DISSERTATION

# WORKPLACE SLEEPINESS: ORGANIZATIONAL ANTECEDENTS AND CONSEQUENCES

Submitted by

Sarah DeArmond

Psychology Department

In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Summer 2007

COLORADO STATE UNIVERSITY

May 1, 2007

WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY SARAH DEARMOND ENTITLED WORKPLACE SLEEPINESS: ORGANIZATIONAL ANTECEDENTS AND CONSEQUENCES BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

Committee on Graduate Work

Jacob Hautaluoma

Pat Sample

Peter Chen, **Advisor**

Lorann Stallones, **Co-Advisor**

**Department Head/Director**

ABSTRACT OF DISSERTATION

WORKPLACE SLEEPINESS: ORGANIZATIONAL ANTECEDENTS AND CONSEQUENCES

The current research consists of two studies which investigate possible antecedents and consequences of workplace sleepiness experienced by Certified Nursing Assistants (CNAs) working in long-term care facilities. The first study explored the relationship between resident aggression (an occupational stressor) and workplace sleepiness. Resident aggression is a subtype of workplace aggression commonly experienced by CNAs working in long-term care facilities. Theory suggests that resident aggression may be associated with workplace sleepiness because resident aggression may lead to subsequent workplace sleepiness but also because workplace sleepiness may lead to subsequent resident aggression. To examine the causal nature of this relationship, this study assessed the relationships between resident aggression and subsequent workplace sleepiness and workplace sleepiness and subsequent resident aggression over the course of four consecutive work shifts. The results showed limited support for a positive relationship between resident aggression and subsequent workplace sleepiness, and no support for a relationship between workplace sleepiness and subsequent resident aggression. Future research might explore the process that might underlie the relationship

between resident aggression and workplace sleepiness. Rumination and attribution were discussed as factors that might play a role in this process.

The second study explored relationships between workplace sleepiness and aspects of occupational safety. Theoretically speaking, workplace sleepiness is thought to be associated with negative occupational safety outcomes such as injuries because sleepiness can lead to job performance decrements. In other words, it is thought that workplace sleepiness might lead to decrements in job performance and that these decrements could then lead to increases in occupational injuries. Therefore the second study explored safety performance (the safety related component of general job performance) as a mediator of this relationship. The results of the study suggest very limited support for safety performance as a mediator. This limited support might be the result of inadequacies in measures of safety performance. Some suggestions were offered for improving the measurement of this construct.

Sarah DeArmond
Psychology Department
Colorado State University
Fort Collins, CO 80523
Summer 2007

ACKNOWLEDGEMENTS

I would like to express my gratitude to a number of people who assisted and supported me throughout this endeavor. Thanks to Jack Hautaluoma and Pat Sample who served as my committee members. I greatly appreciated all of their helpful comments and flexibility throughout this process. I would like to extend a special thanks to Lorann Stallones, my co-advisor. Lorann provided important insight on my work and was always available when I needed her. I would like to express my sincere appreciation for my advisor, Peter Chen. I have learned a tremendous amount about myself and my profession through this process, and I would not have learned as much without him. I thank Peter for all of his time and guidance through the years.

I would also like to extend a heartfelt thanks to everyone in my social support network. I would have never made it through this without everyone's support and encouragement. I would like to extend a special thanks to my mother, Julie, my father, Charlie, my sister, Jennifer, and my best friend, Janelle. I would also like to extend a special thanks to my Colorado family. A vast portion of this family consists of current or former members of the Colorado State University Industrial/Organizational Psychology program. I am very thankful for everyone who has been there for me in my times of need and I hope that I have been or will be able to return the favor. I would also like to extend a special thanks to Ramon (Ray) Agbunag. Ray did more than his fair share of listening, waiting, comforting, and encouraging. For this, I will be eternally grateful.

TABLE OF CONTENTS

Page

INTRODUCTION....1
STUDY 1....17
Method....19
Results....26
Discussion....28
STUDY 2....38
Method....38
Results....47
Discussion....49
GENERAL DISCUSSION....55
REFERENCES....58
TABLES....70
FIGURES....75
APPENDICES....79

# INTRODUCTION

Krauss, Chen, DeArmond, and Moorecroft (2003) called attention to the relative lack of research on workplace sleepiness in the Industrial/Organizational (I/O) Psychological literature. Workplace sleepiness refers to how close someone is to falling asleep at work or put in other words, how sleepy a person is at work. This lack of research is of concern because most people spend a majority of their waking hours at work, and there is significant evidence to suggest that sleepiness during waking hours is a prevalent problem. For instance, a 2005 poll conducted by the National Sleep Foundation (NSF) showed that 40% of a random sample of adults from the United States got less than 7 hours of sleep per night on weekdays (NSF, 2005). Further, 50% of these respondents reported feeling tired, fatigued or not up to par during wake time at least one day a week, and 17% said that this happens every day or almost every day. Given the prevalence of sleepiness during waking hours, further investigation of this topic is needed. The current study is intended to further knowledge in this area by exploring a possible antecedent and consequence of workplace sleepiness.

## What is Workplace Sleepiness?

Before discussing possible antecedents and consequences of workplace sleepiness, it is important to explain how workplace sleepiness is being conceptualized in the current study. Workplace sleepiness is thought of as a type or special case of sleepiness. Sleepiness in general refers to how close someone is to falling asleep, or how

sleepy a person feels. Workplace sleepiness, then, is simply how close someone is to falling asleep or how sleepy that person feels at work.

There are two forms of sleepiness that might occur in the workplace: physiological and subjective. Physiological sleepiness refers to how close someone is to sleep from a physiological perspective. The brain controls sleep using one's sleep quota as well as one's internal biological clock (Culebras, 2002). One's sleep quota is determined by the amount of time spent awake, timing of previous sleep, and the quality and quantity of that previous sleep (Carskadon & Dement, 2000). Approximately one hour of sleep is required for two prior hours of wakefulness; however, there is some degree of variability amongst people. One's biological clock is controlled by the suprachiasmatic nucleus of the hypothalamus which is cued by changes in lightness and darkness. Generally speaking, peak hours of sleepiness are between 12 a.m. and 8 a.m. There is a less severe but still significant increase in sleepiness between the hours of 2 p.m. and 4 p.m. (Culebras, 2002). If sleep quotas are not met or if one's internal biological clock is disrupted, it can cause decrements in brain functioning as well as the onset of sleep. If someone is experiencing these conditions he/she would be said to be experiencing physiological sleepiness.

In contrast to physiological sleepiness, subjective sleepiness is not only influenced by one's sleep quota and one's internal biological clock, but also by things such as job or task characteristics (e.g., tasks that require vigilance), work environment (e.g., temperature), or diet (e.g., consumption of stimulants). For instance, someone who is suffering from physiological sleepiness might be able to overcome this if the work environment is noisy or if they consume caffeine. Further, even if someone is not

suffering from physiological sleepiness when doing a monotonous task he/she could feel subjectively sleepy. Subjective sleepiness at work is the focus of the current research. From this point forward when the term sleepiness is used, it is in reference to the subjective form of the phenomenon.

Krauss et al.'s (2003) review suggested a variety of antecedents and consequences of workplace sleepiness. However, these authors also noted that there had been little research conducted linking some of these proposed antecedents and consequences directly to workplace sleepiness. Much of the empirical work that Krauss et al. reviewed merely indirectly gauged relationships between these proposed antecedents and consequences and workplace sleepiness by measuring variables such as sleep quality, sleep quantity, fatigue, and psychosomatic symptoms. These are variables that are likely related to workplace sleepiness. However, these variables are not synonymous with workplace sleepiness. Thus, research which specifically measures this variable is clearly needed.

To address this need, in the current research I conducted two studies. The first study explored an occupational stressor as a possible antecedent of workplace sleepiness. The second study explored occupational safety as a possible consequence of workplace sleepiness. Unlike previous research, workplace sleepiness specifically was measured in both studies.

## Occupational Stressors as Antecedents of Workplace Sleepiness

Occupational stressors are environmental stimuli that elicit strain (Kahn & Byosiere, 1992) and require individuals to make adaptive responses (Beehr & Franz, 1986; McGrath, 1976; Shuler, 1980). Some of the occupational stressors most commonly

discussed in research literature include: role ambiguity (degree to which information about a specific role within an organization is unavailable), role conflict (when two or more demands conflict with one another such that fulfilling one would mean not fulfilling another), workload (quantity and/or complexity of work), interpersonal conflict (anything from subtle dirty looks to something as obvious as a fist fight), situational constraints (organizational conditions that impair one's ability to perform his/her job), and perceived control (degree to which an employee has discretion over how he/she completes tasks). Krauss et al. (2003) suggested occupational stressors as possible antecedents of workplace sleepiness because "people who experience a lot of stressors on the job may find it difficult to fall asleep at night, which could result in feeling sleepy during the day at work" (pp. 89 and 92). As is the case with many of Krauss et al.'s suggested antecedents of workplace sleepiness, there has been little research done on the connections between many occupational stressors and sleepiness in general let alone workplace sleepiness specifically. However, there has been more research completed on the relationships between these stressors and variables that are presumably related to sleepiness.

For instance, there is substantial research supporting a positive relationship between various occupational stressors and psychosomatic symptoms (Carayon, 1993; Frone, Russell, & Cooper, 1995; Ganster & Schaubroeck, 1991; Kivimaki, & Lindstrom, 1995; Spector, 1986; Spector, Dwyer & Jex, 1988; Spector & Jex, 1998; Spector & O'Connell, 1994). Psychosomatic symptoms are thought to be related to sleepiness because there are often items on these inventories about one's experience with sleep problems (e.g., not being able to fall asleep at night) or tiredness. This positive

relationship suggests that there might be a positive relationship between occupational stressors and sleepiness.

Occupational stressors have also been linked with sleep quantity and sleep quality. Bergmann and Volkema (1994) found that "lost sleep" was the second most likely consequence of interpersonal conflict at work, and Kageyama, Nishikido, Kobayashi, and Kawagoe (2001) documented a positive relationship between workload and "sleep debt" (lack of sleep). Similarly there has been research supporting a negative relationship between occupational stressors and sleep quality (Martens, Nijhuis, Van Boxtel, & Knottnerus, 1999). Sleep quantity and quality are thought to be related to sleepiness because decrements in sleep quantity and quality can negatively impact one's ability to meet his/her sleep quota and in turn affect subsequent experiences of sleepiness at work.

Since there was substantial research which investigated relationships such as those summarized above, DeArmond (2004) conducted a meta-analysis of the relationships between occupational stressors and sleepiness-related variables. She referred to these sleepiness-related variables as sleepiness surrogates. The surrogates included sleep quality, sleep quantity, fatigue, and sleep-related psychosomatic symptoms. This meta-analysis looked at six occupational stressors: role ambiguity, role conflict, workload, interpersonal conflict, situational constraints, and perceived control. Overall, the results of the meta-analysis showed consistent relationships between the stressors and sleepiness surrogates (e.g., ranging in absolute value from $\rho = .10$ to $\rho = .34$, $\rho$ is the sample-size weighted correlation corrected for unreliability in the stressor

measures). This empirical evidence suggests that there might be relationships between occupational stressors and workplace sleepiness.

The meta-analytic results suggest that there is a need to explicitly explore the connection between occupational stressors and workplace sleepiness. This meta-analysis investigated the relationships between a variety of occupational stressors and sleepiness surrogates. However, there are additional occupational stressors that are likely connected to workplace sleepiness which warrant research attention. Among the stressors not yet examined, workplace aggression is one which has received increasing attention in occupational stress literature in recent years.

## Workplace Aggression as an Antecedent of Workplace Sleepiness

Workplace aggression is individual behavior which harms other people in an organizational context (Dupre & Barling, 2003; Neuman & Baron, 1997). Until the late 1990s and early 2000s workplace aggression had received little research attention. However, this changed as many researchers became aware of the prevalence of workplace aggression. In 1995 the Bureau of Labor Statistics (BLS) published a report noting that as of 1993 homicide was the second leading cause of workplace death. In the same year assaults and violent acts by people accounted for 2.7 injuries requiring time away from work per 10,000 full-time workers in private industry. Since that time there has been a substantial amount of research completed on this topic. A great deal of this research has conceptualized workplace aggression as an occupational stressor (Schat & Kelloway, 2000, 2003) and supported the notion that this stressor has a detrimental impact on people's physiological and psychological well-being (Rogers & Kelloway,

1997; Schat & Kelloway, 2000; Schat & Kelloway, 2003; Snyder, Chen, Grubb, Roberts, Sauter, & Swanson, 2004).

As with other occupational stressors, little research has examined the potential impact of workplace aggression on workplace sleepiness. However there are studies which support a relationship between workplace aggression and sleepiness surrogates (Mikkelsen & Einarsen, 2001; Rogers & Kelloway, 1997; Schat & Kelloway, 2000; Schat & Kelloway, 2003; Wildgoose et al, 2003; Wykes, & Whittington, 1998). For instance, Schat and Kelloway (2000) showed that violence was negatively related to somatic health and emotional well-being (measures included items about sleep disturbances). Wildgoose et al. (2003) studied violence in health professionals and found that workers who experienced actual or threatened violence reported more health symptoms such as sleep disturbances than those who had not experienced violence.

These empirical findings suggest a potential relationship between aggression and workplace sleepiness. However, it is quite clear that there is a need for research exploring this relationship which specifically measures workplace sleepiness. Further, Krauss et al. (2003) suggested occupational stressors as antecedents of workplace sleepiness. Suggesting occupational stressors as antecedents of workplace sleepiness implies a direction of causation in the relationship between aggression and workplace sleepiness flowing from aggression to workplace sleepiness. However, there is very little research which investigates this direction of causation or the reverse.

As has been noted previously a number of the studies that investigate the relationship between aggression and sleepiness surrogates have conceptualized aggression as an occupational stressor and sleepiness surrogates as indicators of strain.

Occupational stressors are viewed as stimuli that elicit strain (Kahn & Byosiere, 1992). Therefore, one could infer that these authors are suggesting that aggression leads to sleepiness surrogates. Additionally some models of workplace aggression have suggested sleepiness surrogates as possible consequences of aggression (Snyder et al., 2004). This again seems to suggest that aggression might lead to workplace sleepiness.

Despite the theoretical support for this particular direction of causation, there is very limited empirical research which investigates it. Hogh, Borg, and Mikkelsen (2003) conducted a five-year longitudinal study in which they found a significant relationship between experiencing aggression at time one and feeling fatigue at time two (five years later) even after controlling for fatigue at time one. While this finding suggests that aggression may increase workplace sleepiness, it does not completely rule out the possibility that workplace sleepiness might also induce workplace aggression.

Theoretically this competing idea seems viable. After all, empirical findings have shown that sleep problems are associated with negative mood (Blagrove & Akehurst, 2001; Bugge, Opstad, & Magnus, 1979; Totterdell, Reynolds, Parkinson, & Briner, 1994). There has also been longitudinal research which supports the notion that decrements in sleep quantity are associated with decrements in aspects of mood such as optimism and sociability (Haack & Mullington, 2005). Someone that is in a negative mood might have poor interactions with others, which in turn could make others angry or irritated. Several organizational aggression models suggest that emotional reactions such as anger or irritation precede aggression (Snyder et al., 2004; Spector, 1997). Therefore, workplace sleepiness might elicit subsequent workplace aggression.

Given that it seems possible that workplace aggression could lead to workplace sleepiness and workplace sleepiness could lead to workplace aggression, it is important to begin to explore causal direction within this relationship. One important first step in doing this is exploring the strength of the two relationships (aggression and subsequent workplace sleepiness and workplace sleepiness and subsequent aggression), and answering the question: is the relationship between aggression and subsequent workplace sleepiness stronger than the relationship between workplace sleepiness and subsequent aggression? The current research investigated this issue. No a priori hypotheses were put forth because there was not sufficient research to suggest which of the two relationships would be stronger.

### Occupational Safety as a Consequence of Workplace Sleepiness

While it is important to explore possible antecedents of workplace sleepiness, it is also necessary to explore possible consequences of workplace sleepiness. The consequence explored here was occupational safety which is vital to both employee well-being and organizational productivity. Occupational safety has often been linked with sleep-related issues. For instance, more than 90% of the respondents to the 2002 NSF poll 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 are frequently 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; Akerstedt, 1995; Folkard & Lombardi, 2006). The

current research explored the relationship between workplace sleepiness and two indicators of occupational safety, safety performance and occupational injuries.

*Safety Performance*

Safety performance is a type of job performance. Job performance is defined as volitional, job-relevant behavior (Campbell, 1990). Job performance decrements are often mentioned as possible consequences of sleep-related issues (including sleepiness). There are two typical explanations as to why this connection might exist.

First, it is thought that some performance decrements are the result of what are called microsleeps. Microsleeps are 1 to 10 second periods in which a person slips into Stage 1 sleep while still appearing to be awake (Roehrs, Carskadon, Dement, & Roth, 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 they can easily be awoken; however, it should be noted that the person is sleeping. During this stage there are physiological indications that they have begun to sleep that can be detected by changes in electroencephalogram and electromyogram activity.

Second, it has also been suggested that the brain functions less efficiently when experiencing sleep deprivation, a sleepiness surrogate. Research has linked sleep deprivation to decreased global levels of glucose metabolism in the brain as well as decreased regional levels of glucose metabolism in the thalamus, prefrontal cortex, and portions of the parietal cortex (Thomas et al., 2000). The thalamus is a brain region important in attention and arousal, and the areas of the prefrontal and parietal cortices that seem affected by sleep deprivation are involved in higher-order analysis and

integration of sensory-motor information and cognition. There is also research evidence which suggests a link between sleep deprivation and decreased responding in the left temporal lobes, a region involved in a variety of language processing and learning tasks (Drummond & Brown, 2001). Deficits in all of these brain regions could lead to decrements in job performance.

As mentioned previously safety performance is a type of job performance. Job performance consists of many different types of behaviors and researchers have identified a variety of categories of which safety performance is one (Burke, Sarpy, Tesluk, & Smith-Crowe, 2002; Griffin & Neal, 2000; Hoffman, Morgeson, & Gerras, 2003). Safety performance refers to job behaviors which promote the health and safety of workers, clients, the public, and the environment (Burke et al., 2002). There have been a number of researchers who have begun measuring safety performance and trying to identify its correlates (Burke et al., 2002; Griffin & Neal, 2000; Hoffman et al., 2003).

This research has suggested that there are a wide variety of behaviors that might constitute safety performance, and it seems that these behaviors are likely related to workplace sleepiness. For instance, Burke et al. (2002) and Hoffman et al. (2003) have suggested that safety performance often involves communicating information to others (e.g., talking to others when you have questions about potentially unsafe conditions, making others aware of potentially dangerous situations), planning (e.g., attempting to prevent the recurrence of injuries, illnesses, accidents, and/or near misses, 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, monitoring gauges to ensure safety within one's work environment).

There is substantial research to date suggesting that increases in workplace sleepiness might be linked to decrements in all three of these types of tasks (for communication: Harrison & Horne, 2000; for planning: Babkoff et al., 1985; Blagrove & Akehurst, 2001; Bugge et al., 1979; Harrison & Horne, 2000; Wallace, Vodanovich, & Restino, 2003; for engaging in monotonous tasks: Englund, Ryman, Naitoh, & Hodgdon, 1985; Gillberg & Akerstedt, 1998; Gillberg, Kecklund, & Akerstedt; 1994; & Mertens & 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 job performance (Campbell, 1993). It is thought that sleep issues are related to skill and motivation due to sleep deficits causing lapses such as microsleeps and inefficient brain functioning (Harrison & Horne, 2000). Empirical evidence suggests that workplace sleepiness impacts a variety of skills and motivation. For instance there is research which shows that workplace sleepiness might have a negative impact on problem solving skills (Harrison & Horn, 2000; Mertens & Collins, 1986), logical reasoning skills (Blagrove & Akehurst, 2001; Wallace et al., 2003), and effort (a reflection of motivation; Engle-Friedman et al., 2003).

This type of negative impact is likely also observed in the safety context since these types of skills and motivation are also likely major determinants of safety performance (Griffin & Neal, 2000). After all, to maintain and promote safety at work, employees inevitably need to apply work practices to reduce exposures to hazards, change the way the job is done to make it safer, or make recommendations about how to perform tasks safely. These types of behaviors require one to solve problems, to use logical reasoning, and to put forth substantial effort. If there are decrements in what are

likely determinants of safety performance, it is logical to infer that there might be an association between workplace sleepiness and safety performance.

While it seems likely from the preceding review that workplace sleepiness and safety performance are negatively related, the research which has been reviewed above is limited. None of the studies which support a connection between workplace sleepiness and safety performance explicitly measures workplace sleepiness. Most of them measure some type of workplace sleepiness surrogate (e.g., sleep quality, sleep quantity, fatigue, etc.). This is similar to what was found in the case of occupational stressors and workplace sleepiness.

Unlike the studies on the possible connection between occupational stressors and workplace sleepiness, there has been research which supports the connection between workplace sleepiness and safety performance which has explicitly measured sleepiness (Bonnet & Arand, 2005; Engle-Friedman et al., 2003; Gillberg et al., 1994; Rosa & Colligan, 1988). Nevertheless, one probably cannot refer to these measurements of sleepiness as workplace sleepiness. These studies have been completed in laboratory settings, and while these studies often measured sleepiness before and/or after participants engaged in job relevant tasks, the fidelity with which the laboratory setting mimicked the work setting was not necessarily high. More research is needed which explores the connection between workplace sleepiness and job performance in work settings. Therefore, the current research tested the following hypothesis:

Hypothesis 1: Workplace sleepiness is related to safety performance such that the sleepier the participant the less likely they are to engage in safety behaviors.

*Occupational Injuries*

Another indicator of occupational safety is occupational injuries. As was the case with safety performance, there are a number of indirect research findings which suggest a relationship between workplace sleepiness and occupational injuries. This research can be split into two major streams. The first consists of studies which have demonstrated a relationship between sleepiness or sleepiness surrogates and occupational injuries (Akerstedt, Fredlund, Gilberg, & Jansson, 2002; Gabel & Geberich, 2002; Lilley, Feyer, Kirk, & Gander, 2002; Melamed & Oksenberg, 2002; Nakata et al., 2005; Simpson, Wadsworth, Moss, & Smith, 2005). The second type of evidence is based on studies which substantiate a relationship between sleep disorders and occupational injuries (Chau, Mur, Touron, Benamghar, & Dehaene, 2004; Chau et al., 2002; Ulfberg, Carter, & Edling, 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 indirectly suggest a positive relationship between workplace sleepiness and occupational injuries.

Despite this consistent support in the above research, there are two limitations to this research which should be noted. First and foremost, none of the research above specifically measures workplace sleepiness. Little even measures sleepiness (Melamed & Oksenberg, 2002). More research is needed which specifically explores the connection between workplace sleepiness and occupational injuries. Hence, the current research will test the following hypothesis:

Hypothesis 2: Workplace sleepiness is related to occupational injuries such that the sleepier the participants the more likely they are to be injured.

Perhaps the most glaring limitation in previous literature exploring the connection between sleepiness-related variables and occupational injuries is the fact that none of it explores the mechanism by which these sleepiness-related variables might affect occupational injuries. Much of the previous research exploring connections between sleepiness-related variables and occupational injuries suggests that the mechanism is job performance (Chau et al. 2002; Melamed & Oksenberg, 2002). Put differently it is suggested that the relationships between sleepiness-related variables and occupational injuries are mediated by job performance. As has been noted in the preceding literature review it is thought that increases in workplace sleepiness could lead to job performance decrements due to deterioration of brain function and microsleeps. Empirical research and logic suggests that job performance decrements and specifically safety performance decrements could then lead to occupational injuries (Hofmann & Stetzer, 1996; Reber, Wallin, & Duhon, 1993). Despite this repeated suggestion, there is no known research to date which has empirically investigated this idea. This is a significant gap in occupational safety research which should be filled. Thus, the current research tested the following hypothesis:

Hypothesis 3: Safety performance mediates the relationship between workplace sleepiness and occupational injuries.

## The Current Research

Since the focus of the current research was workplace sleepiness, the two current studies took place in one of the industries where this issue is of particular concern, healthcare. While a great deal of sleepiness-related research has taken place in this industry, much of it has focused on doctors (e.g., medical interns, residents, etc.) and

nurses. The sample for both of the current studies consisted of Certified Nursing Assistants (CNAs).

## STUDY 1

Study 1 explored the relationship between workplace aggression and workplace sleepiness by investigating whether the relationship between workplace aggression and subsequent workplace sleepiness is stronger than the relationship between workplace sleepiness and subsequent workplace aggression. This study utilized data which measured both of these variables over time.

There are a variety of different types of workplace aggression. Dupré and Barling (2003) called attention to four categories of workplace aggression that vary with regard to whom the source of that aggression is. These categories had been identified in prior research (Braverman, 1999; California Occupational Safety and Health Administration, 1995; University of Iowa Injury Prevention Research Center, 2001).

The first category, Type-1 includes aggression in which the source of the violence has no legitimate relationship to the organization or its employees. A good example of such aggression was the incident which occurred at Platte Canyon High School in Colorado (Associated Press, 2006a). A man having no known connection to any school employees or students entered this high school, made threats (e.g., claimed that he had a bomb), took a number of hostages, sexually assaulted at least some of these hostages, and then killed one student and himself.

In Type-2 aggression the source of aggression has a legitimate relationship to an organization (e.g., customers, students, clients, patients, residents) and this person aggresses toward an employee in the process of being served by that organization. A

good example of this type of aggression occurred in Wisconsin in October of 2006. A male student entered Weston High School and shot and killed his principal because he was upset with a reprimand that the principal had given him the prior day (Associated Press, 2006b).

In the third type of aggression, Type-3 the source of the aggression is a current or former employee of the organization. A shooting that took place at a mail processing center in Goleta, California in early 2006 is a clear example of this type of aggression. In this case a woman who had been put on medical leave for psychological problems returned to her place of work and opened fire on employees killing five (Associated Press, 2006c).

Finally, Type-4 aggression is aggression in which the source is a person who has a personal relationship with a member of an organization but does not have a relationship with the organization itself. In Elmwood, Louisiana in 2005 there was an example of such aggression. A man who had a history of abusing his wife walked into the siding supply business where she worked and shot and killed her and one of her coworkers (Hunter, 2005).

The aggression which was measured in Study 1 was that which CNAs faced from residents. This would be classified as Type-2 aggression. This type was chosen because of the frequency with which CNAs experience it. Astrom, et al. (2002) found that 40% of a sample of nurses working in residential care facilities reported having experienced violence in the past year and 18% reported facing violence daily.

## *Method*

### *Participants*

The participants in Study 1 were 76 certified nursing assistants (CNAs) working for six long term care facilities (Facility A: 12, Facility B: 17, Facility C: 13, Facility D: 14, Facility E: 9, Facility F: 11) in the Rocky Mountain region of the United States. There were a total of 155 CNAs at the six long term care facilities (Facility A: 16, Facility B: 30, Facility C: 33, Facility D: 40, Facility E: 21, Facility F: 15). That means that approximately 49% of the population participated in the surveys. As would be expected in a longitudinal study there was some attrition in the sample across data collection sessions (each data collection session consisted of a survey after a CNA's shift). All 76 participants completed data collection sessions one and two. Three participants were lost in session three and another four were lost in session four. A total of 69 participants completed all four data collection sessions.

Of the 76 original participants, 94.7% were women and 75% were Caucasian and 14.5% were Hispanic (the remainder consisted of approximately equal parts Asian-Pacific Islanders, Native Americans, African Americans, and multiracial people). The sample's mean age was approximately 30-years-old. The mean number of years that the sample had been working as CNAs was 6.6 and the mean tenure at the facilities was 1.8 years. Of the 76 CNAs in the sample, 28.9% said that their highest level of education was a high school diploma, 1.3% said it was trade school, 42.1% said that it was some college, 5.3% said it was an associate's degree, 10.5% said it was a bachelor's degree, and 11.8% said it was some other level of education (e.g., one third of those reporting other said that they had not completed high school, another third reported that they were

in the process of completing or had completed their GED, and the remainder gave some example of training in nursing—e.g., 1 year LPN). The mean hours worked by these CNAs per week was 40.4.

*Procedures*

Prior to the study, two focus groups were conducted with approximately five CNAs in each. Each CNA was paid $20 for participating in the focus group. There were two aims for these focus groups: (1) to develop the content of the resident aggression measure, and (2) to revise other survey questions. CNAs in these focus groups were asked to provide examples of physically aggressive acts (e.g., a resident hit me), verbally aggressive acts (e.g., a resident swore at me), and nonverbally/nonphysically aggressive acts (e.g., a resident glared at me) they had faced from patients. They were then given copies of lists of aggressive acts that we had developed based on the work of Hagen and Sayers (1995). They were asked to indicate whether there were aggressive acts included that never happen to CNAs, or if there were aggressive acts that they experience that were not included on the list. Finally, the CNAs were asked to read and critique the instructions and the items included on the survey for clarity.

Survey participants were recruited in the spring and early summer of 2004 by posting flyers throughout the long term care facilities, including project announcement packets (included a flyer and a letter from the researchers) in the CNAs' paychecks, and by announcing the project at staff meetings. Each CNA was scheduled for five data collection sessions. Only the first four sessions were applicable to the current research. Therefore the fifth data collection session will not be discussed further. The data collection sessions were scheduled to occur on consecutive shifts. Data collection

sessions all took place at the end of shifts in each facility. If participants did not make a scheduled data collection session, they were called to reschedule. To minimize forgetting about the data collection sessions, participants received a reminder phone call before their first session. Since the sessions were consecutive, phone calls were not made for sessions two through four. However, at the end of each data collection session the research team reminded each participant about their next scheduled session. Each CNA was paid $10 for completing the first survey and $8 for completing each of the remaining surveys.

*Measures*

During the first data collection session, CNAs were asked questions about their demographic characteristics (e.g., age, gender), the aggressive incidents they faced from residents, and their level of workplace sleepiness. In the remaining data collection sessions, CNAs were asked about their experiences with aggressive incidents and their workplace sleepiness. The measures included in these surveys that were relevant to the current study are detailed below, and the complete measures are provided in Appendix I.

*Resident Aggression.* Resident aggression was measured by presenting participants with a list of 18 aggressive acts such as being hit, kicked, yelled at, threatened, or glared at. For each action listed participants were instructed to "circle the number of incidents that occurred DURING YOUR SHIFT TODAY in which you experienced each of these actions from residents." Response options ranged from one to six or more. The list of acts was developed based on existing literature (Hagen & Sayers, 1995) and input from the two focus groups described above.

Internal consistency reliability of the measure of resident aggression is not reported here because the measure is considered a causal, rather than an effect, indicator

measure. According to Bollen and Lennox (1991), an effect indicator measure is one in which each item is assumed to represent the same underlying construct. For this type of measure, internal consistency is an appropriate reliability estimate, because it assumes that items are interchangeable. In contrast, a causal indicator measure is comprised of conceptually distinct components. Therefore, items are not all indicative of the same underlying construct, but they could be highly related. In the case of the resident aggression measure, an item about "being hit" is not interchangeable with an item about "being glared at."

*Workplace Sleepiness.* Workplace sleepiness was measured using the Stanford Sleepiness Scale (SSS; Hoddes, Zarcone, Smythe, Phillips, & Dement, 1973). The SSS has been used widely within the sleep research domain and there is validity evidence supporting its use (Hoddes et al., 1973). The SSS consists of one item with seven statements ranging from "feeling active and vital; alert; wide awake" to "almost in reverie, sleep onset soon, lost struggle to remain awake." Participants were called upon to choose one of the statements that best described their current level of sleepiness. Because participants responded to the SSS immediately after their shift, this measure approximates participants' levels of sleepiness at work. Internal consistency reliability is not reported due to the fact that this measure only consisted of one item.

*Analyses*

The aim of Study 1 was to investigate whether workplace aggression is more strongly related to subsequent workplace sleepiness or workplace sleepiness is more strongly related to subsequent workplace aggression. The current data set was well-suited for this aim because it included repeated measures of both resident aggression and

workplace sleepiness over four data collection sessions. This made it possible to look at multiple correlations between resident aggression and subsequent workplace sleepiness and between workplace sleepiness and subsequent resident aggression. Since there were four data collection sessions, it was also possible to assess the relationship between resident aggression and workplace sleepiness over three different time lags: 1-day, 2-day, and 3 day. It was possible to calculate a total of three 1-day lags, two 2-day lags, and one 3-day lag. Figures 1 and 2 provide visual depictions of the correlations that were calculated.

I followed methods for analyzing this data that were used in a similar study conducted by Schneider, Hanges, Smith, and Salvaggio (2003). Since multiple correlations could be calculated over the 1-day and 2-day time lags, sample-size weighted average correlations were used. Prior to averaging correlations, I tested to see whether these correlations were from the same population. I did this by conducting the test of homogeneity of an arbitrary set of correlated correlations (Raghunathan, 2003). The equation for this test is:

$$Q = \sum u^2 , \tag{1}$$

where $u^2$ is derived from

$$u = \sqrt{n - 3}(z - \bar{z}_W) . \tag{2}$$

In the above equation, $z$ is the transformed Fisher's z value of Pearson's r, $n$ is the sample size for r, and $\bar{z}_W$ is derived from the following equation.

$$\bar{z}_W = \frac{\sum (n - 3)z}{\sum (n - 3)} \tag{3}$$

This Q statistic is distributed as a chi-square distribution. Degrees of freedom (v) for this statistic are determined by Equation 4,

$$v = k - 1 - 2\frac{C_1 d_1 + C_2 d_2}{k}, \tag{4}$$

where

$$C_1 = \frac{[\bar{r}_W^2 r_*^2 + (2r_* - \bar{r}_W^2)(1 - 2\bar{r}_W^2)]}{2(1 - \bar{r}_W^2)^2}, \tag{5}$$

$$C_2 = \frac{2r_*^2}{(1 + \bar{r}_W)^2}. \tag{6}$$

In Equations 4 and 5, k represents the number of correlation coefficients involved in the hypothesis, $\bar{r}_W$ is the sample-size weighted average correlation and $r_*$ is the median of the nuisance correlation coefficients. The nuisance correlation coefficients are those coefficients for relationships between variables of interest that are not included in the null hypothesis. For example if one is testing the hypothesis that $H_0 = \rho_{AB} = \rho_{BC} = \rho_{CD}$, there are three correlation coefficients involving four variables A, B, C, and D included in the hypothesis. There are other correlation coefficients that could be derived from these variables such as $\rho_{AC}$ or $\rho_{AD}$. It would be these other correlation coefficients that would be considered as the nuisance correlation coefficients.

In Equation 4, $d_1$ refers to the number of pairs of correlation coefficients included in the hypothesis which involve nonoverlapping pairs of variables and $d_2$ refers to the number of pairs of coefficients included in the hypothesis which involve a common variable. For instance, in the hypothesis, $H_0 = \rho_{AB} = \rho_{BC} = \rho_{CD}$, one could have 3 possible pairings of the correlation coefficients. There would be one pair that would

involve variables that are not the same $(\rho_{AB},\rho_{CD})$, this would mean $d_1$=1. There would be two pairs that would involve overlapping variables $(\rho_{AB},\rho_{BC})$, $(\rho_{BC},\rho_{CD})$, this would mean $d_2$=2.

If Q was nonsignificant, this indicated that the possibility the correlations were from the same population could not be rejected. If this was the case, the correlations for a particular time lag were averaged. Once correlations were averaged, I tested to see if any of these average correlations were significantly different from zero using (Hedges & Olkin, 1985):

$$z = \bar{z}_{wt}\sqrt{(N-3k)} \qquad (7)$$

Above, N is the sum of the sample sizes across all correlations. If this z test exceeded 1.96, then I rejected the null hypothesis that the average correlation for a particular lag was zero.

As has been noted previously the lags could have been calculated going in two different directions (See Figures 1 & 2). Since the primary purpose of Study 1 was to assess whether the relationships between resident aggression and subsequent workplace sleepiness are stronger than the relationships between workplace sleepiness and subsequent resident aggression, or vice versa, the lags were calculated in both directions. I then compared the correlations between resident aggression and subsequent workplace sleepiness with the correlations between workplace sleepiness and subsequent resident aggression. I did this by first pooling all of the correlations regardless of direction and then conducting the test of homogeneity of an arbitrary set of correlated correlations (Raghunathan, 2003). If the Q statistic was significant, then I concluded that the

correlations came from different populations. If this was the case, then I inspected the size of the average correlations for both causal directions to see which was higher.

There was only a single correlation for each causal direction for the 3-day lag. These simple correlations were calculated and tested to see if they were significantly different from zero. I then tested whether these two correlations were significantly different from one another. I did so using a Dunn and Clark's z test. That is,

$$z = (z_{r_{jk}} - z_{r_{hm}})\sqrt{\frac{n-3}{2-2\bar{s}}}. \tag{8}$$

In the above equation, $z_{r_{jk}}$ and $z_{r_{hm}}$ are transformed Fisher's $z_r$ values of Pearson's $r_{jk}$ and $r_{hm}$. The $\bar{s}$ is derived from the following equation.

$$\bar{s} = \frac{\psi}{(1-\bar{r}^2)^2} \tag{9}$$

The $\psi$ is derived from the following equation.

$$\begin{aligned}\psi = 0.5\{&[(r_{jh} - r_{kh}\bar{r})(r_{km} - r_{kh}\bar{r})] + [(r_{jm} - r_{jh}\bar{r})(r_{kh} - r_{jh}\bar{r})] + \\ &[(r_{jh} - r_{jm}\bar{r})(r_{km} - r_{jm}\bar{r})] + [(r_{jm} - r_{km}\bar{r})(r_{kh} - r_{km}\bar{r})]\}\end{aligned} \tag{10}$$

Finally, $\bar{r}$ is derived from,

$$\bar{r} = \frac{r_{jk} + r_{hm}}{2}. \tag{11}$$

If the absolute value of the z statistic was greater than 1.96, I concluded that the correlations were significantly different. If the correlations were significantly different, I then compared the sizes of the correlations to determine which was stronger.

*Results*

The results of Study 1 are displayed in two tables. Table 1 presents descriptive statistics and intercorrelations for resident aggression and workplace sleepiness at each

point in time. As shown in Table 1, there were strong correlations between resident aggression measured at different points in time and workplace sleepiness measured at different points in time. However, the correlations between resident aggression and workplace sleepiness were generally weak. Those that were significant were the relationships between resident aggression at time one and workplace sleepiness at time four, resident aggression at time three and workplace sleepiness at time four, and resident aggression at time four and workplace sleepiness at time four. Further, there were no significant relationships between workplace sleepiness and subsequent resident aggression.

Table 2 presents the results of the analyses that explored the relationships between resident aggression and workplace sleepiness. The columns in Table 2 represent the different time lags. The statistics presented in the table for both 1-day time lags and 2-day time lags are different from those presented for the 3-day lags. I will first explain the statistics for the 1-day and 2-day lags.

The two basic statistics provided for the 1-day and 2-day lags are the sample-size weighted average correlations and the tests of homogeneity. A significant Q-statistic indicates that the correlations for a particular relationship and time lag are not homogenous. Table 2 shows that none of the Q-statistics were significant. Thus, sample-size weighted average correlations were calculated for both relationships (resident aggression and subsequent workplace sleepiness and workplace sleepiness and subsequent resident aggression) and both time lags. A significant sample-size weighted average correlation indicates that the average was significantly different from zero. The second to last row in the table presents the Q-test for whether the correlations between

resident aggression and subsequent workplace sleepiness and workplace sleepiness and subsequent resident aggression for a particular time-lag were statistically different. Despite the fact that the sample-size weighted average correlations for resident aggression and subsequent workplace sleepiness were larger than the sample-size weighted average correlations for workplace sleepiness and subsequent resident aggression for both the 1-day lag and 2-day lag, Q statistics failed to support that these differences were statistically significant.

The statistics provided for the 3-day lags are different from those discussed above because there is only one data point for each relationship (one for the relationship between resident aggression and subsequent workplace sleepiness and one for the relationship between workplace sleepiness and subsequent resident aggression). Therefore the correlations provided in Table 2 for this lag are simple Pearson product-moment correlations. An asterisk was used to indicate whether these correlations were significantly different from zero. Since there was only one correlation for each relationship no tests for homogeneity were needed. As described in the Analyses section, a Dunn and Clark z-test was conducted to determine if the correlation between resident aggression and subsequent workplace sleepiness was significantly stronger than that between workplace sleepiness and subsequent resident aggression. As can be seen in Table 2, this was the case.

*Discussion*

There is little research that explores relationships between specific occupational stressors and workplace sleepiness. The current study added to existing research literature by investigating whether there is a relationship between resident aggression and

workplace sleepiness. This study then went a step further to explore a possible causal relationship between resident aggression and workplace sleepiness with a longitudinal design.

*Resident Aggression and Subsequent Workplace Sleepiness*

The results of this study show some support for a relationship between resident aggression and subsequent workplace sleepiness, although the relationship was not consistent across different time lags. Specifically, the 1-day lag sample-size weighted mean correlation between resident aggression and subsequent workplace sleepiness was significant, but the 2-day lag sample-size weighted mean correlation was not. At first glance these findings seem to suggest that the effect of resident aggression from one shift can be seen during the next, but the effect does not continue to have an impact on shifts thereafter. However, this explanation is not supported by the significant 3-day lag correlation.

Another interesting and somewhat related finding in this study was that all of the significant correlations between resident aggression and subsequent workplace sleepiness involved workplace sleepiness measured at Time 4. Which brings to question, what makes workplace sleepiness at time 4 unique? An examination of simple means and standard deviations shows that workplace sleepiness measured at time 4 had the highest mean and second highest standard deviation of any of the measures of workplace sleepiness. By looking at histograms of each of the measures of workplace sleepiness it appears as though the patterns of responding were similar across time. It does not appear that the significant relationships observed between resident aggression at different points in time and workplace sleepiness measured at Time 4 were merely the result of higher

variability or less range restriction in this variable. Better understanding of these inconsistencies will likely only come from further research which explores the process underlying the relationship between resident aggression and workplace sleepiness.

It was suspected in this study that resident aggression would act as a stressor eliciting workplace sleepiness. Krauss et al. (2003) suggested that stressors could lead to sleep disturbances which could then lead to workplace sleepiness. However, Krauss et al. did not suggest mechanisms that might underlie the relationship between stressors and sleep disturbances. One possible mechanism and fruitful area for future research might be rumination. Rumination has been defined as "passively and repetitively focusing on one's symptoms of distress and the circumstances surrounding those symptoms" (Nolen-Hoeksema, McBride, & Larson, 1997). Thomsen et al. suggested that this definition of rumination is fairly narrow and that rumination might not only include repetitive thoughts about symptoms but also repetitive thoughts focusing on problematic situations or events. Guastella and Mould (2007) further suggested that stressors might be an example of problematic situations or events that could be the focus of these repetitive thoughts.

Rumination is thought of as a possible connection between an occupational stressor such as resident aggression and workplace sleepiness because it is a cognitive process that might delay sleep onset or interrupt sleep. There is substantial research to date which suggests that similar cognitive processes such as worry can have a negative impact on sleep quality by delaying sleep onset (Harvey, Tang, & Browning; 2005, Gross & Borkovec, 1982; Harvey, 2000; Tang & Harvey, 2004). Rumination has been likened to worry (Guastella & Mould, 2007; Thomsen et al, 2003) because both are considered cognitive processes that involve repetitive thoughts. Rumination is thought to involve

repetitive thoughts about past events where as, worry is thought to involve repetitive thoughts about future events. While less research has explored the relationship between rumination and sleep quality, there is still some empirical evidence which suggests that this cognitive process, like worry is related to sleep quality decrements (Thomsen et al., 2003). Thomsen et al. (2003) found that rumination was related to decrements in sleep quality and more specifically this study showed that rumination was associated with both delayed sleep onset and more sleep disturbances. Given these findings, future research should explore rumination as a possible link between resident aggression and sleep disturbances.

Future research might also consider the degree to which attribution might play a role in the relationship between resident aggression and workplace sleepiness. Attribution refers to "a perception of inference or cause" (Kelley & Michela, 1980). It is now commonly recognized that people interpret behavior in terms of cause and that this likely has an impact on subsequent reactions to this behavior (Kelley & Michela, 1980). Some theories of occupational stress have suggested that whether an individual experiences strain in response to a stressor is dependent on how that person appraises the stressor (Lazarus, 1966; Lazarus & Folkman, 1984). There are a number of researchers to date which have suggested that attribution might be involved in this appraisal process (Perrewe and Zellars, 1999; Peeters, Schaufeli, & Buunk, 1995), and that different types of attributions might lead to different consequences.

There are a variety of different types of attributions. Weiner's (1985) attribution theory suggests that causes can be classified along three different dimensions: locus, controllability, and stability. The first dimension, locus refers to whether an event or

situation is the result of internal (factors within a person such as ability or effort) or external factors (factors within the environment). The second dimension, stability refers to whether a cause is likely to fluctuate or remain constant. The third dimension, controllability refers to whether or not a cause is under volitional control.

Putting this in the context of the current study, a CNA might believe that a resident's aggressive acts are the result of something within herself such as her social aptitude, the effort that she puts into her job, or level of fatigue. The CNA could also believe that the aggression was the result of a factor external to her such as the resident's unreasonable expectations for care, bad mood, or mental health disorder. These same causes could then be classified on the dimension of controllability. The CNA's aptitude and fatigue are likely outside of the volitional control of the CNA. Similarly the resident's mental health disorder and mood would likely not be within the volitional control of the resident. However, a CNA's effort is likely within her control and a resident's expectations are within his control. Finally, the causes could be classified on the dimension of stability. A CNA's ability and a resident's mental health disorder would likely be thought of as stable. A CNA's effort and fatigue and a resident's expectations and mood would be unstable.

It is possible that resident aggression might have a different impact on workplace sleepiness dependent on how an attribution for this aggression is classified along these three dimensions. This is likely due to the different emotional reactions people have in response to different attributions and then how these different emotional reactions impact coping method choices. Perrewe and Zellars (1999) have offered a theory for how attributions made about stressors impact emotional reactions and in turn choices of

coping methods. Coping methods can play a role in additional consequences for individuals and organizations. I believe that one such consequence could be workplace sleepiness.

Perrewe and Zellars suggested that stressors which are attributed to internal controllable factors (e.g., a lack of effort) will lead to feelings of guilt and those that are attributed to internal, uncontrollable factors (e.g., aptitude) will lead to feelings of shame. They suggested that those stressors that are attributed to external, controllable factors (e.g., unreasonable resident expectations) will lead to anger and that those stressors attributed to external, uncontrollable factors (e.g., mood) will lead to frustration. According to Perrewe and Zellars, feelings of guilt will lead to problem-focused coping but all of the other feelings will lead to emotion-focused coping. Different types of coping likely have different relationships with sleep disturbances and subsequent workplace sleepiness.

Workplace sleepiness is conceptualized in this study as a form of strain. There is research which suggests that problem-focused coping decreases strain whereas emotion-focused coping increases strain (Mitchell, Cronkite, and Moos, 1983). Therefore, it is possible that emotion-focused coping might lead to more workplace sleepiness than problem-focused coping. In addition, there may be certain types of emotion-focused coping that lend themselves to workplace sleepiness more than others. For instance, rumination and worry have both been identified as types of emotion-focused coping (Hong, 2000) that are linked to increases in sleep disturbances. However, other types of emotion-focused coping such as positive reappraisal (emphasizing the positive aspects of

a situation and minimizing the negative) have not been associated with increases in sleep disturbances.

It has already been suggested that future research should explore rumination as a possible link between resident aggression and sleep disturbances. This suggestion fits nicely with Perrewe and Zellar's work. It suggests more generally that future research should look into how attribution might be related to different coping strategies and how these different strategies might be related to sleep disturbances and subsequent workplace sleepiness.

*Workplace Sleepiness and Subsequent Resident Aggression*

The results of this study show no support for a relationship between workplace sleepiness and subsequent resident aggression. This was not the expected result. Prior research and theory suggest that a relationship between workplace sleepiness and subsequent resident aggression might exist. The relationship was thought to exist because sleepy CNAs might be more irritable and less sociable. Thus, their interactions with residents could be negatively impacted in such a way that residents could become irritated or angry with the CNAs and in turn aggress toward them.

It is also possible that CNAs are able to overcome their sleepiness in such a way that they can hide their irritability from the residents that they serve and still be adequately sociable. It stands to reason that CNAs that are not able to do this and as a result have repeated negative interactions with residents might self-select out of the profession or be terminated by their employer. If this is the case, it could explain the findings of the current research.

The procedures used in this study might also contribute to the null findings. This study focused on relationships between workplace sleepiness experienced on one shift and the resident aggression experienced on one subsequent shift. Perhaps residents can overlook a CNA being sleepy and possibly irritable during one shift. It might be that this sleepiness only becomes problematic and leads residents to aggress if it persists over a number of shifts. Since the data for the current study included measures of workplace sleepiness after multiple shifts, it was possible to do a preliminary investigation of this possibility.

To do this, workplace sleepiness measures were summed across time in the following ways. First, workplace sleepiness accumulated over two shifts was calculated by summing workplace sleepiness at Time 1 with Time 2, Time 2 with Time 3, and Time 3 with Time 4. Then workplace sleepiness accumulated over three shifts was calculated by summing across Times 1, 2, and 3 and across Times 2, 3, and 4. Finally, workplace sleepiness accumulated over four shifts was calculated by summing across Times 1, 2, 3, and 4. Next, correlations were calculated between these measures of accumulated workplace sleepiness and resident aggression at times 2, 3, and 4. These correlations are displayed in Table 3. Some of these correlations appear somewhat stronger than those between workplace sleepiness measured on one shift and subsequent resident aggression. However, none of the correlations between accumulated workplace sleepiness and subsequent resident aggression are significantly different from zero.

On the surface this idea that workplace sleepiness has to persist over time before it actually has an impact on resident aggression, does not seem to hold. It is possible that significant correlations were not observed between accumulated workplace sleepiness

and resident aggression, because summing workplace sleepiness over shifts does not provide an accurate picture of accumulated sleepiness. Perhaps a CNA's workplace sleepiness has to be at a certain level before it affects his/her behavior in such a way that residents would notice. The sleepiness might need to be severe and in addition this level of sleepiness might need to persist for multiple shifts before an increase in resident aggression would be observed. If workplace sleepiness is summed across shifts as it was here, a CNA who experienced severe sleepiness one shift and more moderate levels on two subsequent shifts might have a similar if not identical accumulated workplace sleepiness score to a CNA who experienced low level sleepiness one shift and severe levels on two subsequent shifts. The workplace sleepiness pattern involving one shift of severe sleepiness and then two subsequent shifts of moderate level sleepiness might not incite resident aggression; however, the pattern that involved one initial day of low level sleepiness and then two subsequent days of severe sleepiness might actually elicit resident aggression. Therefore, there might appear to be no relationship between accumulated workplace sleepiness and subsequent resident aggression.

The preceding paragraphs have included a variety of plausible explanations for why statistically significant relationships between workplace sleepiness and subsequent resident aggression were not observed. However these explanations and the initial explanation for why a relationship should exist between workplace sleepiness and subsequent resident aggression may all make a flawed assumption. In retrospect, it seems that I have assumed that the residents in these long term care facilities are mentally capable of reading the moods of CNAs and remembering them over time. However, there is evidence which suggests that these residents might not have these capabilities.

The 1997 National Nursing Home Survey (Gabrel, 2000) showed that the second leading reason for nursing home admissions amongst residents 65 years of age or older was a mental disorder. Mental disorders include dementia and Alzheimer's disease which involve cognitive issues such as confusion, impaired memory, and impaired judgement (Donaldson, Tarrier, & Burns, 1997; Rosenstock, 1970). The 2004 National Nursing Home Survey of Residents shows that 56% of the residents involved with the survey were moderately to severely impaired with regard to their ability to make decisions about daily life. These statistics taken together suggest that many of the residents served by the CNAs in our sample could have been cognitively impaired. Therefore, these residents may not have been capable of reading the CNAs' moods and remembering them over time. This might explain why significant relationships were not observed between workplace sleepiness and subsequent resident aggression.

In summary, the findings from the current study show limited support for a relationship between resident aggression and subsequent workplace sleepiness but no support for a relationship between workplace sleepiness and subsequent resident aggression. This study is an important first step in better understanding the relationship between resident aggression and workplace sleepiness. These findings open doors for a variety of different types of future research which will aid in greater understanding of this specific relationship and relationships between occupational stressors and workplace sleepiness in general.

## STUDY 2

Whereas Study 1 aimed to explore the relationship between workplace sleepiness and one of its proposed antecedents, Study 2 aimed to explore the relationship between workplace sleepiness and one of its proposed consequences, occupational safety. More specifically this study investigated the relationships between workplace sleepiness and safety performance and occupational injuries (Hypotheses 1 & 2). It also explored whether safety performance mediates the relationship between workplace sleepiness and occupational injuries (Hypothesis 3). Unlike the first study, Study 2 was cross-sectional.

### *Methods*

#### *Participants*

The participants in Study 2 were 143 certified nursing assistants (CNAs) working for eight long term care facilities (Facility A: 17, Facility B: 7, Facility C: 22, Facility D: 19, Facility E: 18, Facility F: 19, Facility G: 25, Facility H: 16) in the Rocky Mountain region of the United States. There were a total of 388 CNAs at the eight long term care facilities (Facility A: 45, Facility B: 30, Facility C: 85, Facility D: 55, Facility E: 31, Facility F: 48, Facility G: 67, Facility H: 27). That means that approximately 37% of the population participated in the surveys.

Of the 143 participants, 91.6% were women and 84.9% were Caucasian, 10.8% were Hispanic, and 2.2% were African American (the remainder consisted of approximately equal parts Asian-Pacific Islanders and multiracial people). The sample's

mean age was approximately 30 years old. The mean number of years that the sample had been working as CNAs was 5.3 and the mean tenure at the facilities was 2.3 years. Of the 143 CNAs, 7.0% reported that their highest level of education was some high school, 24.0% a high school diploma/GED, 10.1% some trade/technical school, 7.0% completion of trade/technical school, 36.4% some college/university, 13.2% a bachelor's degree, and 2.3% some graduate school. The mean hours worked by these CNAs per week was 39.1.

*Procedures*

Prior to Study 2, three focus groups (19 CNAs) were conducted with approximately six to seven CNAs in each. Each CNA was paid $20 for participating in the focus group. There were two aims of these focus groups: (1) generate and revise the safety performance and occupational injury items so that they are relevant to CNAs, and (2) revise the other survey questions for clarity. CNAs in the first focus group were asked to develop descriptions of safety behaviors that they engage in at work, develop descriptions of incidents in which they were or they observed another CNA being injured, and descriptions of pain that they had experienced which they felt was the result of their job. The CNAs in the second focus group were given the lists of safety performance and occupational injury items to be included on the survey. They were asked to indicate which if any of the safety behaviors or occupational injuries they had not experienced. They were then asked to indicate if there were safety behaviors or occupational injuries that they typically experience that were not included on the lists. Those CNAs in the third focus group reviewed a draft of the survey to be used in Study 2. They critiqued the instructions and the items to ensure clarity.

Survey participants were recruited using the same methods described in Study 1. All materials advertising the study indicated the dates, times, and locations at which data collection sessions were scheduled to take place. All data collection sessions took place at the facilities. Attempts were made to schedule additional data collection sessions if a number of CNAs who wanted to participate were not able to be present at the original session(s). All CNAs were paid five dollars for participation in the study.

*Measures*

In Study 2, workplace sleepiness was again measured. In addition, safety performance and occupational injuries were measured. These measures are detailed below, and the complete measures are provided in Appendix II.

*Workplace Sleepiness.* Workplace sleepiness was again measured using the SSS (Hoddes et al., 1973). However, in Study 2 participants received slightly different directions than they received in Study 1. Participants were instructed to choose one of the seven statements on the SSS that best described their typical sleepiness at work during the two weeks prior to survey administration. A two week time period was selected because it is a short enough period of time that people should still be able to recall their typical level of sleepiness at work. In addition, this time frame was aligned with that used for recalling occupational injury items. A two-week recall period is within the range that has been recommended for assessing occupational injures (Massey & Gonzalez, 1976; Warner, Shenker, Heinen, & Fingerhut, 2005).

*Safety Performance.* The measure of safety performance was developed for CNAs based on focus group input and the content of the General Safety Survey (GSS, Burke et al., 2002) and the safety citizenship behavior scale (SCB scale, Hoffman et al.,

2003). Although both the GSS and SCB measure safety behavior, they focus on different types of safety behavior. The Burke et al. scale focuses on behaviors that are part of formal job requirements and/or the formal reward systems (e.g., complying with safety regulations or policies). In contrast the Hoffman et al. scale focuses on discretionary safety behaviors that are not part of formal job requirements nor considered part of the formal reward system (e.g., pointing out the safety violations of others).

Krauss, Mazurkiewicz, Chen, DeArmond, Smith, & Rosecrance (2006) have noted that the inclusion of both of the above scales is often not practically feasible. These authors created a shortened safety behavior measure based on the 54 original items that consisted of 10 items. The Krauss et al. measure was used in the current study. This measure has proven to be reliable ($\alpha$=.87-.90, $\alpha$=.85 in the current study) and valid. In the current study, participants were asked how frequently they had engaged in each behavior in the past two weeks. They responded using a six-point response scale ranging from sometimes (1) to always (6).

*Occupational Injuries.* The occupational injuries measure consisted of a list of occupational injuries. A tentative list of occupational injuries was generated to give to focus group participants for feedback. The list was created based on the measures used by Barling, Kelloway, and Iverson (2003), Krauss (2004), and information from the BLS (BLS; 2006a), the National Institute for Occupational Safety and Health (NIOSH, 2005), and the American Nurses Association (ANA, 2005). The additional information from the BLS, NIOSH, and the ANA was reviewed because the Barling et al. and Krauss measures were not developed specifically for health professionals. These additional resources provided useful information on injuries that are experienced by the population of interest.

The BLS annually records the frequency of injuries that employees at nursing and residential care facilities experience. In 2005, injuries were ranked from most frequent to least among employees of nursing and residential care facilities as follows: sprains and strains, bruises, pain other than back pain, back pain, fractures, multiple injuries, cuts/punctures, heat burns, chemical burns, and carpal tunnel (BLS, 2006a). While the ANA and NIOSH do not keep their own injury records, they have noted an injury of particular relevance to nurses, needlesticks (ANA, 2005; NIOSH, 2005). Most of the injuries noted by these organizations overlapped with the measures employed by Barling et al. (2003) or Krauss (2004).

Something that has been noted by the BLS, ANA, and NIOSH is the prevalence of low back pain or other pain experienced by those working in this field. As a result I chose to include a pain scale as an additional indicator of injury. The pain items were taken from the Standardised Nordic Questionnaire (Kuorinka et al., 1987). This measure asks respondents to indicate whether or not they have felt pain in different anatomical areas (e.g., feet, upper back, low back, wrists/hands). This measure was selected because it has been used successfully in several worker populations (Baron, Hales, & Hurrell, 1996; Goldsheyder, Nordin, Weiner, & Heibert, 2002; Merlino, Rosecrance, Anton, & Cook, 2003; Rosecrance, Ketchen, Merlino, Anton, & Cook, 2002).

There were a total of 18 injury items and eight pain items presented to the focus group participants. Focus group participants consistently agreed that three of the injury items were not relevant to CNAs. These three items were: asbestos exposure, hearing loss, and radiation exposure. Therefore these items were eliminated from the finalized measure. Focus group participants were also asked to generate examples of injuries that

they had experienced or that other CNAs that they knew had experienced. They did not generate any injuries that were not already covered. The final injury list consisted of 15 items and the final pain list consisted of the original eight items.

In effort to be thorough I collected information both on the frequency and severity of these injuries and types of pain. Survey participants were asked to report whether they had experienced each of the occupational injuries in the past two weeks and if so whether or not they took time off of work for the injuries. Responses were made using a seven-point scale: 1-No, I did not have this injury, 2-Yes, but it didn't require time away from work, 3-Yes, I took less than a half day off, 4-Yes, I took a half day off, 5-Yes, I took a day off, 6-Yes, I took two days off, Yes, I took three or more days off. Frequency of injury was calculated by summing all injuries each participant reported regardless of the amount of time taken off work. Injury severity was calculated by summing the numeric responses pertaining to the amount of time taken off work across all the injuries. Time taken off of work was used as an index of injury severity because this has been commonly done in previous research (Carrivick, Lee, Yaus, & Stevenson, 2005; Collins, Wolf, Bell, & Evanoff, 2004; Horwitz & McCall, 2004).

For the pain items participants were asked if they had experienced work-related pain in each of the eight body areas and if so how long the pain lasted. Responses were made on a seven-point scale: 1-No, I did not have pain in this area, 2-Yes, for a couple of hours, 3-Yes, for a half of a day, 4-Yes, for a day, 5-Yes, for two days, 6-Yes, for three days, 7-Yes, for four or more days. Frequency of pain was calculated by summing the number of instances of pain experienced regardless of duration.

Two indices of pain severity were used: pain duration and pain intensity. These indices were chosen because both have been commonly used in injury research (Bolton, 1999; Centers for Disease Control, 2006; Tait & Chibnall, 2005). Pain duration was calculated by summing the numeric responses to the scale provided above. Pain intensity was assessed by again presenting the participants with the eight body areas and then asking them to rate each on a seven-point scale ranging from "I did not have pain in this area" to "Unbearable pain". Not every point on the scale had an anchor; however, these two extreme anchors were given along with "moderate pain" at the middle of the scale. Appendix II includes the measure in its entirety. Pain intensity was calculated by summing responses to this numeric scale.

A two-week time period for injury recall was chosen based on the recommendations of Massey and Gonzalez (1976), Smith (2006), and Warner et al. (2005). There are two major concerns when choosing a recall period for injury research. First, a recall period needs to be long enough to allow for injuries to have occurred. Second, a recall period needs to be short enough that people are able to remember the injuries that they have experienced. Massey and Gonzalez and Warner et al. have compared the accuracy of injury memories over different recall periods while taking this first concern into account. Their research findings led them to suggest recall periods of 2-4 or 3-6 weeks as the best balances of these two concerns. Furthermore, a number of studies on injury recall have noted that shorter recall reference periods are better for less severe injuries (Landen & Hendricks, 1995; Warner et al., 2005). According to information gathered in focus group sessions, CNAs face a great deal of minor injuries such as bruises/contusions, strains, or minor cuts.

*Additional Injury Questions.* Three additional questions were asked to help readers have a better understanding of the organizational consequences associated with the occupational injuries that were reported. Two questions were asked about workers' compensation claims. The first question asked participants if they had filed any workers' compensation claims about any of the occupational injuries that they had reported. The second question asked if they had filed any workers' compensation claims about any of the types of work-related pain that they had reported. The third question asked participants to report whether they had taken time off of work due to any of the types of pain that they had experienced.

*Analyses*

The first goal of the second study was to explore whether workplace sleepiness was related to safety performance and occupational injuries. This goal was accomplished by examining Pearson product-moment correlations involving these variables. The second goal of this study was to explore safety performance as a mediator of the relationship between workplace sleepiness and occupational injuries. The mediation hypothesis was tested using the Baron and Kenny (1986) approach. According to Baron and Kenny, three criteria must be met in order for a mediation hypothesis to be upheld. First, the independent variable (workplace sleepiness) must be a significant predictor of the mediator (safety performance). The second criterion is that the mediator be a significant predictor of the dependent variable (injury frequency, injury severity, pain frequency, pain severity-duration, or pain severity-intensity) after controlling for the effect of the independent variable. The third and final criterion is that the effect of the independent variable on the dependent variable be lessened after accounting for the effect

of the mediator. To test the second and third criterion a hierarchical regression analysis with two steps was conducted for each measure of occupational injuries. In the first step of each analysis, workplace sleepiness was entered as a predictor and in the second step safety performance. The second criterion was met when safety performance was a significant predictor of the dependent variable. The third criterion was met when the standardized regression coefficients for workplace sleepiness produced in the second step of each regression analysis was smaller than that for workplace sleepiness produced in the first step.

Although widely used, the Baron and Kenny (1986) method for assessing mediation has been criticized (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). One of the major criticisms of this method is that while it establishes conditions for mediation, it never really tests the indirect effect of the independent variable on the dependent variable through the mediator (referred to as the intervening variable effect). Other tests have been developed to test the intervening variable effect. Perhaps the most widely used is that created by Sobel (1982). This test involves dividing an estimate of the intervening variable effect by its standard error and then comparing this value to a standard normal distribution. MacKinnon, Lockwood, and Hoffman (1998) pointed out a problem with the Sobel (1982) test and others like it. These authors demonstrated that most of the tests of the significance of the intervening variable effect have low statistical power due to the distribution of the intervening variable effect not being normally distributed.

MacKinnon et al. (1998) developed three possible new methods to test the intervening variable effect. In a later study MacKinnon et al. (2002) compared the

statistical power and Type I error rates associated with each test. One of the variants that performed the best, the empirical distribution of $z' = \alpha\beta/\sigma_{\alpha\beta}$ is a modification of the Sobel method. The Sobel test involves the calculation of a z-statistic. This alternative method involves the same calculation, but the statistic is referred to as z' instead of z. This is because the statistic is compared against a distribution created by MacKinnon et al. (1998). The critical value for the .05 significance level for this distribution is .97 instead of 1.96. If all the criteria outlined by Baron and Kenny (1986) were met, this statistic was calculated to provide a more thorough test of the mediation hypothesis.

*Results*

Prior to testing the hypotheses for this study, descriptive information about the occupational injuries and work-related pain that were reported was considered. This information revealed that of those participants responding to the injury items, 63.6% reported having had at least one occupational injury and 3.6% reported filing a worker's compensation claim about an injury that they had during the past two weeks. This means that 5.6% of those who had experienced an injury filed a worker's compensation claim. Of those participants responding to the pain items, 80.7% reported having experienced pain in at least one body region and 2.1% of those responding reported filing a worker's compensation claim about the pain that they had experienced. This means that 2.7% of those that reported having pain filed a worker's compensation claim. Of the 89 CNAs who reported work-related injuries, 6.7% took some time off of work for their injury. Of the 113 CNAs who experienced work-related pain, 4.4% took some time off of work for their pain.

Descriptive statistics and intercorrelations for all of the variables used in the primary analyses are provided in Table 4. As can be seen in this table, workplace sleepiness was significantly correlated to safety performance such that increases in workplace sleepiness were associated with decreases in safety performance. This result provides support for the first hypothesis. To test the second hypothesis, multiple measures of occupational injuries were used. Workplace sleepiness was significantly related to pain frequency, pain severity-duration, and pain severity-intensity. The direction was as expected; increases in workplace sleepiness were associated with increases in each of these variables. Thus, the second hypothesis was partially supported.

To test the mediation hypothesis, I used Baron and Kenny's (1986) approach in combination with a test of the significance of the intervening variable effect proposed by MacKinnon et al. (1998). The support for the first hypothesis fulfills the first criterion for mediation outlined by Baron and Kenny. Results for tests of the second and third criteria can be seen in the Table 5. After controlling for the effect of workplace sleepiness, safety performance was only a significant predictor of pain frequency. So, the second criterion for mediation was only met in the case of pain frequency. The size of the standardized regression coefficients for workplace sleepiness produced in the first step of the regression analysis involving pain frequency were compared to those produced in the second step. The results show that this third criterion was met for pain frequency. The z′ statistic (MacKinnon et al., 1998) was calculated to test the intervening variable effect when pain frequency was used as a dependent variable. This test showed that the intervening variable effect was significant ($z'=2.29$, $p<.05$). Despite this, there was very limited support for the third hypothesis in general.

## *Discussion*

Prior occupational safety research has suggested that sleep related variables such as workplace sleepiness are likely related to increases in occupational injuries as a result of job performance decrements. There is no known research which empirically tests this suggestion, so this gap in the literature was addressed in the current study. However, the results of this study did not match expectations.

### *Relationships between Workplace Sleepiness and Occupational Safety*

This study provided support for a negative relationship between workplace sleepiness and safety performance and limited support for a positive relationship between workplace sleepiness and occupational injuries. Occupational injuries were measured in multiple ways: injury frequency, injury severity, pain frequency, pain severity-duration, and pain severity-intensity. 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 difference in relationships between workplace sleepiness and indices of injury versus indices of pain was likely due to differences in the rates at which injuries and pain were experienced. There were more instances of work-related pain reported than instances of injury and therefore more variability in measures of pain than measures of injury. This would not have necessarily been expected based on BLS occupational injury reports. According to records from 2005 the most common types of injuries involving days away from work for people working in nursing and residential care are sprains/strains, bruises, pain other than back pain, and back pain (BLS, 2006a). The frequency of pain observed in this study might seem high in relation to BLS statistics

because this study did not solely assess injuries that involved time away from work. It involved minor injuries as well. Pain might account for a higher proportion of minor injuries in nursing and residential care facilities than major injuries.

One other factor that likely contributed to the limited variability in injury frequency was the response options provided for injury items. Participants in essence were asked whether or not they had experienced each of fifteen different injuries. Then the number of injuries was summed to come up with an injury frequency score. Participants could not report any more than one instance of each type of injury. It is quite possible that participants experienced multiple instances of some of these injuries. Therefore, this procedure likely artificially restricted the range of injury frequency.

This measurement method was also used with pain frequency. While this method likely also limited its variability, there were so many participants in this study experiencing each type of pain it was not as significant of a problem. If one looks at the frequency with which each type of injury was reported and compares that to the frequency with which each type of pain was reported, there is a large discrepancy. There were 11 or fewer people who reported having experienced 12 of the 15 injuries presented to participants. More than 11 people reported every single type of pain. In fact 60 or more respondents reported each of the following types of pain: neck, shoulder, lower back, and foot pain. In future research it would likely be beneficial to ask participants to report the number of instances of each type of injury and pain and then calculate sums for injury frequency and pain frequency.

Measurement issues might also be to blame for the non-significant relationship between workplace sleepiness and injury severity. Injury severity was indexed as the

amount of time taken off of work due to injury. There was likely a lack of variability in this measure because CNAs try to avoid taking time off of work for financial reasons. When talking to CNAs informally during data collection, it became clear that many of them live paycheck to paycheck, and that they are not paid a great deal (median hourly rate of $10.07, BLS, 2006b).

This calls into question the practice of indexing injury severity as the amount of time taken off of work amongst CNAs. A review of occupational injury research shows that other methods might not be much better. For instance one other method involves asking whether the injury required medical attention. CNAs might not seek medical attention for an injury because they often do not have medical insurance or have poor medical insurance (Case, Himmelstein, & Woolhandler, 2002; Potter, Churilla, & Smith, 2006). Granted, a visit to the doctor would be covered if a CNA chose to file a workers' compensation claim. However, there is research which suggests that health care workers might be hesitant to report an injury to a supervisor or facility administrator let alone file a workers' compensation claim (Agnew, 1987; Blegen et al., 2004; Brown et al., 2005; Owen, 1989; Porta, Handelman, & McGovern, 1996). Future research needs to explore how injury severity might be measured more effectively in this population and others that might be similar.

*Safety Performance as a Mediator*

The results of this study provide limited support for the hypothesis that safety performance mediates the relationship between workplace sleepiness and occupational injuries. The mediation hypothesis was only upheld in the case of pain frequency. The mediation hypothesis might not have been upheld in the case of injury frequency and

injury severity due to limitations in variability. The mediation was also not upheld in the case of pain severity-duration or pain severity-intensity.

It is within the realm of possibility that safety performance might mediate the relationship between workplace sleepiness and pain frequency and not the relationship between workplace sleepiness and pain severity. After all, a person might be sleepier at work and as result his/her safety performance might decrease and that might make him/her more likely to experience some work-related pain. However, the decrements in safety performance might not necessarily lead to more severe pain. Consider this example. A person might be sleepy and as a result not pay attention to a slippery floor sign. This person might then be more likely to slip and fall and have pain as a consequence. However, environmental factors such as how slippery the floor was, the position of person's body in space, the presence or absence of other objects in the person's path might have a greater bearing on the severity of the resulting pain than the sleepiness related safety performance decrements.

The mediation hypothesis was upheld in the case involving pain frequency; yet, it should be noted that the results do not support full mediation but instead partial mediation. Full mediation means that workplace sleepiness was only related to pain frequency indirectly through safety performance. Partial mediation means that workplace sleepiness was related to pain frequency indirectly through safety performance but also directly (Baron and Kenny, 1986).

One possible explanation for the direct relationship between these variables is that pain might be impacting workplace sleepiness. There is research evidence which suggests that pain leads to sleep problems. These sleep problems could then in turn lead

to workplace sleepiness. Another possibility is that the direct relationship still appears because safety performance was not adequately captured by the current measure. The general job performance literature has been used as a guide for the development of a model of safety performance (Burke et al., 2002; Griffin & Neal, 2000; Hofmann et al., 2003) and this literature might offer some insight into where the safety performance measure might be lacking. The measure that was used here and other measures of the same construct have been influenced by distinctions made between two different components of job performance: task and contextual performance (or organizational citizenship behaviors; Borman & Motowidlow, 1993; Motowidlow, 2003; Organ, 1987). However, one component of job performance that has not yet been considered in the safety domain is adaptive performance.

Adaptive performance deals with how well people "adapt to new conditions or job requirements (Pulakos, Arad, Donovan, & Plamondon, 2000)." Perhaps there is a component of safety performance which involves adapting one's behavior to insure safety. Inclusion of this component in future measures of safety performance might help to better capture the latent construct which it underlies. It seems probable that there would be an adaptive component of safety performance. After all, certain aspects of a CNAs' jobs likely change frequently. A major portion of their jobs is caring for residents. However, residents leave, others die, and new residents come. The mental and physical functioning of residents can also change. Therefore some of the CNAs' behaviors probably involve adjusting to safely deal with different residents and their changing needs.

It is likely that workplace sleepiness could lead to decrements in adaptive aspects of safety performance. After all, it has already been noted that sleep deprivation causes decrements in cognitive functioning such as integration of sensory-motor information (Thomas et al., 2000) and learning (Drummond & Brown, 2001). Further there is research which suggests that workplace sleepiness might have a negative impact on problem solving skills (Harrison & Horn, 2000; Mertens & Collins, 1986), logical reasoning skills (Blagrove & Akehurst, 2001; Wallace et al., 2003), and effort (a reflection of motivation; Engle-Friedman et al., 2003). These types of skills and effort are likely necessary for effectively adjusting one's behavior. Failing to effectively adjust could lead to negative safety outcomes just as decrements in other aspects of job performance did (Hofmann & Stetzer, 1996; Reber, Wallin, & Duhon, 1993). Perhaps if safety performance measures were expanded to include an adaptive component, safety performance would be a better mediator of the relationship between workplace sleepiness and occupational injuries.

## GENERAL DISCUSSION

The current research which took place in the healthcare industry supports connections between resident aggression and workplace sleepiness, and workplace sleepiness and occupational safety. Past research has suggested that characteristics of organizations and the work that takes place in them including the timing (e.g., work at night, rotating shift work, on-call work) and quantity of work (e.g., number of work hours) can have an impact on workplace sleepiness. The current investigation went beyond this previous work to investigate how resident aggression may impact workplace sleepiness. Past research has also suggested that workplace sleepiness might lead to increased occupational injuries through its negative effects on job performance but there are no known empirical investigations of this suggestion. The current research helps to close this gap.

While this research makes important contributions to the workplace sleepiness research literature and offers a number of suggestions for future research, it is not without limitations. Some of these limitations have already been discussed; yet, there are additional limitations that deserve note. First, both of these studies involved solely self-report data. This raises a concern that the relationships that were observed could have been inflated due to common method variance. Future research should use a combination of other measurement techniques in effort to reduce these concerns.

The second limitation is that there were restrictions on the causal inferences that could be made due to shortcomings of the research designs utilized. The first study was

longitudinal; however, it took place over four days. Generally speaking one strength of a longitudinal design, compared to a cross-sectional design is that all of the variables of interest are not measured at the same time. If all of the variables are measured at the same time, observed relationships could be the result of temporal factors such as mood. The longitudinal design used here might allow some fleeting temporal factors to be ruled out as explanations for the observed relationships; however, it is questionable whether mood could be ruled out within four days. Future research is needed which helps to rule out alternative explanations for the significant relationships that were observed here.

The second study utilized a cross-sectional design which puts even more limitations on causal inferences than those that have already been noted. For instance, a cross-sectional design does not allow one to rule out the possibility that a causal chain could work in the reverse. In the second study, the mediation hypothesis that was upheld could indicate that increases in workplace sleepiness lead to decrements in safety performance which lead to increases in work-related pain. However, these results could also indicate that more pain could lead to decrements in safety performance and as a result increased workplace sleepiness. Future research which uses a longitudinal design to explore these hypotheses would be helpful.

*Conclusions*

This work taken together implies that organizations need to be wary of workplace sleepiness. There is likely a natural tendency for people to look at workplace sleepiness as a personal issue. After all, sleep is something that individuals do most often on personal time. The current research emphasizes that workplace sleepiness is an issue that

goes beyond individual people. It is an organizational issue. It is hoped that these studies act as an impetus for future organizational research in the area of workplace sleepiness.

## REFERENCES


Agnew, J. (1987). Back pain in hospital workers. *Occupational Medicine, 2,* 609-616.

Akerstedt, T., Fredlund, P., Gillberg, M., & Jansson, B. (2002). A prospective study of fatal occupational accidents – relationship to sleeping difficulties and occupational factors. *Journal of Sleep Research,* 11, 69-71.

American Nurses Association (2005) Handle with Care. [On-line]. Available: http://www.nursingworld.org/handlewithcare/.

Arnetz, J.E., Arnetz, B.B., & Petterson, I.L. (1996). Violence in the nursing profession: Occupational and lifestyle risk factors in Swedish nurses. *Work & Stress, 10,* 119-127.

Associated Press (2006a Septmber 28, 2006). Details from Colorado school shooting emerge: 53-year-old shooter's attack was 'sexual in nature' sheriff says. MSNBC http://www.msnbc.msn.com/id/15041037/ March 6, 2007.

Associated Press (2006b October 1, 2006). Details emerge about teen held in Wisconsin shooting: Neighbor boy charged in principal's death bragged about getting in trouble. MSNBC http://www.msnbc.msn.com/id/15060698/ March 6, 2007.

Associated Press (2006c January 31, 2006). Police look for motive in deadly postal shooting: Ex-employee killed 6, including herself; had been on medical disability. MSNBC http://www.msnbc.msn.com/id/11107022/ March 6, 2007.

Astrom, S., Bucht, G., Eisemann, M., Norberg, A., & Saveman, B.I. (2002). Incidence of violence towards staff caring for the elderly. *Scandinavian Journal of Caring Sciences,* 16, 66-72.

Babkoff, H., Thorne, D. R., Sing, H. C., Genser, S. G., Taube, S.L., & Hegge, F.W. (1985). Dynamic changes in work/rest duty cycles in a study of sleep deprivation. *Behavior Research Methods, Instruments, & Computers, 17,* 604–613.

Barling, J., Kelloway, E.K., & Iverson, R.D. (2003). Accidental outcomes: Attitudinal consequences of workplace injuries. *Journal of Occupational Health Psychology, 8,* 74-85.

Baron S, Hales T, Hurrell J. 1996. Evaluation of symptom surveys for occupational musculoskeletal disorders. *American Journal of Industrial Medicine, 29*, 609-17.

Baron, R.M., & Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Beehr, T. A. & Franz, T. M. (1986). The current debate about the meaning of job stress. *Journal of Organizational Behavior Management, 8*, 5-18.

Bergmann, T.J., & Volkema, R.J. (1994). Issues, behavioral responses and consequences in interpersonal conflicts. *Journal of Organizational Behavior,* 15, 467-471.

Blagrove, M., & Akehurst, L. (2001). Personality and the modulation of effects of sleep loss on mood and cognition. *Personality and Individual Differences,* 30, 819-828.

Blegen, M.A., Vaughn, T., Pepper, G., Vojir, C., Stratton, K., Boyd, M., et al. (2004). Patient and staff safety: Voluntary reporting. *American Journal of Medical Quality, 19*, 67-74.

Bollen, K., & Lennox, R. (1991). Conventional wisdom on measurement: A structural equation perspective. *Psychological Bulletin, 110*, 305-314.

Bonnet, M.H., & Arand, D.L. (2005). Performance and cardiovascular measures in normal adults with extreme MSLT scores and subjective sleepiness levels. *Sleep, 28*, 685-693.

Borman, W.C., & Motowidlo, S.J. (1993). Expanding the criterion domain to include elements of contextual performance. In N. Schmitt & W.C. Borman (Eds.), *Personnel selection in organizations* (pp. 71-98). San Francisco: Jossey-Bass.

Braverman, M. (1999). *Preventing Workplace Violence.* London: Sage Publications, Inc.

Brown, J.G., Trinkoff, A., Rempher, K., McPhaul, K., Brady, B., Lipscomb, J., et al. (2005). Nurses' inclination to report work-related injuries: Organizational, work-group, and individual factors associated with reporting. *American Association of Occupational Health Nurses Journal, 53*, 213-217.

Bugge, J.F., Opstad, P.K., & Magnus, P.M. (1979). Changes in the circadian rhythm of performance and mood in healthy young men exposed to prolonged, heavy physical work, sleep deprivation, and caloric deficit. *Aviation, Space, and Environmental Medicine,* 50, 663-668.

Bureau of Labor Statistics (1995). *National census of fatal occupational injuries, 1993.* [On-line]. Available: http://www.bls.gov/iif/home.htm#pub.

Bureau of Labor Statistics (2006a). *Number of nonfatal occupational injuries and illnesses involving days away from work by industry and selected natures of injury or illness, 2005.* [On-line]. Available: http://www.bls.gov/iif/oshwc/osh/case/ostb1657.pdf.

Bureau of Labor Statistics (2006b). *May 2005 National Industry-Specific Occupational Employment and Wage Estimates.* [On-line]. Available: http://www.bls.gov/oes/current/naics4_623100.htm#b31-0000.

Burke, M. J., Sarpy, S. A., Tesluk, P. E., & Smith-Crowe, K. (2002). General safety performance: A test of a grounded theoretical model. *Personnel Psychology, 55*, 429-457.

California Occupational Safety and Health Administration (Cal/OSHA) (1995). *Cal/OSHA Guidelines for Workplace Security.* San Francisco, CA: State of California, Department of Industrial Relations, Division of Occupational Safety and Health.

Campbell, J.P. (1990). Modeling the performance prediction problem in industrial and organizational psychology. In M.D. Dunnette & L.M. Hough (Eds.), Handbook of industrial and organizational psychology (2nd ed., Vol. 1, pp. 687-732). Palo Alto, CA: Consulting Psychology Press.

Campbell, J. P., McCloy, R. A., Oppler, S. H., & Sager, C. E. (1993). A theory of performance. In N. Schmitt & W. C. Borman (Eds.), *Personnel Selection in Organizations* (pp. 35-69). San Fransisco, CA: Jossey-Bass.

Carayon, P. (1993). A longitudinal test of Karasek's job strain model among office workers. *Work & Stress, 7*, 299-314.

Carrivick, P.J.W., Lee, A.H., Yaus, K.K.W., & Stevenson, M.R. (2005). Evaluating the effectiveness of a participatory ergonomics approach in reducing the risk and severity of injuries from manual handling. *Ergonomics, 48*, 907-914.

Carskadon, M. A., & Dement, W. C. (2000). Normal human sleep: An overview. In M. H. Kryger, T. Roth, & W. C. Dement (Eds.), *Principles and Practice of Sleep Medicine* (3rd Edn, pp. 15–25). Philadelphia: Saunders.

Case, B.G.S., Himmelstein, D.U., & Woolhandler, S. (2002). No care for the caregivers: Declining health insurance coverage for health care personnel and their children, 1988-1998. *American Journal of Public Health, 92*, 404-408.

Centers for Disease Control and Prevention (2006). National Health Interview Survey (NHIS) Questionnaire. Division of Health Interview Statistics, National Center for Health Statistics, Hyattsville, MD, Centers for Disease Control and Prevention, U.S. Department of Health and Human Services, February 2006. Available at ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2006/english/QADULT.pdf (accessed August 2006).

Chau, N., Mur, J.M., Touron, C., Benamghar, L., & Dehaene, D. (2004). Correlates of occupational injuries for various jobs in railway workers: A case-control study. *Journal of Occupational Health, 46*, 272-280.

Chau, N., Mur, J.M., Benamghar, L., Siegfried, C., Dangelzer, J.L., Francais, M., et al. (2002). Relationships between some individual characteristics and occupational accidents in the construction industry: A case-control study on 880 victims of accidents occurred during a two-year period. *Journal of Occupational Health, 44*, 131-139.

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences.* Hillsdale, NJ: Erlbaum.

Collins, J.W., Wolf, L., Bell, J., & Evanoff, B. (2004). An evaluation of a "best practices" musculoskeletal injury prevention program in nursing homes. *Injury Prevention, 10*, 206-211.

Culebras, A. (2002). Normal sleep. In T. L. Lee-Chiong, Jr, M. J. Sateia, & M. A. Carskadon (Eds.), Sleep Medicine (pp. 1–6). Philadelphia: Hanley & Belfus.

DeArmond, S. (2004). *The effects of job stressors on workplace sleepiness: A meta-analysis*. Unpublished master's thesis, Colorado State University, Fort Collins, Colorado.

Donaldson, C., Tarrier, N., & Burnse, A. (1997). The impact of the symptoms of dementia on caregivers. *British Journal of Psychiatry, 170*, 62-68.

Drummond, S.P.A., & Brown, G.G. (2001). The effects of total sleep deprivation on cerebral responses to cognitive performance. *Neuropychopharmacology, 25*, S68-S73.

Dupre, K.E., & Barling, J. (2003). Workplace aggression. In A. Sagie, S. Stashevsky, & M. Koslowsky (Eds.), *Misbehavior and Dysfunctional Attitudes in Organizations*. (Ch. 2, pp. 13-32). New York, NY: Palgrave Macmillan.

Engle-Friedman, M., Riela, S., Golan, R., Ventuneac, A.M., Davis, C.M., Jefferson, A.D., et al. (2003). The effect of sleep loss on next day effort. *Journal of Sleep Research, 12*, 113-124.

Englund, C.E., Ryman, D.H., Naitoh, P., & Hodgdon, J.A. (1985). Cognitive performance during successive sustained physical work episodes. *Behavior Research Methods, Instruments & Computers,* 17, 75-85.

Farrell, G., & Cubit, K. (2005). Nurses under threat: A comparison of content of 28 aggression management programs. *International Journal of Mental Health Nursing, 14*, 44-53.

Frone, M.R., Russel, M., & Cooper, M.L. (1995). Job stressors, job involvement and employee health: A test of identity theory. *Journal of Occupational and Organizational Psychology,* 68, 1-11.

Gabel, C.L., & Gerberich, S.G., (2002). Risk factors for injury among veterinarians. *Epidemiology, 13,* 80-86.

Gabrel, C.S. (2000). *Characteristics of elderly nursing home current residents and discharges: Data from the 1997 National Nursing Home Survey.* (Advance Data from vital and health statistics No. 312). Hyattsville, Maryland: National Center for Health Statistics.

Ganster, D. C. & Shaubroeck, J. (1991). Role stress and worker health: An extension of the plasticity hypothesis of self-esteem. *Journal of Social Behavior & Personality, 6*, 349-360.

Gillberg, M., & Akerstedt, T. (1998). Sleep loss performance: No "safe" duration of a monotonous task. *Physiology & Behavior,* 64, 599-604.

Gillberg, M., Kecklund, G., & Akerstedt, T. (1994). Relations between performance and subjective ratings of sleepiness during a night awake. *Sleep: Journal of Sleep Research & Sleep Medicine,* 17, 236-241.

Goldsheyder, D., Nordin, M., Weiner, S.S., & Heibert, R. (2002). Musculoskeletal symptom survey among mason tenders. *American Journal of Industrial Medicine, 42*, 384-396.

Griffin, M. A., & Neal, A. (2000). Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of Occupational Health Psychology, 5*, 347-358.

Gross, R.J., & Borkovec, T.D. (1982). Effects of a cognitive intrusion manipulation on the sleep-onset latency of good sleepers. *Behavior Therapy, 13*, 112-116.

Guastella, A.J., & Moulds, M.L. (2007). The impact of rumination on sleep quality following a stressful life event. *Personality and Individual Differences, 42*, 1151-1162.

Haack, M., & Mullington, J.M. (2005). Sustained sleep restriction reduces emotional and physical well-being. *Pain, 119*, 56-64.

Hagen, B.F., & Sayers, D. (1995). When caring leaves bruises: The effects of staff education on resident aggression. *Journal of Gerontological Nursing, 21*, 7-16.

Harrison, Y., & Horne, J. A. (2000). The impact of sleep deprivation on decision making: A review. *Journal of Experimental Psychology-Applied, 6*, 236–249.

Harvey, A.G. (2000). Pre-sleep cognitive activity: a comparison of sleep-onset insomniacs and good sleepers. *British Journal of Clinical Psychology, 39*, 275-286.

Harvey, A.G., Tang, N.K.Y., & Browning, L. (2005). Cognitive approaches to insomnia. *Clinical Psychology Review, 25*, 593-611.

Hedges, L.V., & Olkin, I. (1985). *Statistical methods for meta-analysis*. New York: Academic Press.

Hoddes, E., Zarcone, V. & Dement, W. (1973). Quantification of sleepiness: A new approach. *Psychophysiology, 9*, 431-436.

Hofmann, D.A., & Stetzer, A. (1996). A cross-level investigation of factors influencing unsafe behaviors and accidents. *Personnel Psychology, 49*, 307-339.

Hofmann, D. A., Morgeson, F. P., & Gerras, S. J. (2003). Climate as a moderator of the relationship between leader-member exchange and content specific citizenship: Safety climate as an exemplar. *Journal of Applied Psychology, 88*, 170-178.

Hogh, A., Borg, V., Mikkelsen, K.L. (2003). Work-related violence as a predictor of fatigue: A 5-year follow-up of the Danish Work Environment Cohort Study. *Work & Stress,* 17, 182-194.

Hong, R.Y. (2007). Worry and rumination: differential associations with anxious and depressive symptoms and coping behavior. *Behavior Research and Therapy, 45*, 277-290.

Horwitz, I.B., & McCall, B.P. (2004). The impact of shift work on the risk and severity of injuries for hospital employees: an analysis using Oregon workers' compensation data. *Occupational Medicine, 54*, 556-563.

Hossain, J.L., Ahmad, P., Reinish, L.W., Kayumov, L. Hossain, N., & Shapiro, C.M. (2005). Subjective fatigue and subjective sleepiness: Two independent consequences of sleep disorders? *Journal of Sleep Research, 14*, 245-253.

Hunter, M. (July 15, 2005). Elmwood office mourns slayings: Manager and data clerk are recalled fondly. *Times-Picayune* Metro Section p. 1. New Orleans, LA.

Kageyama, T., Nishikido, N., Kobayashi, T., & Kawagoe, H. (2001). Estimated sleep debt and work stress in Japanese white-collar workers. *Psychiatry and Clinical Neurosciences,* 55, 217-219.

Kahn, R.L., & Byosiere, P. (1992). Stress in organizations. In M.D. Dunnette & L.M. Hough (Eds.), *Handbook of industrial and organizational psychology* (2nd ed., Vol. 3, pp. 571-650). Palo Alto, CA: Consulting Psychologist Press.

Kelley, H.H., & Michela, J.L. (1980). Attribution theory and research. *Annual Review of Psychology, 31*, 457-501.

Kenny, D.A., Kashy, D.A., & Bolger, N. (1998). Data analysis in social psychology. In D.T. Gilbert, S.T. Fiske, & G. Lindzey (Eds.), *TheHandbook of Social Psychology* (pp. 233-265). Boston: McGraw-Hill.

Kivimaki, M. & Lindstroem, K. (1995). Effects of private self-consciousness and control on the occupational stress-strain relationship. *Stress Medicine, 11*, 7-16.

Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sorensen, F., Andersson, G., et al. (1987). Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied Ergononmics, 18*, 233-237.

Krauss, A. D. (2004). *Examination of the motivational component of safety performance: An application of expectancy theory.* Unpublished master's thesis, Colorado State University, Fort Collins, Colorado.

Krauss, D. A., Chen, P. Y., DeArmond, S., & Moorcroft, B. (2003). Sleepiness in the workplace: Causes, consequences, and countermeasures. In C. L. Cooper and I. T. Robertson (Eds.). *International Review of Industrial and Organizational Psychology (Vol.* 8, pp. 81-129). West Sussex, England: John Wiley.

Krauss, A.D., Mazurkiewicz, M., Chen, P.Y., DeArmond, S., Smith, A., & Rosecrance, J.C. (2006, March). *The Development of a Mini-Measure of Safety Performance.* Paper presented at the Sixth International Conference on Occupational Stress and Health, Miami, Florida.

Landen, D.D., & Hendricks, S. (1995). Effect of recall on reporting at-work injuries. *Public Health Reports, 110*, 350-354.

Lanza, M.L. (1988). Factors relevant to patient assault. *Issues in Mental Health Nursing,* 9, 239-258.

Lanza, M.L. (1995). Nursing staff as victims of patient assault. In B.S. Eichelman & A.C. Hartwig (Eds.), *Patient Violence and the Clinician.* Washington D.C.: American Psychiatric Press.

Lazarus, R.S. (1966). *Psychological Stress and the Coping Process.* New York: McGraw-Hill.

Lazarus, R.S., & Folkman, S. (1984). *Stress, Appraisal, and Coping.* New York: Springer.

Lilley, R., Feyer, A.M., Kirk, P., & Gander, P. (2002). A survey of forest workers in New Zealand: Do hours of work, rest, and recovery play a role in accidents and injury? *Journal of Safety Research,* 33, 53-71.

Lion, J.R., Snyder, W. & Merrill, G.L. (1981). Underreporting assaults on staff in a state hospital. *Hospital and Community Psychiatry, 32,* 497-498.

MacKinnon, D.P., Lockwood, C.M., Hoffman, J.M., West, S.G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7,* 83-104.

MacKinnon, D.P., Lockwood, C., & Hoffman, J. (1998, June). *A new method to test for mediation.* Paper presented at the annual meeting of the Society for Prevention Research, Park City, UT.

Martens, M. F. J., Nijhuis, F. J. N., Van Boxtel, M. P. J., & Knottnerus, J. A. (1999). Flexible work schedules and mental and physical health. A study of a working population with non-traditional working hours. *Journal of Organizational Behavior, 20,* 35–46.

Massey, J.T., & Gonzales, J.F. (1976). Optimum recall periods for estimating accidental injuries in the National Health Interview survey. Proceedings from the American Statistical Association (Social Statistics Section) 18: 584-588.

McGrath, J.E. (1976). Stress and behavior in organizations. In M.D. Dunnette (Ed.), *Handbook of industrial and organizational psychology* (pp. 1351-1395). Chicago: Rand McNally.

Melamed, S., & Oksenberg, A. (2002). Excessive Daytime Sleepiness and Risk of Occupational Injuries in Non-Shift Daytime Workers. *Sleep: Journal of Sleep and Sleep Disorders Research,* 25, 315-321.

Merlino, L.A., Rosecrance, J.C., Anton, D, & Cook, T.M. (2003). Symptoms of musculoskeletal disorders among apprentice construction workers. *Applied Occupational and Environmental Hygiene, 18,* 1-8.

Mertens, H. W., & Collins, W. E. (1986). The effects of age, sleep deprivation, and altitude on complex performance. *Human Factors, 28*, 541–551.

Mikkelsen, E.G., & Einarsen, S. (2001). Bullying in Danish work-life: Prevalence and health correlates. *European Journal of Work and Organizational Psychology,* 10, 393-413.

Mitchell, R.E., Cronkite, R.C., & Moos, R.H. (1983). Stress, coping, and depression among married couples. *Journal of Abnormal Psychology, 92*, 433-448.

Moorcroft, W.M. (1993). *Sleep, Dreaming, and Sleep Disorders: An Introduction* (2nd ed.). Lanham, MD: University Press of America.

Motowidlo, S.J. (2003). Job performance. In W.C. Borman, D.R. Ilgen, & R.J. Klimoski (Eds.) *Handbook of Psychology: Vol. 12. Industrial and Organizational Psychology* (pp. 39-53). Hoboken, NJ: John Wiley & Sons, Inc.

Nakata, A., Ikeda, T., Takahashi, M., Haratani, T., Fujioka, Y., Fukui, S., et al. (2005). Sleep-related risk of occupational injuries in Japanese small and medium-scale enterprises. *Industrial Health, 43,* 89-97.

National Institute for Occupational Safety and Health (2005). *NIOSH Safety and Health Topic: Health Care Workers.* [On-line]. Available: http://www.cdc.gov/niosh/topics/healthcare/.

National Sleep Foundation (2005). Sleep in America Poll: Summary of Findings. [On-line]. Available: http://www.sleepfoundation.org/hottopics/index.php?secid=16&id=245.

National Sleep Foundation (1998–2002). Sleep in America Poll. [On-line]. Available: http://www.sleepfoundation.org/_content/hottopics/2002SleepInAmericaPoll.pdf.

Nolen-Hoeksema, S., McBride, A., & Larson, J. (1997). Rumination and psychological distress among bereaved partners. *Journal of Personality and Social Psychology, 72*, 855-862.

Occupational Safety and Health Administration. (2004). *Guidelines for preventing workplace violence for health care and social service workers.* (OSHA Publication No. 3148-01R). [On-line]. Available: http://www.osha.gov/Publications/osha3148.pdf.

Organ, D.W. (1988). *Organizational citizenship behavior: The good soldier syndrome.* Lexington, MA: Lexington Books.

Owen, B.D. (1989). The magnitude of low-back problem in nursing. *Western Journal of Nursing Research, 11*, 234-242.

Perrewé, P.L., & Zellars, K.L. (1999). An examination of attributions and emotions in the transactional approach to the organizational stress process. *Journal of Organizational Behavior, 20*, 739-752.

Peeters, M.C.W., Schaufeli, W.B., & Buunk, B.P. (1995). The role of attributions in the cognitive appraisal of work-related stressful events: an event-recording approach. *Work & Stress, 1995*, 463-474.

Potter, S.J., Churilla, A., Smith, K. (2006). An examination of full-time employment in the direct-care workforce. *Journal of Applied Gerontology, 25*, 356-374.

Pulakos, E.D., Arad, S., Donovan, M.A., & Plamondon, K.E. (2000). Adaptability in the workplace: Development of a taxonomy of adaptive performance. *Journal of Applied Psychology, 85*, 612-624.

Reber, R.A., Wallin, J.A., & Duhon, D.L. (1993). Preventing occupational injuries through performance management. *Public Personnel Management, 22*, 301-311.

Roehrs, T., Carskadon, M.A., Dement, W.C., & Roth, T. (2000). Daytime sleepiness and alertness. In M.H. Kryger, T. Roth, & W.C. Dement (Eds.), *Principles and Practice of Sleep Medicine* (3rd ed., pp. 43-52). Philadelphia: Saunders.

Rogers, K.A., & Kelloway, E.K. (1997). Violence at work: Personal and organizational outcomes. *Journal of Occupational Health Psychology, 2*, 63-71.

Rosa, R.R., & Colligan, M.J. (1988). Long workdays versus restdays: Assessing fatigue and alertness with a portable performance battery. *Human Factors, 30*, 305-317.

Rosecrance, J.C., Ketchen, K.J., Merlino, L.A., Anton, D.C., & Cook, T.M. (2002). Test-retest reliability of a musculoskeletal symptom and job factors questionnaire used in ergonomics research. *Applied Occupational and Environmental Hygiene, 17*, 613-621.

Rosenstock, H.A. (1970). Alzheimer's presenile dementia: A review of 11 clinically diagnosed cases. *Diseases of the Nervous System, 31*, 826-829.

Schat, A.C., Kelloway, K.E. (2000). Effects of perceived control on the outcomes of workplace aggression and violence. *Journal of Occupational Health Psychology,* 5, 386-402.

Schat, A.C., & Kelloway, K.E. (2003). Reducing the adverse consequences of workplace aggression and violence: The buffering effects of organizational support. *Journal of Occupational Health Psychology,* 8, 110-122.

Schuler, R. S. (1980). Definition and conceptualization of stress in organizations. *Organizational Behavior & Human Decision Processes, 25*, 184-215.

Segerstrom, S. C., Tsao, J. C. I., Alden, L. E., & Craske, M. G. (2000). Worry and rumination: Repetitive thought as a concomitant and predictor of negative mood. *Cognitive Therapy and Research, 24*, 671–688.

Simpson, S.A., Wadsworth, E.J.K., Moss, S.C., & Smith, A.P. (2005). Minor injuries, cognitive failures and accidents at work: Incidence and associated features. *Occupational Medicine, 55*, 99-108.

Snyder, L. A., Chen, P. Y., Grubb, P. L., Roberts, R. K., Sauter, S. L., & Swanson, N. G. (2004). Workplace aggression and violence: causes, consequences, and interventions. In P. L. Perrewe and D. C. Ganster (Eds.). *Research in Occupational Stress and Well Being, 4,* 1-65.

Sobel, M.E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhardt (Ed.), Sociological methodology 1982 (pp. 290-312). Washington, DC: American Sociological Association.

Spector, P. E. (1997). The role of frustration in anti-social behavior at work. In R. A. Giacalone & J. Greenberg (eds.) *Anti-social Behavior in the Workplace* (pp. 1-17). Newbury Park, CA: Sage.

Spector, P. E. (1986). Perceived control by employees: A meta-analysis of studies concerning autonomy and participation at work. *Human Relations, 39*, 1005-1016.

Spector, P.E., Dwyer, D.J., & Jex, S.M. (1988). Relation of job stressors to affective, health, and performance outcomes: A comparison of multiple data sources. *Journal of Applied Psychology,* 73, 11-19.

Spector, P.E., & Jex, S.M. (1998). Development of four self-report measures of job stressors and strain: Interpersonal Conflict at Work Scale, Organizational Constraints Scale, Quantitative Workload Inventory, and Physical Symptoms Inventory. *Journal of Occupational Health Psychology,* 3, 356-367.

Spector, P.E., & O'Connell, B.J. (1994). The contribution of personality traits, negative affectivity, locus of control and Type A to the subsequent reports of job stressors and job strains. *Journal of Occupational and Organizational Psychology,* 67, 1-12.

Thomas, M., Sing, H., Belenky, G., Holcomb, H., Mayberg, H., Dannals, R., et al., (2000). Neural basis of alertness and cognitive performance impairments during sleepiness. Effects of 24 hours of sleep deprivation on waking human regional brain activity. *Journal of Sleep Research, 9*, 335-352.

Thomsen, D.K., Mehlsen, M.Y., Christensen, S., & Zachariae, R. (2003). Rumination—relationship with negative mood and sleep quality. *Personality and Individual Differences, 34*, 1293-1301.

Totterdell, P., Reynolds, S., Parkinson, B., & Briner, R. B. (1994). Associations of sleep with everyday mood, minor symptoms and social interaction experience. *Sleep, 17*, 466–475.

Ulfberg, J., Carter, N., & Edling, C. (2000). Sleep-disordered breathing and occupational accidents. *Scandinavian Journal of Work and Environmental Health, 26*, 237-242.

University of Iowa Injury Prevention Research Center (2001). Workplace Violence: A Report to the Nation. Retrieved 3 March 2007, from the University of Iowa Injury Prevention Web Site: http://www.public-health.uiowa.edu/IPRC/NATION.PDF.

Wallace, J.C., Vodanovich, S.J., & Restino, B.M. (2003). Predicting cognitive failures from boredom proneness and daytime sleepiness scores: An investigation within military and undergraduate samples. *Personality and Individual Differences, 34*, 635-644.

Warner, M. Schenker, N., Heinen, M.A., & Fingerhut, L.A. (2005). The effects of recall on reporting injury and poisoning episodes in the National Health Interview Survey. *Injury Prevention, 11*, 282-287.

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review, 92*, 548-573.

Wildgoose, J., Briscoe, M., Lloyd, K. (2003). Psychological and emotional problems in staff following assaults by patients. *Psychiatric Bulletin,* 27, 295-297.

Wykes, T., & Whittington, R. (1998). Prevalence and predictors of early traumatic stress reactions in assaulted psychiatric nurses. *Journal of Forensic Psychiatry,* 9, 643-658.

Yamada, Y. (2002). Profile of home care aides, nursing home aides, and hospital aides: historical changes and data recommendations. *The Gerontologist, 42*, 199-206.

Table 1. Descriptive Statistics and Intercorrelations for Resident Aggression and Workplace Sleepiness

| | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Aggression Time 1 | 7.303 | 10.806 | | | | | | | | |
| 2. Aggression Time 2 | 8.118 | 10.736 | .446* | | | | | | | |
| 3. Aggression Time 3 | 5.795 | 9.936 | .772* | .503* | | | | | | |
| 4. Aggression Time 4 | 7.536 | 11.296 | .724* | .543* | .762* | | | | | |
| 5. Sleepiness Time 1 | 2.473 | 1.333 | .153 | -.073 | .079 | -.023 | | | | |
| 6. Sleepiness Time 2 | 2.355 | 1.208 | .123 | .137 | .133 | .093 | .507* | | | |
| 7. Sleepiness Time 3 | 2.390 | 1.155 | .186 | .121 | .196 | .070 | .587* | .663* | | |
| 8. Sleepiness Time 4 | 2.507 | 1.279 | .350* | .094 | .311* | .281* | .480* | .541* | .540* | |

*Note.* $N$=68. *$p$<.05.

Table 2. Relationships between Resident Aggression and Workplace Sleepiness

| Relationship | 1-day lag | 2-day lag | 3-day lag |
|---|---|---|---|
| Resident Aggression- Subsequent Workplace Sleepiness | | | |
| Average $r_{A-S}$ | .172* | .100 | .350[a]* |
| Q (v) | 2.465 (1.128) | .004 (.550) | N/A |
| Workplace Sleepiness- Subsequent Resident Aggression | | | |
| Average $r_{S-A}$ | .023 | .069 | -.023[a] |
| Q (v) | 2.883 (1.307) | .153 (.679) | N/A |
| $r_{A-S}$ vs. $r_{S-A}$ | | | |
| Q (v) | 7.688 (2.642) | .225 (1.752) | N/A |
| Z | N/A | N/A | 2.71* |

N/A = not applicable. [a] Pearson product-moment correlation. *$p$<.05.

Table 3. Intercorrelations between Accumulated Workplace Sleepiness and Resident Aggression

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Sleepiness12 | | | | | | | | | |
| 2. Sleepiness23 | .853* | | | | | | | | |
| 3. Sleepiness34 | .737* | .851* | | | | | | | |
| 4. Sleepiness123 | .965* | .938* | .839* | | | | | | |
| 5. Sleepiness234 | .836* | .941* | .962* | .905* | | | | | |
| 6. Sleepiness1234 | .932* | .914* | .932* | .968* | .964* | | | | |
| 7. Aggression2 | .026 | .141 | .121 | .064 | .137 | .079 | | | |
| 8. Aggression3 | .119 | .181 | .292* | .156 | .256* | .220 | .503* | | |
| 9. Aggression4 | .034 | .089 | .206 | .050 | .180 | .129 | .543* | .762* | |

*Note.* $N$=68. *$p$<.05.

Table 4. Descriptive Statistics and Intercorrelations for All Variables Included in the Analyses

| | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Sleepiness | 2.504 | 1.224 | | | | | | | |
| 2. Safety | 42.427 | 10.626 | -.208* | | | | | | |
| 3. Injury Frequency | 1.343 | 1.464 | .049 | -.157 | | | | | |
| 4. Injury Severity | 16.321 | 2.264 | .045 | -.100 | .731* | | | | |
| 5. Pain Frequency | 3.161 | 2.440 | .270* | -.312* | .452* | .416* | | | |
| 6. Pain Severity (Duration) | 17.021 | 10.886 | .299* | -.137 | .385* | .398* | .815* | | |
| 7. Pain Severity (Intensity) | 17.242 | 8.027 | .290* | -.096 | .411* | .478* | .771* | .792* | |

*Note.* $N$=116. *$p$<.05.

Table 5. Tests of the Second and Third Criteria for Assessing the Mediation Hypothesis

| | | Injury Frequency B(β) | SE | Injury Severity B(β) | SE | Pain Frequency B(β) | SE | Pain Severity-Duration B(β) | SE | Pain Severity-Intensity B(β) | SE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Criteria 2 & 3 | | | | | | | | | | | |
| Step 1 | Sleepiness | .185 (.153) | .105 | .030 (.016) | .165 | .581 (.291)* | .167 | 2.518 (.289)* | .736 | 2.091 (.321)* | .563 |
| Step 2 | Sleepiness | .133 (.110) | .108 | -.028 (-.015) | .171 | .434 (.218)* | .168 | 2.265 (.260)* | .763 | 1.972 (.303)* | .581 |
| | Safety Performance | -.022 (-.158) | .012 | -.025 (-.117) | .020 | -.062 (-.270)* | .019 | -.108 (-.108) | .088 | -.055 (-.075) | .065 |
| | *N* | 132 | | 130 | | 132 | | 130 | | 122 | |

* p<.05

Figure 1. The relationship between resident aggression and subsequent workplace sleepiness.

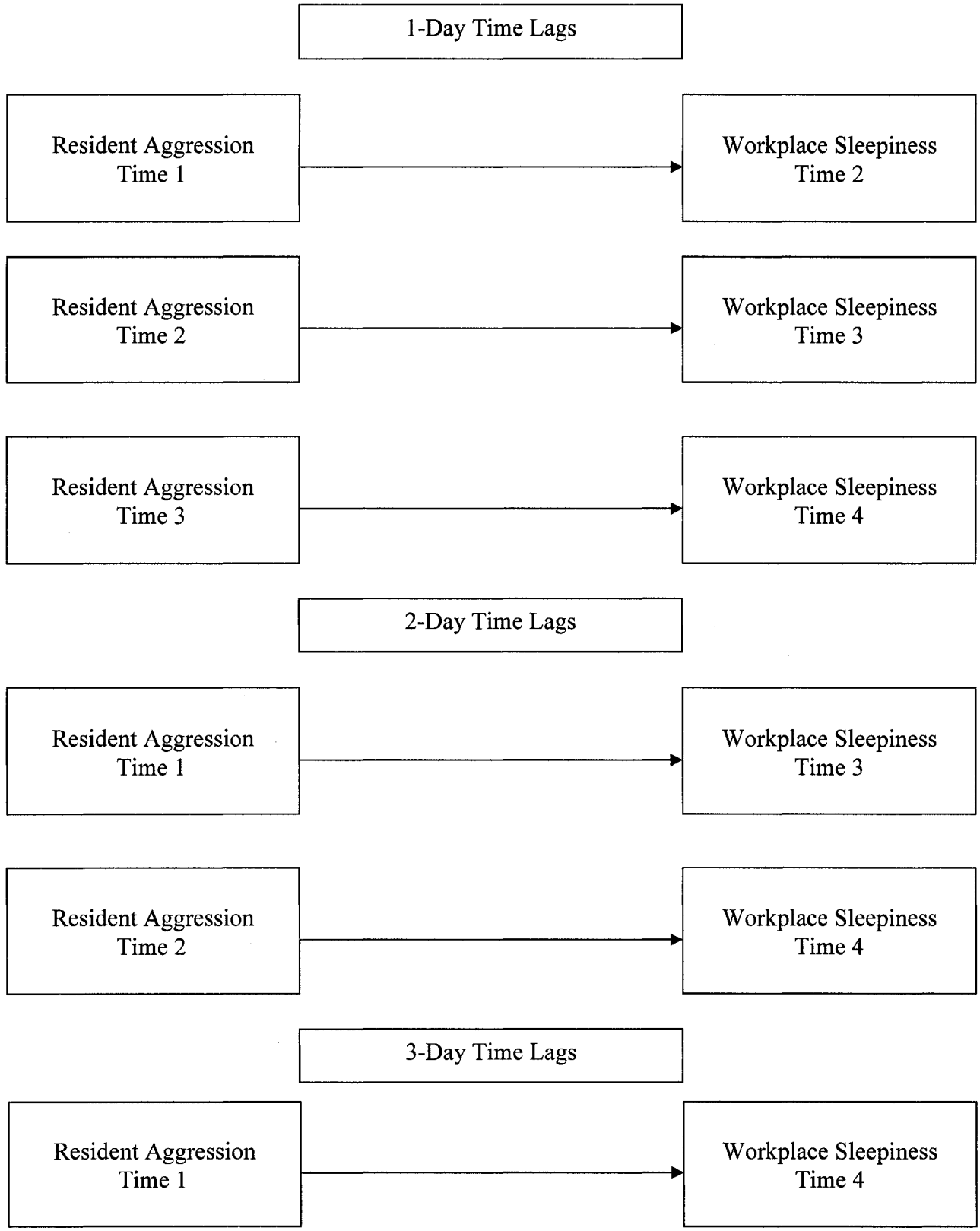
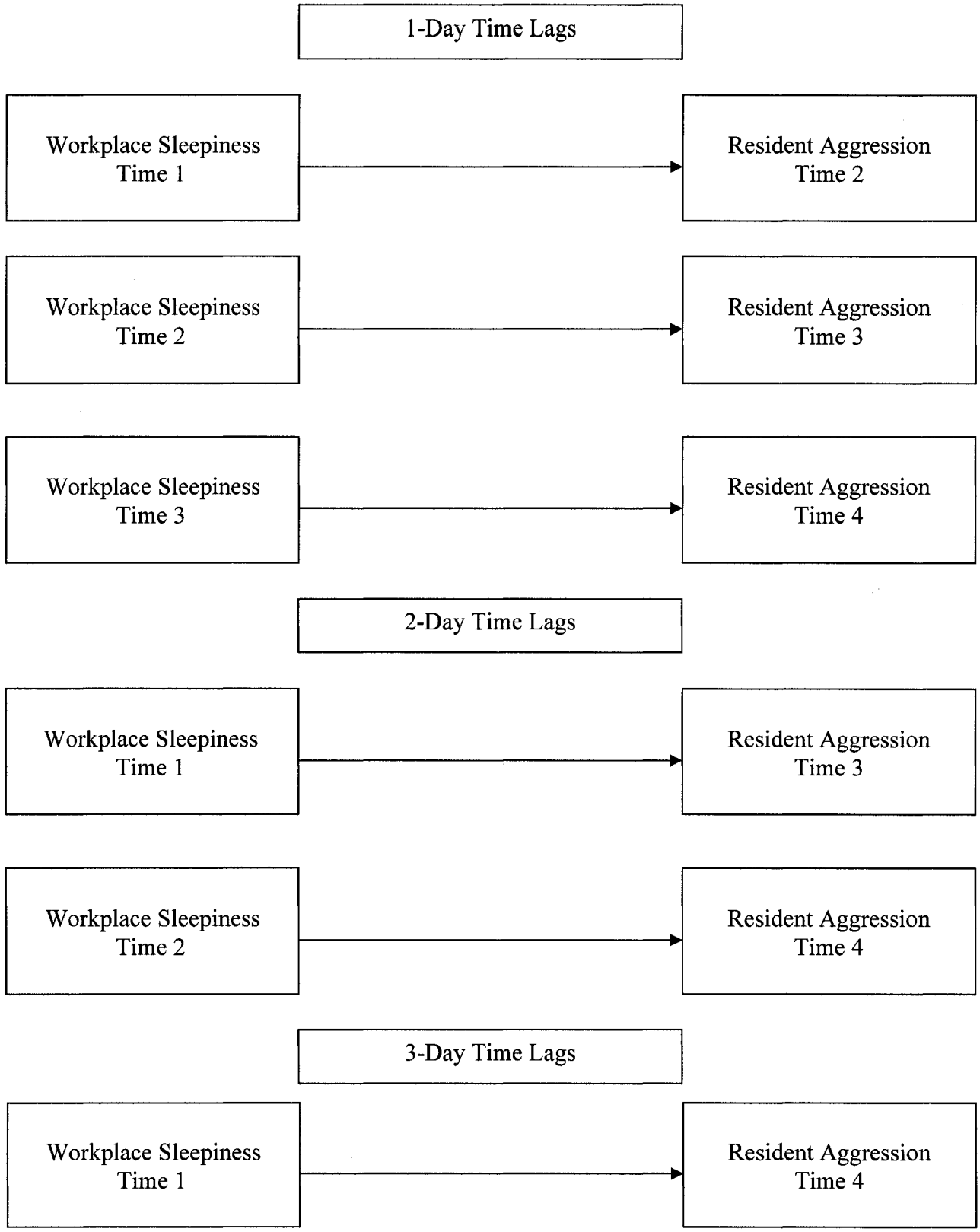


Figure 2. The relationship between workplace sleepiness and subsequent resident aggression.



APPENDIX I

**Resident Aggression**

For each action listed, please circle the number of incidents that occurred **DURING YOUR SHIFT TODAY** in which you experienced the action **from residents**. For each kind of action you experienced, also indicate the **ACTUAL NUMBER** of incidents you reported to a supervisor, either verbally or in writing.

| **Actions from Residents** | **How many incidents today?** | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. Hit me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 2. Kicked me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 3. Grabbed me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 4. Pulled my hair | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 5. Called me names | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 6. Shoved me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 7. Pinched me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 8. Pushed me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 9. Spat on me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 10. Bit me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 11. Threw an object at me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 12. Yelled at me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 13. Swore at me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 14. Glared at me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 15. Threatened me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |

| Actions from Residents | How many incidents today? | | | | | | |
|---|---|---|---|---|---|---|---|
| 16. Made an obscene gesture at me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 17. Made a sexual comment to me | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |
| 18. Touched me sexually | 0 | 1 | 2 | 3 | 4 | 5 | 6 or above |

**Workplace Sleepiness**

Please choose **ONE** of the seven statements below which describes your **CURRENT** state. Write down the number that corresponds to your choice in the left column.

| | |
|---|---|
| | 1. Feeling active and vital; alert; wide awake |
| | 2. Functioning at a high level, but not at peak; able to concentrate |
| | 3. Awake, but relaxed; responsive but not fully alert |
| | 4. A little foggy, not at peak; let down |
| | 5. Fogginess, beginning to lose interest in remaining awake; slowed down |
| | 6. Sleepiness, prefer to be lying down, fighting sleep, woozy |
| | 7. Almost in reverie, sleep onset soon, lost struggle to remain awake |

APPENDIX II

**Workplace Sleepiness**

Please choose **ONE** of the following statements which describes how you have typically been feeling **AT WORK** in the PAST TWO WEEKS. Place a check in the box that corresponds to your choice.

- ☐ Feeling active and vital; alert; wide awake
- ☐ Functioning at a high level, but not at peak; able to concentrate
- ☐ Awake, but relaxed; responsive but not fully alert
- ☐ A little foggy, not at peak; let down
- ☐ Fogginess, beginning to lose interest in remaining awake; slowed down
- ☐ Sleepiness, prefer to be lying down, fighting sleep, woozy
- ☐ Almost in reverie, sleep onset soon, lost struggle to remain awake

**Safety Performance**

**Please complete the following section based on your experiences at work in the past two weeks.**

| | **When necessary how often in the PAST TWO WEEKS have you...** | Sometimes | Fairly Often | Quite Often | Usually | Frequently, if not always | Always |
|---|---|---|---|---|---|---|---|
| 1 | Used the appropriate personal protective equipment as indicated by the site health and safety plan? | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | Applied the appropriate work practices to reduce exposures to hazards including applicable standard operating procedures? | 1 | 2 | 3 | 4 | 5 | 6 |
| 3 | Appropriately reported incidents, accidents, or illnesses? | 1 | 2 | 3 | 4 | 5 | 6 |

| | **When necessary how often in the PAST TWO WEEKS have you…** | Sometimes | Fairly Often | Quite Often | Usually | Frequently, if not always | Always |
|---|---|---|---|---|---|---|---|
| 4 | Taken the appropriate steps if prevented from or punished for exercising your rights under OSHA policies and procedures? | 1 | 2 | 3 | 4 | 5 | 6 |
| 5 | Assisted others to make sure they performed their work safely? | 1 | 2 | 3 | 4 | 5 | 6 |
| 6 | Attended non-mandatory safety oriented training? | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | Spoken up and encouraged others to get involved in safety issues? | 1 | 2 | 3 | 4 | 5 | 6 |
| 8 | Tried to change the way the job is done to make it safer? | 1 | 2 | 3 | 4 | 5 | 6 |
| 9 | Explained to other workers that you will report safety violations? | 1 | 2 | 3 | 4 | 5 | 6 |
| 10 | Taken action to stop safety violations in order to protect the well-being of other coworkers? | 1 | 2 | 3 | 4 | 5 | 6 |

**Occupational Injuries**

**In the PAST TWO WEEKS, have you experienced any of the following injuries at work? If so, how much time did you have to take off of work because of the injury? Circle the number that corresponds to your answer.**

| | | No, I did not have this injury | Yes, but it didn't require time away from work | Yes, I took less than a half day off | Yes, I took a half day off | Yes, I took a day off | Yes, I took two days off | Yes, I took three or more days off |
|---|---|---|---|---|---|---|---|---|
| 11 | Strain | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12 | Sprain | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13 | Cut/Laceration | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14 | Blisters | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 15 | Puncture | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 16 | Burn | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 17 | Bruise/Contusion | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 18 | Fractured bone | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 19 | Dislocated joint | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 20 | Electrical shock | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 21 | Eye injury | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 22 | Tendonitis | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 23 | Carpal tunnel | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 24 | Chemical exposure | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 25 | Concussion | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

26 Have you filed a workers' compensation claim for an injury that you experienced at work during the PAST TWO WEEKS? Yes No

If yes, what type of injury from above did you file the claim about? _____

**In the PAST TWO WEEKS, have you experienced work-related pain in any of the following body areas? If so, how long did the pain last? Circle the number that corresponds to your answer.**

| | | No, I did not have pain in this area | Yes, for a couple of hours | Yes, for a half of a day | Yes, for a day | Yes, for two days | Yes, for three days | Yes, for four or more days |
|---|---|---|---|---|---|---|---|---|
| 27 | Head/Skull/Face | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 28 | Neck | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 29 | Shoulders | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 30 | Hand/Wrist/Fingers | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 31 | Chest/Ribs/Sternum | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 32 | Lower back | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 33 | Knees | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 34 | Feet | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**On average, how severe has the work-related pain been in these areas in the PAST TWO WEEKS? Circle the number that corresponds to the severity of your pain.**

| | | I did not have pain in this area | | | Moderate Pain | | | Unbearable pain |
|---|---|---|---|---|---|---|---|---|
| 27 | Head/Skull/Face | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 28 | Neck | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 29 | Shoulders | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 30 | Hand/Wrist/Fingers | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 31 | Chest/Ribs/Sternum | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 32 | Lower back | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 33 | Knees | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 34 | Feet | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | | | |
|---|---|---|---|
| 35 | Have you taken time off of work during the PAST TWO WEEKS as a result of any of the pain you reported in the previous sections? | Yes | No |
| | If yes, what type of pain from the previous sections caused you to do this? | _____ | |
| | How long were you off work? | _____ | |
| 36 | Have you filed a workers' compensation claim due to the pain that you have experienced at work during the PAST TWO WEEKS? | Yes | No |
| | If yes, what type of pain from the previous sections did you file the claim about? | _____ | |

## AUTHOR NOTE

Sarah DeArmond, Department of Psychology, Colorado State University.

This study serves as the dissertation requirement for the Doctor of Philosophy Degree in Psychology from Colorado State University.

This study was supported by Grant Number R49/CCR811509 from the Centers for Disease Control and Prevention and the Colorado State University Occupational Health Psychology Scholarship. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention nor Colorado State University.