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Occupational safety: The role of workplace sleepiness

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ABSTRACT

Workplace sleepiness refers to how sleepy a person feels at work, and it is thought to be associated with negative occupational safety outcomes such as injuries because sleepiness can lead to behavioral decrements at work. This study explored safety behavior as a mediator of the relationship between workplace sleepiness and occupational safety outcomes (e.g., occupational injuries). A survey was conducted on certified nursing assistants working in long term care facilities. The Stanford Sleepiness Scale was used to measure workplace sleepiness. Occupational injuries were assessed in multiple ways: injury frequency, injury severity, pain frequency, pain severity-duration, and pain severity-intensity. This study provided support for a negative relationship between workplace sleepiness and safety behavior and limited support for a positive relationship between workplace sleepiness and occupational injuries. Workplace sleepiness was significantly related to pain frequency and pain severity (as indexed by both duration and intensity); however, it was not significantly related to injury frequency or severity. The results of the study also suggest very limited support for safety behavior as a mediator of this relationship. The findings suggest that the relationship between workplace sleepiness and occupational injuries might be more complex than originally assumed.

1. Introduction

Occupational safety is, and should be, a major concern for organizations and society as a whole. Data from the United States Bureau of Labor Statistics (USBLS) show that among private industry employers in the United States there were 4.4 cases of nonfatal occupational injuries and illnesses per 100 equivalent full-time workers in 2006 (USBLS, 2007b). In the same year the USBLS recorded 5703 fatal work injuries (USBLS, 2007a). While these numbers reflect a decrease in occupational injuries and illnesses from previous years, there is still cause for concern. The costs associated with occupational injuries and illnesses are extremely high. One study estimated the financial costs in the United States to be over a hundred billion dollars (Leigh et al., 2000). Hence, there is a need for continued research aimed at identifying factors which may play a role in occupational safety. The current study focuses on one such factor, workplace sleepiness.

Workplace sleepiness refers to how sleepy a person is at work (DeArmond and Chen, 2007). There are two forms of workplace sleepiness. The first is physiological in nature and refers to how sleepy someone is from a physiological perspective. Physiological workplace sleepiness is a function of sleep quotas and one's internal biological clock. The second form is subjective in nature. While subjective workplace sleepiness is influenced by one's physiology it is also influenced by other factors such as work environment, task characteristics, and motivation. The current study will focus on the latter form of workplace sleepiness.

Workplace sleepiness does not receive frequent attention in organizational research; however, the notion of a connection between sleep-related issues and occupational safety is not new. For instance, more than 90% of the respondents to the 2002 National Sleep Foundation (NSF) (1998–2002) poll conducted in the United States believed that work performance and safety were influenced by deficits in sleep. Similarly, when there is discussion of sleep and safety in research literature, references frequently are made to the 1986 Chernobyl nuclear power plant accident, the 1979 Three Mile Island nuclear power plant accident, or the 1989 Exxon Valdez oil spill. All of these catastrophes were found to be the result of human error occurring during peak hours of sleepiness (midnight to 6 am) (Folkard and Lombardi, 2006).

Despite recognition of a link between workplace sleepiness and occupational safety, there is little field research that has specifically measured workplace sleepiness and directly examined its critical role in predicting occupational safety (Krauss et al., 2003). Therefore, the current study measured workplace sleepiness in a sample of healthcare workers and explored its relationships with two occupational safety outcomes: safety behavior and occupational injuries. Both are discussed in subsequent sections. Since

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there has been fairly little research which has looked at workplace sleepiness, readers should be aware that a great deal of the previous research we used to help formulate our hypotheses focuses on variables which are likely related to workplace sleepiness (e.g., sleep quality, sleep quantity, general sleepiness, sleep deprivation, fatigue). We have used research on these types of variables due to evidence that there is a relationship between these variables and sleepiness (Carskadon and Dement, 2000; Pilcher et al., 1997, 2003, 2000; Rogers et al., 1993).

1.1. Safety behavior

Safety behavior is a specific type of job behavior that promotes the health and safety of workers, clients, the public, and the environment (Burke et al., 2002; Griffin and Neal, 2000; Hofmann et al., 2003). Burke et al. and Hoffman et al. have suggested that safety behavior involves activities such as communicating information to others (e.g., making people aware of potentially dangerous situations), planning (e.g., taking proper safety precautions before and during work in a dangerous situation), and engaging in monotonous tasks (e.g., checking and rechecking safety equipment to ensure that it is in good working order).

There is substantial research to date suggesting that workplace sleepiness might be related to safety behavior. For instance, there is evidence which links sleepiness-related variables to decrements in communication (Harrison and Horne, 2000), planning (Babkoff et al., 1985; Blagrove and Akehurst, 2001; Bugge et al., 1979; Harrison and Horne, 2000; Wallace et al., 2003), and problems engaging in monotonous tasks (Englund et al., 1985; Gillberg and Akerstedt, 1998; Gillberg et al., 1994; Mertens and Collins, 1986). There is also support for the notion that increases in workplace sleepiness might be connected to decrements in skills and motivation, which are major determinants of behavior at work (Campbell et al., 1993). With regard to skill, there is empirical evidence which supports a negative relationship between workplace sleepiness and problem solving skills (Harrison and Horne, 2000; Mertens and Collins, 1986) and also logical reasoning skills (Blagrove and Akehurst, 2001; Wallace et al., 2003). With regard to motivation there is evidence to suggest that increases in workplace sleepiness are associated with decreases in effort (Engle-Friedman et al., 2003).

These findings have been explained two ways typically. First, it is thought that some decrements in behavior are the result of what are called microsleeps. Microsleeps are 1–10 s periods in which a person slips into Stage 1 sleep while still appearing to be awake (Roehrs et al., 2000). This could be particularly problematic in work settings because when people fall into Stage 1 sleep, they do not typically report being asleep, yet their reactions to outside stimuli are diminished (Moorcroft, 1993). When someone has entered Stage 1 sleep, he/she can easily be awoken; however, electroencephalogram and electromyogram activity clearly indicates that the person sleeping.

Second, it has been suggested that the brain functions less efficiently when experiencing sleep deprivation, which can cause sleepiness. Research has linked sleep deprivation to decreased functioning in parts of the brain important for attention, arousal, higher order analysis and integration of sensory-motor information, cognition, language processing, and learning (Drummond and Brown, 2001; Thomas et al., 2000). Deficits in these functions could clearly lead to decrements in behavior at work including safety behavior.

Given these empirical findings in conjunction with the rationale for them, it seems likely that workplace sleepiness and safety behavior are negatively related; however, the research in this area has had limitations. First, studies supporting a connection between sleepiness and safety behavior often do not measure workplace sleepiness. Most measure some type of sleepiness-related variable (e.g., sleep quality, sleep quantity, fatigue, etc.). Second, studies that do measure workplace sleepiness (Bonnet and Arand, 2005; Engle-Friedman et al., 2003; Gillberg et al., 1994; Rosa and Colligan, 1988) often are conducted in laboratory settings with low realism and external generalizability. Therefore the first objective of the current study was to conduct a field study which explored the following hypothesis:

Hypothesis 1. There is a negative relationship between workplace sleepiness and safety behavior.

1.2. Occupational injuries

Another indicator of occupational safety is the occurrence of injuries. As was the case with safety behavior, a number of research findings indirectly suggest a relationship between workplace sleepiness and occupational injuries. This research can be split into two major streams. The first consists of studies that have demonstrated a relationship between sleepiness or sleepiness-related variables (e.g., difficulty sleeping, sleep quantity, fatigue) and occupational injuries (Akerstedt et al., 2002; Gabel and Gerberich, 2002; Lilley et al., 2002; Nakata et al., 2005; Simpson et al., 2005). The second is based on studies that substantiate a relationship between sleep disorders and occupational injuries (Chau et al., 2004, 2002; Ulfberg et al., 2000). Sleep disorders are thought to be related to workplace sleepiness because people with sleep disorders tend to experience increased sleepiness during waking hours (Hossain et al., 2005). These two streams of research suggest a positive relationship between workplace sleepiness and occupational injuries.

Despite this consistent support in the above research, two limitations to this research should be noted. First and foremost, none of the research above specifically measures workplace sleepiness, and there is a very limited body of research which explores associations between general sleepiness and occupational injuries (Melamed and Oksenberg, 2002). While it is quite possible that general sleepiness and workplace sleepiness are related, they should not be conceptualized as the same construct. How sleepy a person is can be influenced by what he/she is doing (e.g., engaging in tasks that are monotonous), his/her environment (e.g., temperature), or diet (e.g., consumption of stimulants). One's tasks, environment, and diet can be different at work than home. For instance, someone who did not get much sleep might have a tendency to feel sleepy at home where he/she has fairly little to do yet alert at work because his/her work is dynamic and stimulating.

To address the above concern, the second objective of the current study was to explore the connection between workplace sleepiness and occupational injuries. Following the logic behind Hypothesis 1, we propose the following hypothesis:

Hypothesis 2. There is a negative relationship between workplace sleepiness and occupational injuries.

1.3. Safety behavior as a possible mediator

Much of the existing literature that explores the connection between sleepiness-related variables and occupational injuries has suggested that the relationship may be mediated by job behavior (Chau et al., 2002; Melamed and Oksenberg, 2002). It seems logical to expect that an increase in workplace sleepiness would be related to decrements in safety behavior, and that these decrements might be in part responsible for outcomes such as occupational injuries (Hofmann and Stetzer, 1996; Reber et al., 1993). Despite this, there is no known research which explores this pattern of relationships. Thus, the third objective of the current study is to explore safety behavior as a mechanism underlying the relationship between workplace sleepiness and occupational injuries. Thus, we hypothesize that. . .