was not tailored for health care workers in the current study for the sake of maintaining the fidelity of the evidence-based course. Recent work has started to examine the effectiveness of mindfulness training modified specifically for health care workers. For example, Irving and colleagues (2014) assessed a training called mindfulness-based medical practice, that added mindful communication training to the standard 8-week MBSR course to enrich clinician-patient interactions. Participants in the modified course, like those in the current study, reported scheduling conflicts and difficulties with the time-intensiveness of the course. Other recently developed mindfulness training programs intended for health care workers, such as the one used by Fortney et al. (2013), employ the same teaching methods and mindfulness practices taught in MBSR but condense the course over a shorter time period to better conform to the schedules of health care workers. Fortney and colleagues found that the modified mindfulness training led to significant improvements in mental health outcomes among health care workers, but the authors did not discuss the participants' perceptions of the feasibility of the course or participants' ability to adhere to the mindfulness practices taught in the course. While these mindfulness training programs offer mindfulness training options that may be more appropriate for health care workers than the standard MBSR training, additional evidence is needed to establish the programs' efficacy and feasibility among health care workers.

Mindfulness and Health Care Safety

The quantitative findings of the study suggest that mindfulness training can affect safety outcomes among hospital health care workers. The MBSR intervention led to a significant decrease in workplace cognitive failures and an increase in the safety compliance aspect of safety performance among participants. Estimated effect sizes for each of the significant relationships were large (η_P^2 values ranging from .27 to .28). These effects were stable six months after participants completed the training. Contrary to the study's hypothesis, mindfulness training did not increase hospital health care workers' safety participation, the facet of safety performance that involves advocacy of safety within the workplace.

The significant impact of the MBSR intervention on workplace cognitive failure in the present study aligns with previous cross-sectional research that has demonstrated an inverse relationship between mindfulness and cognitive failure both in general (Froeliger, Garland, & McClernon, 2012; Herndon, 2008) and within the workplace (Klockner & Hicks, 2015). 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, it did not significantly impact the safety participation aspect of safety performance. The latter finding conflicts with the cross-sectional research conducted by Zhang and colleagues, 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 (Zhang, Ding, Li, & Wu, 2013) and those with more experience and higher levels of intelligence (Zhang & Wu, 2014). While all of the present study's participants were complex task-holders in their roles as health care workers, the study was not designed to test potential moderators such as

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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 and colleagues.

Cultural or industry differences might also account for the discrepancies between the current study's findings on U.S. health care workers and those of Zhang and colleagues, who studied Chinese power plant workers. Previous research suggests that safety behaviors and their antecedents are influenced by industry and national culture (Dragano, Lunau, Eikemo, Toch-Marquardt, Starren, Hornikx, & Luijters, 2013; van der Wel, & Bambra, 2015). No known studies examine the impact of culture or industry on the effectiveness of mindfulness training on work outcomes. It seems plausible that Chinese workers, who may have more familiarity with the centuries-old Buddhist-based mindfulness concepts taught in MBSR that originated in Asia (Kabat-Zinn, 2003), incorporate aspects of the MBSR training into their lives differently than their American counterparts.

Another possible explanation for the failure of the MBSR intervention to increase safety participation in the current study 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 (Broadbent, Cooper, Fitzgerald, & Parkes, 1982; Norman, 1981; Wallace & Chen, 2005). Good et al. (2015) 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 and colleagues 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. While safety participation is reported at the individual level, it operates on an interpersonal level with the promotion of safety and reporting of hazards. As such, 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.

The lack of the mindfulness training's impact on safety participation in the current study could be due to its inclusion of health care workers from a variety of work groups rather than whole work teams. Research findings indicate that mindfulness training that targets health care provider teams can increase teamwork and collaboration (Singh, Singh, Sabaawi, Myers, and Wahler, 2006). 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 (Clarke, 2010). This is especially important within the healthcare setting, where effective teamwork also impacts patient care outcomes (Kalisch, Curley, & Stefanov, 2007; Manser, 2009).

Both the qualitative and quantitative findings in the present study suggest that mindfulness training among health care workers may improve patient safety and quality of care. In the qualitative portion of the study, participants described improved communication with participants, which they believed improved the quality of care they provided to patients. This aligns with previous work that found that patient satisfaction and patient-centered communication increases with health care providers' mindfulness (Beach et al., 2013; Krasner et al., 2009). Additionally, the quantitative findings that mindfulness training led to significant decreases in workplace cognitive failure have implications for patient safety. Workplace cognitive failure has been suggested by Groopman (2007) and tested by Park and Kim (2013) to contribute to patient safety incidents.

Implications

The present study adds to the growing body of literature on the impact of mindfulness training on health care workers, indicating that the training not only affects previously examined worker well-being outcomes (Irving, Dobkin, & Park, 2009; Lamothe et al., 2016), but also influences health care worker safety outcomes, which in turn impact occupational injuries and patient care. The 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 (Charney & Schirmer, 2007; Yassi & Hancock, 2005).

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 health care safety. This project's

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estimates of effect sizes and trends in the relationship between mindfulness training and hospital health care worker cognitive failure and safety compliance can inform the power calculations of future randomized controlled trials that address the larger questions about the impact of mindfulness on health care safety.

The study's qualitative findings suggest that health promotion practitioners who aim to provide mindfulness training to health care workers should tailor the course timing and materials to fit health care workers' demanding schedules. Didactic materials and group discussions should thoroughly explain the growing body of evidence that supports the use of mindfulness practices in health care and provide practical, health care-specific applications of mindfulness practices. By addressing the barriers that participants described in the present study, practitioners may be able to maximize the benefits experienced by health care workers who participate in mindfulness training as an occupational safety and health intervention strategy.

Limitations

Researcher Engagement

As the primary researcher, my perspectives, experiences, and engagement with the research topic influenced the development of the study approach as well as the analysis and interpretation of the findings. As such, it's important to state my background and level of involvement in the study. I am a 33-year-old Caucasian female doctoral student in applied social and health psychology with a focus in occupational health psychology. I have completed two mindfulness interventions as a research participant. Shortly before the beginning of the current study, I attended the Mindfulness-Based Stress Reduction in Mind-Body Medicine 7-Day professional training program led by Drs. Kabat-Zinn and Santorelli, which deepened my understanding of the MBSR intervention and supported the growth of my personal mindfulness

practice. I have found that these experiences and my personal mindfulness practice have improved my focus and ability to regulate my attention and emotions. I expected that the participants of the study would experience similar outcomes. I engaged in the first of the two MBSR courses used in the study to observe the training. My presence in the training may have had unknown effects on the first group of participants that did not apply to the participants in the waitlist control group.

Study Design and Setting

The study 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 participants self-selected into the MBSR course as volunteers in the study. The study's findings on participants' experiences in adopting and adhering to mindfulness practices were shaped by their motivations and willingness to participate in the study and may not generalize to other health care workers. The randomized waitlist controlled trial design increased the study's internal validity, helped limit selection bias, and provided an ability to assess causality between constructs in the quantitative portion of the study. However, the nature of the study as a dissertation project prevented me from employing blinding in allocation or analysis, which may have introduced some researcher bias in the study. Additionally, the study used a waitlist control group as the comparison group rather than a placebo control or an active control. As such, the findings cannot speak to the equivalence of the mindfulness training in comparison to health care safety training or relaxation training that does not incorporate mindfulness meditation (e.g. Creswell et al., 2016).

The qualitative data were collected using open-ended questions in a series of surveys. Although participants were encouraged to provide examples of their experiences, many of the

participants kept their responses brief. Their concise statements are valuable in understanding

their adoption and adherence to mindfulness practices taught in MBSR training. However, due

to the survey methodology used in the present study, I did not have an opportunity to ask

participants for additional explanation or narrative examples or probe deeper into themes that

emerged as researchers do when using other qualitative methods such as focus groups and in-

person interviews.

The qualitative portion of the study used the Health Belief Model as a guiding health

behavior theory. The Health Belief Model is a psychosocial health behavior model that focuses

on individual-level attitudes and beliefs that influence health behavior decisions (Becker, 1974).

Given the intrapersonal focus of many mindfulness practices, constructs of the Health Belief

Model, particularly the perceived barriers and benefits seen in the present study, offer a useful

theoretical starting point to understand health care worker adoption and adherence to

mindfulness practices taught in the MBSR course. Reviews of research using the Health Belief

Model demonstrate the model's constructs that best explain health behaviors are the perceived

barriers followed by the perceived benefits, especially among preventive health behaviors

(Carpenter, 2010; Janz & Becker, 1984), like mindfulness practices. However, the model does

not directly address the potentially powerful social and societal determinants of health behaviors,

which limits the scope of the study's qualitative findings on the experiences of health care

workers as they adopted mindfulness practices. This is a limitation of the quantitative findings

as well, which focused on individual-level factors and did not examine the many organizational

factors that influence health care safety.

Additional limitations of the quantitative portion of the study stem from its small sample

size. The study was not designed with enough power to statistically test the hypothesized

mediation model between mindfulness, workplace cognitive failure, and components of safety performance or test for potential moderators in the relationship between mindfulness and safety outcomes. 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 group. However, clinician experience seemed to differ slightly on face value, although the Pearson's Chi Square test did not indicate a significant difference between the two groups. Additionally, the quantitative 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.

Due to its scope, the study relied on self-reported measures of safety outcomes. Self-reported measures may have introduced response bias due to variations in participants' recall accuracy or their desire to provide responses to questions about workplace safety and cognitive failures that they perceived as favorable (Donaldson & Grant-Vallone, 2002). The present study assessed workplace cognitive failure and safety compliance and participation as proximal outcomes for occupational injuries among hospital health care workers and patient safety incidents, which are the ultimate outcomes of interest. While the use of subjective measures of proximal safety outcomes is a limitation of the present study, previous research provides validity evidence for the measures used in the present study and supports their relationship to objective measures workplace injuries (Wallace & Chen, 2005; Neal & Griffin, 2006) and patient safety (Park & Kim, 2013).

Future Research

In view of the study's limitations and partial support for its hypotheses, additional investigation into the role of mindfulness training as an occupational safety and health intervention strategy for health care workers with patient safety implications is warranted. Given the attrition that occurred and the participants' description of components of the course as too time-intensive and conflicting with their schedules, it is important for future research to assess the feasibility of abbreviated or modified mindfulness training programs, such as those developed by Fortney et al. (2013). 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. Researchers should partner with health care organizations when planning future studies to determine how to successfully incorporate mindfulness training and practices within healthcare organizations.

The qualitative findings in the present study describing the health care workers' experiences of adopting mindfulness practices only partially fit within the Health Belief Model's constructs, with no themes emerging from two of its six constructs – perceived susceptibility and perceived severity. As research continues to explore the impact that mindfulness training has on health care worker occupational safety and health and ultimately patient care, the field could be advanced by researchers using other more complex health behavior models as guiding theories. For instance, models with a social-ecological framework (McLeroy, Bibeau, Steckler, & Glanz, 1988) incorporate the interplay of individual, social, organizational, and societal factors in determining health behaviors. Such models may offer a richer and more nuanced understanding of health care workers' adoption and sustained use of mindfulness practices. By examining the factors at multiple levels of influence that enhance the occupational safety and health benefits of

health care worker mindfulness practice, researchers can identify ways organizations and health promotion practitioners can extend support for continued mindfulness practice within the workplace. This may in turn enable health promotion practitioners to maximize the health care safety benefits of mindfulness programs.

Additionally, the quantitative findings supported the ability of mindfulness training to decrease cognitive failures and improve safety compliance; however, no effect on safety participation was seen in the current study. Future research can explore factors and conditions, such as offering training to health care worker teams rather than individuals from numerous hospital units, under which mindfulness may improve safety participation. Further examination of other possible moderators, such as clinician experience, on the impact the effectiveness of mindfulness training on health care safety is needed. Identifying critical moderating variables would allow practitioners to understand the contextual and participant characteristics that enhance or limit the effect of mindfulness training on health care safety.

Future studies can extend and improve upon the current study by using objective measures of health care safety outcomes, such as hospital records of workplace injuries that result in time away from work and hospital incident reports of medical errors and adverse patient events, in addition to subjective outcomes such as clinician and patient reports of quality of care. Larger studies can also build on the current study by statistically testing the hypothesized mediation model between mindfulness, workplace cognitive failure, safety compliance and ultimately occupational injuries and patient safety outcomes. Examination of other potential mediating variables, in addition to cognitive failure, in the causal pathway between mindfulness training and health care safety outcomes is needed. As discussed above, Good et al. (2015) have suggested that mindfulness training leads to cognitive, emotional, behavioral, and physiologic

changes that influence the broad categories of performance, well-being, and relationship work outcomes. Cognitive failure is only one variable within the cognition line of influence of mindfulness training on safety performance, which falls under the larger area of study related to performance at work. There are potentially impactful emotional, behavioral and physiologic mediating variables that have yet to be explored. Similarly, there has not been research on the interplay between performance, well-being, and relationship work outcomes of mindfulness training. An assessment of the interconnectedness of these areas of influence from mindfulness training could lead to useful lines of intervention research in understanding the link between health care worker safety and well-being and patient safety and care. By addressing these avenues of investigation, future research can build off of the present study's findings to explain how and why workplace mindfulness interventions work as well as how mindfulness training outcomes may differ by population and setting. In doing so, future studies can further support the promotion of practical and sustainable mindfulness practices as part of employee safety and wellness initiatives that reduce health care worker injuries and improve the well-being of clinicians and their patients.

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