

# Minding the Gap: Extending Mindfulness to Safety-Critical Occupations

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In their focal article, Hyland, Lee, and Mills (2015) discuss several potential areas in which mindfulness interventions may improve work performance. Some of these include creativity and sales performance (Chaskalson, 2011; Seligman, 2006). We agree that future research should continue to examine the potential benefits of mindfulness and propose an additional domain in which mindfulness interventions may be particularly beneficial: safety performance.

Safety performance has widespread implications both for individuals and for society as a whole. Consider, for instance, the recent Amtrak Train 188 accident in Philadelphia that killed eight and injured scores more. Despite safety speed limitations of 50 mph, Amtrak Train 188 was traveling over 100 mph when the accident happened. Although the cause of the accident remains officially undetermined, the fact that the train was exceeding the safe speed recommendations begs for an explanation and methods of prevention. The health and safety literature tells us that contextual variables can impact safety decisions. Though pure mechanical error is a possible cause of this particular accident, investigations have suggested that human factors may be implicated in many transportation incidents. Such human factors (e.g., attention, fatigue, changing work schedules) have been speculated to influence the speed at which the engineer chose to travel (Knickerbocker, 2015).

The prevalence of safety incidents and unsafe behavior at work is profound. Although workplace fatalities are down by approximately 25% over the past decade, there remain an astonishing 4,600 to 5,900 workplace fatalities and 3 million nonfatal injuries each year in the United States (U.S. Department of Labor, 2014/2015). Further, these fatalities, injuries, and illnesses are associated with subsequent mood disorders, substance abuse, and

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family hardship in survivors (Kaplan & Tetrick, 2011), resulting in great economic and psychological strain.

A broad framework of predictors, drawn from Kaplan and Tetrick's (2011) work and call for future research, illustrates how mindfulness may improve safety performance. With a greater focus on cognitive and physical effects, fatigue and decrements in vigilance compose the first group of predictors. The second group of predictors, more related to well-being, includes stress and anxiety. Evidence suggests that mindfulness has the potential to positively influence each of these predictors, as we will describe further below. Hyland et al. (2015) propose that the positive effects of mindfulness have both mental and psychological roots, and this response will link those roots to safety behavior in hopes that future mindfulness research will include safety-related performance outcomes.

### **Fatigue and Decrements in Vigilance**

Many safety-critical occupations (e.g., counterterrorism screenings, medical monitoring, military surveillance) require *vigilance performance*: sustained periods of attention in which employees monitor the environment for rare but important signals with possible safety implications (Parasuraman, 1986). Vigilance performance has been shown to be highly mentally demanding, and although monitoring for and identifying threat-related stimuli can have life-or-death implications, research suggests that human capability to perform sustained vigilance is generally poor (Davies & Parasuraman, 1982). Extended periods of vigilance drain one's limited pool of attentional resources, resulting in a propensity to miss important signals. In fact, a well-documented *vigilance decrement* occurs after 30 minutes of vigilance task performance. Research has further suggested that this vigilance decrement is associated with fatigue and cognitive demand as opposed to boredom and inattention (Warm, Parasuraman, & Matthews, 2008). The vigilance decrement may threaten not only employees performing such tasks (e.g., nuclear power plant operators monitoring plant levels or pilots monitoring autopilot performance) but also public safety more generally. Thus, interventions that decrease fatigue and improve the capacity for sustained mental attention may increase vigilance performance—as discussed further below, mindfulness interventions may be one lever for improving vigilance performance.

Before turning to mindfulness, however, we note that fatigue is an oft-cited cause of poor safety performance in nonvigilance contexts as well. Fatigue, and its subsequent depletion of cognitive and emotional resources, is an especially dangerous outcome of occupations involving shift work (e.g., doctors, nurses) and long hours (e.g., truck drivers), leaving employees at risk of unsafe behavior (Helton & Russell, 2011). In fact, recent legislation has called for more limitations on medical intern and resident work hours,

a limit set at 80 hours nearly a decade ago. Moreover, in the Amtrak case, many speculate whether recent restructuring of engineers' jobs, leading to more variable, potentially longer shifts, might have impacted the engineer's behavior the night of the accident.

Research shows that mindfulness has the potential to affect safety performance by decreasing physical and emotional fatigue. As a supplemental recovery mechanism, mindfulness boosts sleep quality (Carlson & Garland, 2005), a particular concern for those faced with shift work or irregular schedules. These schedules conflict with human circadian rhythms and limit the amount of sleep one is able to acquire. Although there is no replacement for sleep itself, improved sleep quality provides a valuable benefit. In addition to alleviating physical fatigue, mindfulness can alleviate the emotional exhaustion (Hülshager, Alberts, Feinholdt, & Lang, 2013) that is especially common in jobs with a safety-critical emphasis. For example, in caregiving and customer service occupations (e.g., nursing, teaching, and mental health care), mindfulness has been shown to alleviate fatigue (Gold et al., 2010; Mackenzie, Poulin, & Seidman-Carlson, 2006; Shapiro, Brown, & Biegel, 2007).

Fatigue has also been linked to compromised working memory (Lange et al., 2005), and studies such as that by Wallace and Vodanovich (2003) demonstrate that cognitive failure, unsurprisingly, is an indicator of unsafe performance. Mindfulness not only lessens physical and emotional fatigue but additionally buffers against depletion of one's limited pool of cognitive resources through its ability to increase attentional processing capabilities. As the focal article highlights, Thich Nhat Hanh describes mindfulness as the process of "keeping one's consciousness alive to the present reality" (1976, p. 11). This cultivated practice of actively attending to one's present experience is likely to circumvent cases of absentmindedness and compromised attention connected to workplace accidents (Lawton & Parker, 1998). Such attentional augmentation may also improve employees' abilities to identify safety hazards and procedural violations. Thus, we propose working memory capacity may mediate the association between fatigue and safety performance. Moreover, mindfulness may encourage higher safety performance by decreasing such fatigue and strengthening cognitive resources.

As explained above, fatigue and vigilance decrements have well-established relationships with safety performance. Confronted with demands such as shift work, long hours, and cognitive overload caused by sustained attention, employees face a depletion of precious resources, leaving them susceptible to unsafe choices and more acute vigilance decrement. Mindfulness offers employees improved sleep quality, increased working memory capacity, and other tools with which to better assess and cope with such demands. We argue its value as an intervention capable of bolstering

safety performance through its mitigation of the negative effects tied to fatigue and vigilance decrements.

### **Stress and Anxiety**

Stress and anxiety have also been investigated as antecedents of safety performance. The job demands-resources (JD-R) model (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001) provides a valuable framework for considering this relationship. When jobs simultaneously entail high levels of demand (e.g., changing or unpredictable schedules, production or schedule delays, role overload) and low levels of resources (e.g., low job control, low supervisor support), employees commonly experience greater stress, illness, and injury. When one exerts effort to manage overwhelming job demands, overload may result. Moreover, when faced with less stark yet chronic job demands, one may experience an erosion of resources over time. In turn, employees are unable to sustain levels of exertion and are prone to symptoms such as burnout and compromised safety.

Burnout is a common outcome in safety performance research and is especially relevant to this discussion as it is commonly described as a compilation of stress, anxiety, and other health and psychological reactions. In Nahrgang, Morgeson, and Hofmann's (2011) JD-R model of workplace safety, burnout was illustrated as an outcome of both demands levied and resources available. Further, the researchers meta-analytically linked burnout with safety performance. Thus, it is evident that burnout is impacted by an employee's internal resources and is a critical antecedent of safety. It is likely that interventions like mindfulness, which bolster these resources, will reduce ensuing burnout and result in improved safety performance.

Additional research has investigated specific components of burnout, stress, and anxiety, independently. The linkages have been supported, and evidence suggests that the relationship between demands and resources and resulting safety performance often occurs indirectly through these psychological symptoms (Goldenhar, Williams, & Swanson, 2003). For example, Probst and colleagues (Probst, 2002; Probst & Brubaker, 2001) found that anxiety- and stress-provoking job insecurity was linked to decreased safety motivation and compliance. They further found that perceptions of incipient layoffs (an example of high demand and low resources) resulted in greater productivity yet decreased safety behaviors. The implication is that the employees' limited resources could not meet both productivity and safety demands at once. These studies and numerous others evaluating stress, anxiety, and burnout (e.g., Berland, Natvig, & Gundersen, 2008; Laschinger & Leiter, 2006) underscore how stress and anxiety in the workplace are critical components of safety.

As Hyland et al. (2015) argue, stress and anxiety reduction are core outcomes of mindfulness. Perhaps most promising is the amount of corroborating evidence, both physiological and psychological, supporting this relationship. Brain imaging studies suggest a clear association between mindfulness and portions of the brain thought to be most linked with stress (e.g., Hölzel et al., 2010). Mindfulness is also associated with decreased cortisol secretion, well known for its association with stress (Brand, Holsboer-Trachsler, Naranjo, & Schmidt, 2012). At the psychological level, evidence indicates mindfulness results in less rumination on negative past events and catastrophizing of potential future events, thus equipping individuals with more adaptive coping styles (Weinstein, Brown, & Ryan, 2009). Instead of feeling subject to the unpredictability of one's work environment and the powers that be (i.e., job demands), in an enlightened state, those who are mindful are able to press the pause button to *purposefully* regulate their thoughts and responses, including those related to safety.

Under the JD-R model, one can think of this process as bolstering one's supply of resources to handle demands. For instance, though one may not have control over shift work, available safety equipment, or unsafe colleagues, individuals have some influence over how they *cope* with such stressors. By reevaluating their stressors and choosing an alternative response to them, mindfulness allows one to circumvent the likelihood of further exacerbating such factors through high levels of stress and anxiety. Ultimately, these more adaptive coping and evaluation processes help to free employees from maladaptive psychological states and, through this process, prevent burnout as well (e.g., Goodman & Schorling, 2012). As such, mindful individuals are able to bring their full selves to work, thus enabling them to better recognize threats to safety and consciously choose safe behavior.

## Conclusion

In sum, the health and safety literature explains the interplay between the demands of the job and the resources of the employee. These demands can be physical, cognitive, and emotional in nature. We posit that mindfulness interventions are likely to equip employees with a broader set of personal resources with which to cope with these demands. Evidence already supports the viability of traditional safety training programs aimed at developing employees' overall knowledge of safety-related policies and procedures. Year after year, however, we continue to face profound rates of safety-related injury and illness, signifying the need for additional training and interventions. Given the proposed benefits of mindfulness, future research should investigate possible incremental effects and its potential to expand current safety training efforts.

Echoing Kaplan and Tetrick's (2011) original call for broader predictors of safety, we believe mindfulness interventions have an important place in the study of workplace safety and interventions to improve it. Hyland et al. (2015) highlight the booming popularity of mindfulness in psychology over the past few decades. We argue that the significance and contribution of mindfulness to our field remains in a nascent stage. Safety-critical occupations represent just one imperative and promising avenue we have yet to fully explore.

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