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Drinking on a Work Night: a Comparison of Day and Person-Level Associations with Workplace Outcomes

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Drinking on a Work Night: A Comparison of Day and Person-Level Associations with

Workplace Outcomes

by

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Abstract

Alcohol use and misuse is costly for U.S. employers, primarily due to health care expenses and lost work productivity. Despite high costs for organizations, employee alcohol use is understudied within the organizational literature. The scant research conducted largely utilized cross-sectional designs examining differences across individuals, despite prevailing theoretical frameworks describing primarily within-person processes. This study examined the simultaneous within-person and between-person relationships between employee alcohol use and work and well-being outcomes. The separation and comparison of within-person and between-person effects is essential for the evaluation of key theoretical frameworks around employee alcohol use. Additionally, this study investigates one mechanism (i.e., sleep quality) that may help to explain how drinking links to work and well-being outcomes. Data was collected from separated post 9/11 service members and active reservists working in the civilian workforce via an internet-based survey completed in the evening over 32 consecutive days. Results indicated that within this sample of more moderate drinkers, between-person estimates were better predictors of the examined outcomes. Specifically, individuals who drank more in general tended to perceive higher levels of self-control demands and sleep less well. Additionally, between-person drinking was indirectly related to work performance, creativity, and perceived self-control demands through poor sleep quality across individuals. Examinations of the work and nonwork factors associated with work and

well-being outcomes help identify risk factors that hinder employee success and provide

insights into which intervention efforts may be most impactful.

Dedication

For my sister, in memoriam.

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CHAPTER 1: INTRODUCTION

About 77% of U.S. employees drink alcohol, 9% of whom engage in heavy

drinking, and 32% in heavy episodic drinking (Frone, 2019). Heavy episodic drinking

refers to consuming five or more drinks in one sitting (SAMHSA, 2017). Although

consumption is widespread, alcohol has been linked to a number of adverse

consequences, particularly among those who engage in more problematic drinking

patterns such as heavy episodic drinking. The Center for Disease Control and Prevention

(2018) reported that drinking may result in both short and long-term consequences

including impaired cognitive function, changes in mood and behavior, damage to vital

organs such as the liver, heart, and pancreas, and increased risk for certain cancers.

Alcohol use and misuse also impacts the workplace in the form of reduced work

performance and productivity as well as increased absence and workplace accidents

(Frone, 2019). It has been estimated that excessive alcohol use costs the U.S. about 249

billion dollars annually, and that about 72% of that cost is due to lost work productivity

(Sacks, Gonzalez, Bouchery, Tomedi, & Brewer, 2015).

Despite these astronomical costs, organizational researchers have largely ignored

employee alcohol use (Frone, 2019) and the studies that have been conducted typically

utilized research designs and methods that only allow for between-person inferences and

that may not generalize across occupational groups or to the individual. For instance,

much of the research examining drinking and work performance utilized either cross-

sectional designs (Blum, Roman, & Martin, 1993; Lehman & Simpson, 1992; Mangione

et al., 1999) or overly specific workplace simulations (Howland et al., 2001; Price & Liddle, 1982; Streufert et al., 1994). Outside of psychology, experimental research has examined alcohol's more immediate impact on aspects of performance, largely focusing on the extent to which cognitive functioning is impaired after drinking (Moskowitz & Fiorentino, 2000; Paraskevaides et al., 2009). Taken together, these studies provide a number of insights into the potential consequences of alcohol use including experimental evidence that aspects of physical and cognitive functioning are impaired in the short-term after alcohol consumption, and some mixed evidence that those who tend to drink more in general may report poorer work outcomes. What is lacking is an examination and comparison of these associations at both the within-person and between-person levels to determine whether daily fluctuations in drinking or more stable drinking patterns have more bearing on key work and well-being outcomes.

Among military personnel, alcohol use and alcohol-related problems are even higher than for the general population. It is estimated that 20% of military personnel are heavy drinkers, 43% engage in heavy episodic drinking (Stahre, Brewer, Fonseca, & Naimi, 2009), and 18-27% have an alcohol abuse disorder (Adler et al., 2011; Santiago et al., 2010). In contrast to an estimate of nine percent for the U.S. workforce with an alcohol abuse disorder (Frone, 2019), these estimates are alarming. Deployment (Kelsall et al., 2015) and combat exposure rate and intensity are known risk factors for alcohol-related problems (Santiago et al., 2010; Wilk et al., 2010). Among veterans, substance use disorders often co-occur with mental disorders including PTSD, traumatic brain

injury (TBI), and major depressive disorder (MDD) (DeBell et al., 2014; Fear et al., 2010; Sayer, Carlson, & Frazier, 2014; Taylor, Kreutzer, Demm, & Meade, 2003). Comorbid conditions require more specialized treatment that is often not sought or provided (Watkins, Burnam, Kung, & Paddock, 2001).

Therefore veterans as an employee subpopulation may be struggling disproportionately, and the workplace may be one avenue through which organizational researchers and practitioners can intervene to provide additional support and resources. In a sample of VA enrolled Iraq-Afghanistan combat veterans, about 25% had trouble finding or keeping a job (Sayer et al., 2010) and veterans with severe depression reported even higher rates of unemployment (Cohen, Suri, Amick, & Yan, 2013). Adler and colleagues (2011) reported marked differences between employed and unemployed veterans in mental and physical functioning, financial stress, and social support indicating that employment may buffer some negative consequences associated with reintegration. Due to the high prevalence of alcohol misuse among veterans (Burnett-Ziegler et al., 2011; Jakupcak et al., 2010; Santiago et al., 2010), and the need for research investigating work-related outcomes among this group, this study examined the effects of drinking on work and well-being outcomes among post-9/11 separated service members and current reservists (henceforth referred to as veterans).

Contributions

Past research conducted on work outcomes of employee alcohol use focused exclusively on between-person differences, however, prevailing theoretical frameworks

typically describe within-person associations. Considering that alcohol use varies day-to-day (Armeli, Todd, & Mohr, 2005; Mohr et al., 2005) and the importance of temporal considerations in the assessment of alcohol use (Frone, 2008), the use of designs that are able to capture variation at the day-level may be more appropriate. As outlined by Curran and Bauer (2011), it can be challenging to articulate the way in which outcomes vary looking across versus within individuals, an issue further exacerbated by the potential for simultaneous yet opposite influences at different levels. Separation and comparisons of within-person and between-person effects help avoid errors of inference such as incorrectly assuming that within-person and between-person effects generalize and are essential for the evaluation of many theoretical frameworks in psychology (Curran & Bauer, 2011). A multilevel modeling approach was used in order to account for non-independence of an individual's observations across multiple days and allow for the comparison of within-person and between-person associations. Moreover, this study answers the call for more person-centered organizational research (Meyer & Morin, 2016; Woo, Jebb, Tay, & Parrigon, 2018), for research designs and measures that consider the temporal context of alcohol use (Frone, 2008), and for studies that account for the multidimensional nature of alcohol use and work and well-being outcomes (Frone, 2019).

Furthermore, an exclusive focus on between-person designs has implications for the measurement of employee drinking. Past research typically utilized measures of average drink quantity and frequency over a span of time such as a month (Bacharach,

Bamberger, Sonnenstuhl, & Vashdi, 2008; Frone, 2008; Mangione et al., 1999; Martin, Blum, & Roman, 1992), even though there may be substantial variation in both how much one drinks on a given day and how often. While assessments of typical drinking patterns such as these are useful for predicting alcohol-associated risks and dependence in the long-term (Jackson, 2008), some researchers speculate based on between-person findings that episodic heavy drinking may be more likely to be associated with short-term consequences such work performance detriments (Aas, Thorrisen, Innerby, & Skogen, 2018; Bacharach, Bamberger, & Biron, 2010). The daily design of this study, uniquely positions us to examine variance in episodic drinking across days allowing for within-person inferences. Furthermore, by aggregating daily estimates over time to calculate person-level average drinking, this study addresses concerns regarding retrospective and common method biases that threaten the validity of past research findings through the introduction of measurement error (Podsakoff, MacKenzie, Lee, & Podsakoff, 2011).

Additionally, within psychological research, alcohol use is most often assessed as an outcome; much of past research focusing on individual and contextual factors that contribute to drinking or particular drinking patterns. This approach to the examination of drinking is important for identifying those with the greatest risk for the development of alcohol-related problems and who may benefit most from intervention efforts. However, it is also important to understand the implications, workplace and otherwise, for more typical drinkers. Within the medical literature, the consequences of alcohol use have been thoroughly investigated leading to determinations that even moderate alcohol use has

negative implications for health and longevity (CDC, 2018). Within the organizational

literature, research has indicated the potential importance of employee drinking for work

outcomes such as task performance, accidents and injuries, and absenteeism and tardiness

(Frone, 2013; 2019), however the results are inconsistent across studies. Therefore, this

study contributes to the scant literature within psychology by investigating the impact of

employee drinking on a number of outcomes important for success in the workplace

including subjective work performance, creativity, subjective assessments of self-control

demands, and sleep quality among lighter or more moderate drinkers.

This study also tests and expands on an established framework used to understand

how employee alcohol use impacts work productivity outcomes. The employee substance

involvement and work productivity (ESIWP) model proposes that off-the-job and on-the-

job alcohol use impact performance, attendance, and safety outcomes through the

mechanism impairment (Frone, 2013). Alcohol impairment is defined as intoxication,

withdrawal symptoms, or hangover (Frone, 2013). To date there has been limited support

for this model in its entirety, although there is some support for between-person links

(Ames et al., 1997, Bacharach et al., 2010; Boles et al. 2004; Burton et al. 2005; Frone,

1998; Shi et al. 2013; Yu et al. 2015). While the model does not explicitly specify the

level at which the proposed relationships operate, several of the associations seem to

imply a day-level (or even more frequent) causal process. For example, according to the

model, alcohol may result in intoxication (depending on a myriad of factors) that may

spill over into the next day resulting in either the decision to be absent from work, or to

go to work but potentially perform less well and put in less effort. This study examines the relationship between off-the-job alcohol use and work and well-being outcomes both within-person and between-person, which may help to further clarify aspects of the ESIWP model. Furthermore, this study expands on this model by assessing two additional outcomes (i.e., perceived self-control demands and sleep quality) as well as an alternative mechanism through which evening drinking is linked to work and well-being outcomes (i.e., sleep quality). There is an abundance of evidence for the impact of alcohol on sleep (Lydon et al., 2016; Roehrs & Roth, 2001) and the impact of sleep on performance (Barber, Grawitch, & Munz, 2013; Kessler et al., 2011; Lanaj, Johnson, & Barnes, 2014; Williamson & Feyer, 2000), creativity (Drago et al., 2011; Han, Harms, & Bai, 2017; Ritter, Strick, Bos, Van Baaren, & Dijksterhuis, 2012; Cai, Mednick, Harrison, Kanady, & Mednick, 2009; Wagner, Gais, Haider, Verleger, & Born, 2004) and self-control capacity (Barber et al., 2013; Lanaj et al., 2014). Clarification and expansion of this model may help provide a better understanding of the interplay between drinking behaviors and the workplace as well as the levels at which they operate.

Finally, identification of high-risk employee subpopulations across contexts of alcohol use has been highlighted as an area for future research (Frone, 2019). Due to the high prevalence of substance abuse disorders and heavy drinking among veterans and military service members (Kelsall et al., 2015; Stahre et al., 2009), this study examined the impact of evening drinking on work and well-being outcomes among post-9/11 separated service members and current reservists, as drinking may be one risk factor

contributing to challenges at work and maintaining employment. While evidence related to the physical, mental, and interpersonal challenges faced after reintegration is plentiful (see Sayer et al., 2014 for a review), less is known about the particular workplace challenges faced when veterans re-enter the civilian workforce. Research that identifies occupations and employee subgroups with higher risk for substance-related problems and may lead to more efficacious intervention efforts.

CHAPTER 2: LITERATURE REVIEW AND HYPOTHESES

Alcohol and Alcohol Impairment

Alcohol generally belongs to the class of substances called depressants; although there is some evidence to suggest that alcohol may be biphasic acting also as a stimulant at low, ascending blood alcohol concentration (BAC) levels (Martin, Earleywine, Musty, Perrine, & Swift, 1993; Pohorecky 1977). When alcohol is ingested, it is absorbed into the bloodstream slowing down the nervous system and producing a calm or drowsy feeling. During and after alcohol is consumed, performance-related behavior and functioning is impaired including detriments to coordination, cognitive functioning, speech, vigilance and reaction time, and memory (Moskowitz & Fiorentino, 2000; NIAAA, 2004; Paraskevaides et al., 2009). There is, however, marked variation in effects of alcohol across individuals due to differences in tolerance, the context in which the use occurs (e.g., mood, company of others, physical environment), and alcohol outcome expectancies (Frone, 2013). These factors add to the complexity of studying the outcomes of alcohol use in field settings.

While BAC can be increased rapidly, it declines more slowly as the liver is only able to metabolize alcohol at a rate of .016% per hour (Wilkinson, Sedman, Sakmar, & Wagner, 1977). Alcohol absorption estimates however depend on gender, weight, how fast you drink, and how much you drink (Baraona et al., 2001; Matsumoto & Fukui, 2002). Based on these factors, BAC is estimable. For most individuals, after about four drinks, BAC is likely to remain elevated beyond seven hours, more than the current

average night's sleep for Americans (Gallup, 2013). This suggests that those who drank

four or more drinks on a work night are likely to be impaired upon waking (i.e., BAC

above .00), however for those who drank less, evidence of impairment may still be

observed due to hangover effects observed when BAC is at or very near zero (Moskowitz

& Fiorentino, 2000). Therefore, the amount of drinks consumed in a single episode is

expected to influence the extent to which we could observe spillover into the next day,

subsequently impacting work and well-being outcomes.

Alcohol and Work Performance

It is clear from research conducted in other fields that alcohol and alcohol

impairment affect performance in the form of cognitive and physical functioning.

Paraskevaides and colleagues (2010) found that moderate doses of alcohol resulted in

impairments to prospective memory, which is important for future thinking and planning.

A review of laboratory studies examining BAC and skills important for operating a motor

vehicle reported that immediate effects of alcohol impacted drowsiness, psychomotor

skills, cognitive tasks, tracking, reaction time, vigilance, perception, ability to divide

attention, and visual functions (Moskowitz & Fiorentino, 2000) all of which may impact

an individual's ability to perform their job if still impaired when they report to work the

next day. Aspects of performance such as memory recall, reaction time, and psychomotor

performance may be impaired the morning after alcohol consumption despite BAC levels

at or very near zero, although there are mixed findings regarding which effects are

observed across studies and the effect sizes are often small (Gunn, Mackus, Griffin,

Munafo, & Adams, 2018; McKinney & Coyle, 2004). Therefore, while alcohol has been demonstrated to impact aspects of performance even in small doses or after long time lags, typically greater quantities and shorter durations between drinking and measurement of performance outcomes will result in the greatest impact on physical and cognitive functioning.

Much of the past research on organizational outcomes of drinking relied on cross-sectional, prospective designs, highly specific workplace simulations (Blum et al., 1993; Boles et al., 2004; Burton et al., 2005; Frone, 1998; Lehman & Simpson, 1992; Mangione et al., 1997; Streufert et al., 1994). These designs cannot capture within-person fluctuations in the more immediate consequences of drinking across days. Utilizing a prospective design, Bacharach and colleagues (2010) found that while the frequency of heavy episodic drinking was associated with employee absenteeism, modal consumption (i.e., a measure of typical alcohol use based on the average frequency one drinks multiplied by average drink quantity) was not. Another cross-sectional study found that the frequency of heavy episodic drinking was more strongly associated with workplace presenteeism (i.e., showing up for work even when one is ill; Johns, 2010), than average drinking frequency (Aas et al., 2017). These studies suggest that heavy episodic drinking may be a better predictor of more proximal work outcomes, however they rely on one data point, which speaks to the importance of heavy episodic drinking for between-person outcomes only. Inferring that these processes generalize to the within-person level would be not be appropriate.

A recent review of the literature on between-person associations in employee alcohol use and work performance revealed mixed results for the impact of drinking on workplace presenteeism, self-reported performance, and supervisor rated-performance (Frone, 2019). One study reported that with regard to presenteeism, only 11% of their sample of drinkers reported inefficiency the following work day after drinking, however authors suggest that the effects of the drinking are far reaching, impacting the psychosocial work environment as well as workplace safety (Buvik, Moan, & Halkjelsvik, 2018). Among post 9/11 veterans, heavy drinking episodes and alcohol dependence were both associated with at-work productivity loss and all four subscales of Work Loss Questionnaire including mental and interpersonal demands, time management, work output, and physical demands (Adler et al., 2011). Mixed findings may be due not only to study design and measure limitations, but also the omission of important moderators such as age and occupation (Frone, 2013).

In addition to cross-sectional research, a number of experimental workplace simulation studies have been conducted. These studies demonstrate that while low levels of alcohol do not consistently impact performance on simulated work tasks (e.g., fixing a faucet, operating a ship, etc.), higher doses do result in consistent performance detriments (Frone, 2013). One study investigated managerial performance and found evidence that moderate to high doses of alcohol had an immediate impact on some cognitive performance dimensions, however the effects were small (Streufert et al., 1994). While simulation studies are able to account for the temporal component critical for

investigating the question of how drinking impacts the following or current workday,

they may not be applicable to 'real world' work performance or generalize across

occupations as they often utilize very specific, 'blue collar' tasks.

While these studies do suggest that employee drinking can impact aspects of work

performance (at least for some individuals) they are unable to address whether daily

variation in drinking has an immediate impact on the workplace. Based on past research,

it is not clear whether drinking impacts next day work performance outcomes, rather,

research tells us that those who exhibit problematic typical drinking patterns (e.g., high

quantities relatively frequently) may perform less well in general, and that for those who

drink heavily the evening prior to a work shift; we may see worse performance on a

number of highly specific, simulated work tasks.

Irrespective of the mixed findings in the literature, a model has been proposed that

outlines the work outcomes impacted by employee alcohol use and the mechanisms

involved. The employee substance involvement and work productivity model (ESIWP)

proposed that both on-the-job and off-the-job alcohol consumption are associated with

attendance and performance outcomes including task and contextual performance,

counterproductive work behaviors, and accidents and injuries (Frone, 2013). Alcohol is

associated with work outcomes through impairment at work, which may occur in the

form of lingering intoxication from the evening prior, withdrawal symptoms, or hangover

(Frone, 2013). Off-the-job alcohol use is proposed to influence work performance when it

results in off-the-job impairment that becomes on-the-job impairment when the employee

decides to attend work. Greater quantities of drinks are expected to result in greater

impairment in general, although impairment extent depends on various physiological

processes (Frone, 2013). Based on evidence from past research that individuals who tend

to drink more may also perform less well at work and the ESIWP model, this study

proposes that employee drinking will be negatively associated with subjective

assessments of work performance.

> *Hypothesis 1: Drinking will be negatively associated with overall work*
>
> *performance.*

Alcohol and Creativity

With regard to creative performance, the literature is wanting. There is no

research examining the impact of drinking patterns on creativity at work, although there

is some evidence that creativity may be heightened while intoxicated (Benedek,

Panzierer, Jauk, & Neubauer, 2017; Jarosz, Colflesh, & Wiley, 2012). However, there is

no evidence that alcohol has any positive effects on next day creative performance as

BAC descends. Rather, one study found minimal effects of alcohol on creative cognitive

performance, however those who thought they were in the alcohol condition rated

themselves higher in creativity (Lang, Verret, & Watt, 1984). A review identified a

pattern across several experimental studies in which moderate intoxication hindered the

preparation and verification phases of creativity, but enhanced the incubation phase

(Norlander, 1999). These results should be interpreted with caution however as these

studies largely utilized small samples or case studies (Brunke & Gilbert, 1992; Jarosz et

al., 2012, Lang et al., 1984; Norlander & Gustafson, 1996) and may not generalize to a typical work population.

In light of the mixed findings for creativity, this study proposes that the same mechanisms associated with subjective work performance are also associated with subjective creativity at work as both involve one's perceived ability to execute work tasks and are more general constructs. Specifically, when an individual drinks alcohol, the effects may spill over into the next workday through one of the impairment dimensions (i.e., intoxication, withdrawal, or hangover) subsequently impacting appraisals of one's ability to execute their work as well as they would have had they not drank. It may be that this is especially true for creativity, particularly if creativity is not a core component of that job. Overall work performance may not vary as much as creativity at work day-to-day as it refers more to the basic standard of performance one must meet to keep their job. Creativity on the other might be more similar to contextual performance, or performance characterized by helpful and cooperative job behaviors (Borman & Motowidlo, 1993). When an individual is impaired, they may be less likely to go above and beyond that day and focus instead on their more basic job tasks. Furthermore, those who tend to drink more in general may also report lower creativity at work due to the long-term impact of alcohol on the brain. Chronic alcohol use results in brain deficits that run the gamut from mild lapses in memory to debilitating and irreversible neurological conditions (NIAAA, 2004). Damage to areas of the brain including the right prefrontal cortex, posterior temporal, and parietal areas has been linked to declines in creativity

(Palmiero, Di Giacomo, & Passafiume, 2012) indicating that in addition to daily lapses in creative behaviors due to episodic heavy drinking, longer-term, problematic drinking patterns may also be linked to less creativity at work.

Hypothesis 2: Drinking will be negatively associated with creativity at work.

Alcohol and Self Control Demands

While not exclusive to the workplace the ability to effectively manage self-control demands is crucial for work performance. Self-control demands (SCDs) are demands that require self-control capacity to manage, including regulating moods and dealing with stressors (Muraven, Collins, Shiffman, & Paty, 2005). While some research suggests that perceived SCDs are stable job characteristics (Schmidt & Neubach, 2010), Muraven and colleagues (2005) suggested that they vary at the day-level. Within the organizational literature, perceived SCDs are typically considered an antecedent to well-being and strain outcomes including person-level emotional exhaustion, absenteeism, and depressive symptoms (Diestal & Schmidt, 2011) and day-level need for recovery, ego depletion, work engagement (Rivkin, Diestel, & Schmidt, 2015), and vitality (Gombert, Rivkin, & Schmidt, 2018). There is also some evidence that high levels of perceived SCDs lead to increased same day alcohol consumption because high levels of demands decrease an individual's capacity to exercise restraint (Muraven et al., 2005). Other research finds that among young adults, high levels of perceived SCDs did not necessarily lead to more drinking at the day-level, rather that only trait SCDs were positively associated with alcohol consumption (Walters, Simons, & Simons, 2018).

While higher daily and trait perceptions of SCDs may lead to reduced regulatory capacity and subsequently more drinking, alcohol consumption may also lead to higher assessments of perceived SCDs because drinking may also drain one's self-regulatory capacity and place additional demands on the individual. For example, when alcohol is consumed in excess, a hangover may result which is characterized by a number of unpleasant symptoms including dehydration, headaches, and fatigue (Hogewoning et al., 2016; Wiese, Shilpak, & Browner, 2000). Consistent with the ESIWP model, dealing with these symptoms may place additional demands on the individual which may make it more difficult to manage other external demands in the workplace that require self-control.

Hypothesis 3: Drinking will be positively associated with perceived self-control demands.

Alcohol and Sleep Quality

While Ferrara and Gennaro (2001) note that the large individual differences in need for sleep preclude ascribing a standard sleep level, it has been proposed that adults should strive for seven or more hours per night (CDC, 2017). Within the literature, insomnia affects about one in five military service members pre-deployment and has been linked to a variety of mental and physical health problems including depression, anxiety, headaches, back pain, and alcohol use problems (Taylor et al., 2016). Post deployment, sleep problems may be exacerbated. One study found that about 90% of post 9/11 veterans could be classified as 'poor sleepers', and that sleep problems were even worse

among those with a mental illness such as PTSD and among those with greater combat

experience (Plumb, Peachey, & Zelman, 2014). Therefore, sleep is a salient concern

within this population; identification of factors that contribute to poor sleep would be

beneficial.

    While the body metabolizes alcohol, there is evidence that sleep waves and REM

sleep are disrupted, particularly in the second half of the night in what's known as the

'rebound effect' (Roehrs & Roth, 2001). It has been proposed that the rebound effect

occurs when the alcohol has been metabolized by the body and the processes change in

the direction opposite to the way they changed in the presence of the alcohol. For

example, drinking may result in falling asleep more quickly, referred to as sleep onset

latency, or colloquially called 'passing out'. However, in the second part of the night as

the alcohol is eliminated from the body, the body tries to correct for this change and

overcorrects resulting in light or unrestful sleep (Roehrs & Roth, 2001). This is because

drinking alcohol before bed suppresses the parasympathetic nervous system, which is

responsible for automatic responses including ability to rest, digestion, respiration, and

the regulation of hormones (Pietila et al., 2018). Effects on REM sleep can be observed at

low doses of alcohol, although larger doses tend to result in greater disruptions (Ebrahim,

Shapiro, Williams, & Fenwick, 2013). Therefore, consuming more drinks is likely to

have a greater impact on the processes carried out by the parasympathetic nervous system

resulting in less restoration for the body and poorer quality sleep.

    Hypothesis 4: Evening drinking will be negatively associated with sleep quality.

Indirect Effects through Sleep Quality

While the link between alcohol and sleep has been well established outside of psychology, evidence has also amassed supporting a relationship between sleep and work outcomes. Sleep disorders are consistently associated with absenteeism and lower subjective work performance (Jurado-Gamez, Guglielmi, Gude, & Buela-Casal, 2015; Kucharcyk, Morgan, & Hall, 2012; Swanson et al., 2011). However, Kucharcyk and colleagues (2012) note that there is a need to better standardize measures and account for health-related covariates, which may include alcohol use. One study reported that employees with insomnia were more than four times more likely to use alcohol as a sleep aid and nearly five times more likely to report reduced performance than 'good sleepers' (Daley et al., 2009). While it is clear that sleep disorders are linked to poorer work and well-being outcomes, there is also evidence that poor sleep among those without a diagnosable sleep disorder is related to sickness absence and daytime symptoms including irritability, moodiness, and fatigue (Reynolds et al., 2017). With regard to performance, Roehrs, Yoon, and Roth (1991) demonstrated that relatively low doses of alcohol impaired next day alertness and ability to divide attention through its interference with sleep. It is possible that the effects of alcohol on work performance, creativity, and perceptions of SCDs are due, at least in part, to alcohol's relationship with sleep.

Sleep may interfere with work and well-being outcomes due to its influence on self-regulation. Drawing from the neuroscience literature, Christian and Ellis (2011) proposed and tested a model called the self-regulatory resource depletion model in which sleep

deprivation was hypothesized to adversely influence organizational outcomes through its impact on self-regulation. The authors argued that sleep deprivation impaired executive brain function through reductions in glucose metabolism, determined by several studies to be critical for self-regulation (Galliot et al., 2007; Masicampo & Baumeister, 2008), resulting in reduced regulatory capacity. They demonstrated that sleep deprivation was negatively related to trait self-control, and that trait self-control mediated the relationship between sleep deprivation and counterproductive work behaviors (Christian & Ellis, 2011). While glucose certainly plays a role in ego depletion, a recent review notes that glucose may not be the only or even the best indicator of regulatory capacity depletion, and that more research is needed (Pilcher, Morris, Donnelly, & Feigl, 2015).

This model is derived from another model of self-regulation in which self-regulation is conceived as a limited resource that when depleted results in a reduced capacity to exercise self-regulation resulting in poor outcomes for tasks that require attention and effort (Muraven & Baumeister, 2000). When regulatory capacity is exhausted, this is referred to as ego-depletion (Baumeister, Bratslavsky, Muraven, & Tice, 1998). Despite some debate in the literature over the validity of the ego depletion model, recent experimental research found evidence for the effects of ego depletion on attention control (Garrison, Finley, & Schmeichel, 2017). Attention control allows one to override the automatic capture of attention by distracting stimulus (Schmeichel & Baumeister, 2010). When self-regulatory capacity is low after a night of poor sleep, employees may be less

able to direct attention in a constructive way leading to a continued focus on salient

stressors, and an inability to manage moods and thoughts.

Recent research investigated interrelations between sleep, self-regulation, and work

and well-being outcomes finding that evening technology use impacted sleep, which was

associated with diminished self-regulatory resources and subsequently work engagement

(Lanaj et al., 2014). Another study reported that sleep hygiene was related to reduced

self-regulatory capacity and resource depletion, and subsequently, work engagement

(Barber et al., 2013). These studies suggest that sleep is closely tied to self-regulatory

capacity and may restore its strength resulting in an enhanced capacity to remain engaged

and manage job demands.

In accordance with these frameworks, this study proposes that sleep will be disrupted

by the consumption of alcohol resulting in poorer work and well-being outcomes because

employees are less able to restore their regulatory capacity after a poor night's sleep.

Specifically, an inability to restore regulatory capacity through high quality sleep after an

evening of drinking will be associated with higher depletion the following morning,

which will be associated with perceptions of higher self-regulatory demands. To the

extent that employees are not able to replenish regulatory capacity while sleeping, they

will likely experience a diminished capacity to expend extra effort impacting their ability

and desire to not only attend work, but to perform well if they decide to attend.

Hypothesis 5: Drinking will be indirectly related to overall work performance

through sleep quality.

Hypothesis 6: Drinking will be indirectly related to creativity at work through sleep quality.

Hypothesis 7: Drinking will be indirectly related to self-control demands through sleep quality.

CHAPTER 3: METHODS

Data for this study were collected as a part of the Study for Employment Retention of Veterans (SERVe) funded through the Department of Defense (DOD). The SERVe project contained a randomized controlled trial (RCT) of a supervisor training designed to improve work and well-being outcomes for military veterans. SERVe recruited 500+ separated active duty and current reservists from 35 organizations in the Pacific Northwest who were employed at least 20 hours per week at a participating organization. The sample is diverse in terms of military background, experience, branch, deployment history, time since military separation, time since deployment, and length of deployment (see Hammer, Wan, Brockwood, Mohr, & Carlson, 2017 for more details). Because the sample comprises both separated service members and active reservists, most of whom have deployed (88.3%), we refer to the group collectively as veterans. Veterans who agreed to participate in the larger SERVe project were invited to participate in the Daily Family Study (DFS) with spouses or cohabiting partners. The DFS was a 32-day daily web-based diary survey that took place *prior* to the study intervention. This project utilizes variables from the DFS survey only (completed prior to the intervention), with the exception of a number of demographic variables. Research hypotheses and analyses include data only from the veterans and not their spouse/partners.

Sample

Of the 509 SERVe participants located in the Pacific Northwest, 191 qualified and enrolled in the DFS. Of these, 17 veterans had incomplete survey data as a result of different survey structures and were removed from the dataset. A small number of veteran employees (15%) were classified as shift workers. Research has amassed evidence that shift work impairs sleep (Akerstedt, 2003; Kecklund & Axelsson, 2016) and that shift workers engage in different patterns of drinking (Dorrian & Skinner, 2012), therefore this group is not comparable to regular shift workers. While ideally we would have liked to compare these two groups to determine how this process unfolds among shift workers, the sample was not large enough to be confident in any observed effects. For this reason, shift workers were screened out (n=27). Additionally, because the focus was drinking and work outcomes, those who did not drink on at least one work night during the 32-day duration of the study were also excluded (n= 52). For a visual depiction of the exclusions, please see the consort diagram in Figure 1.

A final sample of 95 participants was retained comprised of employed post 9/11 service members who represent 3 categories of service members: separated active duty service members, separated National Guard/Reservists, and actively drilling National Guard/Reservists who work regular shifts and drank on at least one worknight during the 32 days data was collected. Whether or not participants in the final sample differed from persons who were excluded because they did not drink on any workdays was examined. There were no statistically significant differences with respect age, gender, professional tenure, weekly work hours, gross income, and race/ethnicity.

Participants were approximately 39 years old (*SD*= 9.23) and primarily male (86%). About half (51%), completed college or some type of technical program and about 27% reported they completed or are currently completing graduate studies. Characteristic of the Northwest, participants were predominantly white (82%). Per the DFS criteria, SERVe participants were eligible if they were in a cohabitating relationship for at least six months. Most of the cohabitating partners were married (87%) and had children (75%). On average, participants had been in their relationship for about 12 years (*SD*= 8.90). The sample is predominantly non-tobacco users; in the past 6 months only 17% reported using a tobacco product. However about 73% of the sample are considered overweight or obese based on BMI. Most participants described their non-military occupation as a government job (50%), although participants also worked in industries such as professional/business (15%), education and health (11%), and manufacturing (10%). Average work hours were about 67 hours per week across all jobs (*SD*= 11.55). Participants had been in their current job for about 6 years on average (*SD*= 6.21).

Considering that all participants were previously or currently involved in the military, a variety of service-related descriptive information was collected. At the time of the survey or the time of separation with the military, 75% were enlisted and 25% were officers, and 43% were regular active duty and 57% were national guard/reserves. On average, participants had been in the military for 12.65 years (*SD*= 8.17) and the average length of time since their last deployment was 7.74 years (*SD*= 3.82). Most of the sample had deployed at least once (86%); the average the number of deployments both foreign

and domestic was 3.16 (*SD*= 2.66, range= 0-14 deployments). For descriptive statistics

on the larger sample including shift workers and those who did not drink on a work night,

see Hammer et al., 2017.

DFS Procedure

Brief daily surveys were administered online via a secure email link, once a day

for 32 days. Participants were required to complete the survey within a 6-hour window

between 5:00 PM and 11:00 PM (after work but before bedtime). Daily surveys probed a

variety of experiences at work and at home related to veteran health, attitudes, and

relationships. Veterans could earn up to $90 for their continued participation in the daily

study. All research activities were approved by an Institutional Review Board and the

U.S. Army Medical Research and Material Command, Human Research Protection

Office.

The compliance rate was calculated based on the ratio of completed daily

observations to the total number of possible observations (based on the number of

participants who participated in the study). Based on the study design, participants could

provide a maximum of 32 days of data. A total of 95 participants were retained, therefore

3040 observations were possible (95*32=3040). Of the 3040 possible observations, data

was obtained for 2091 (69% of the possible observations). Considering that the focus of

this study was on work outcomes, the analyses utilized a smaller subset consisting of

work days only (1283 days, 61% of the obtained observations, 42% of the possible

observations). The average number of daily observations per participant was 13.50 (*SD*=

7.19).

Daily Measures

All daily measures were self-reported and assessed in the evening after work.

While several variables were measured with a single item, this approach is not

uncommon in daily diary research and has been demonstrated to be valid for similar

constructs (Dollinger & Malmquist, 2009; van Hoof, Guerts, Kompier, & Taris, 2007).

Alcohol use. Drinking was assessed with a composite of two items to capture

drinking over the span of an entire evening. The item asked participants to think back to

either yesterday between 5pm-12am or today from 12am-8am and report how many

drinks containing alcohol they consumed. They could choose 0-8 on a continuous scale or

the response option 'more than 8'. More than eight was treated as nine drinks in order to

utilize this variable as a continuous variable even though they may have consumed more

than 9 drinks on that reporting day. There were nine days total in which individuals

reported drinking 'more than 8' drinks. Evening drinking was considered alcohol

consumption that occurred after 5pm and prior to going to sleep that night. Unfortunately,

the data does not allow for determinations of whether the drinking occurred at 1am or

8am, but it was assumed that most drinks consumed during that window for regular shift

workers occurred as a continuation of the evening drinking. Prevalence estimates of

drinking prior to work among the U.S. workforce range from 1.4-1.7% (Frone, 2013)

therefore it is unlikely that this type of drinking was prevalent. To assess differences in

drinking within individuals, daily drink quantity was person-centered, assessing the

deviation from an individual's average drink quantity on a given day. To assess

differences in drinking across individuals, person averages were calculated by

aggregating across days.

Daily work performance. Overall work performance was assessed with the

single statement 'Today I performed my job well', on a 5-point rating scale ranging from

1 (*Not at all*) to 5 (*Extremely*).

Daily creativity at work. Creativity at work was assessed with the single

statement 'Today I was creative at work', on a 5-point rating scale ranging from 1 (*Not at

all*) to 5 (*Extremely*).

Daily self-control demands. Perceptions of self-control demands were measured

with four items developed by Muraven et al., (2005). However, a composite score for

each day was created based on only three items asking, at any point today, did you, 'Have

to manage your moods?', "Have to control your thoughts?', 'Deal with stress'. All items

were rated on a five-point scale ranging from 1 (*Not at all*) to 5 (*A great deal*). The fourth

item, 'Felt overwhelmed', may theoretically refer more to strain, an outcome of demands,

rather than a demand itself. Given that this scale had not been validated and only

demonstrated adequate internal consistency ($\alpha = .75$; Muraven et al., 2005), the factor

structure and internal consistency estimates were examined. The four-item composite

demonstrated good internal consistency across all days ($\alpha = .90$) and removal of the

fourth item resulted in only a slightly worse internal consistency estimate ($\alpha = .88$).

Results of an exploratory factor analysis indicated that there is only one underlying

factor, all four items explained 76.4% of the total variance in the underlying factor and

the percentage of variance in each item accounted for by the factor was greater than 60%.

However, results of a confirmatory factor analysis (CFA) including all items and

measures in the model indicated considerably worse fit when the fourth item was

included (see below). Due to theoretical and statistical considerations, the fourth item was

dropped, and the three-item composite retained.

  Daily sleep quality. Sleep quality was assessed with one item from the Pittsburgh

Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1988), 'How would

you rate last night's sleep quality overall?' measured on a four-point scale from 1 (*Very*

bad) to 4 (*Very good*).

  Demographic information. Veteran demographic information was collected in

the SERVe baseline survey.

  Construct validity and reliability. Due to a reliance on primarily single item

measures, the construct validity of all measures was assessed with a confirmatory factor

analysis. A five-factor model (i.e., drink quantity, work performance, creativity at work,

self-control demands, sleep quality) with all items loading on their respective factors had

great fit, $\chi^2 = 28.58$, $df = 8$, CFI = 0.994, RMSEA = 0.045, SRMR = 0.018 and fit the

data better than alternative models (e.g., a single factor model) suggesting that the

measures refer to distinct constructs.

CHAPTER 4: RESULTS

The final dataset retained 1283 days of data from 95 individuals. While the drinking assessment refers to drinks consumed the evening prior, data was reported the following day in order to capture drinks that occurred after the survey was taken up until the participant went to bed. Therefore, all daily measures were reported on the same day. A multilevel analytic strategy with days (level 1) nested within individuals (level 2) was employed where both within-person and between-person variables are included in the same model.

Descriptive Statistics

Drinking. Drinking alcohol in the evening prior to a workday is not necessarily indicative of alcohol-related problems. Within our sample of work night drinkers, 73% are considered 'low risk' per the AUDIT, a screening tool for alcohol use disorders (World Health Organization, 2001). An AUDIT score of 8+ is typically considered to indicate hazardous drinkers (about 27% of our sample). Prevalence estimates for alcohol use disorders are about nine percent for U.S. workforce (Frone, 2019), however this estimate included non-drinkers, estimates among sample of drinkers is expected to be higher. At baseline, 65% reported having one or two drinks on a typical day when drinking, however about 12% reported having 5 or more drinks, considered heavy episodic drinking per the NIAAA (2018).

The distribution of daily alcohol use on work days was skewed (range= 0 –9 drinks, median= 1). Specifically, participants had an average of only 7.06 drinking days

(SD= 5.79, range= 1-21, 62% of work days) and had 2.36 drinks on average on days they

consumed alcohol (SD= 1.64). Looking at daily data, only about 3% reported actually

drinking 5 or more drinks on average over the course of the month. This may be due to

lack of compliance on days when the individual drank heavily the night before. In order

to investigate this possibility, the correlation between the number of days of data

provided and AUDIT scores were examined. There was not a statistically significant

correlation, however a plot of this association reveals that those with the very highest risk

for hazardous drinking (n=4) generally provide fewer days of data. Looking across all

days, not just work days, drinking occurred most frequently on Wednesdays and

Thursdays. Across all days, slightly more drinks were consumed on average on a non-

workday, (*m*=1.69, *SD*=2.07) than on a work day (*m*=1.23, *SD*=1.67). This was a

statistically significant difference, but the effect size was small.

Drinking motives have been linked to both alcohol use and alcohol-related

problems (Mohr, McCabe, Haverly, Hammer, & Carlson, 2018). Drinking motives

assessed at baseline indicated that within this sample, participants were primarily

motivated to drink for social (*m*= 2.18, *SD*= .98) and enhancement motives (*m*=2.08, *SD*=

.95) and less motivated to drink for coping (*m*=1.63, *SD*= .84) and conformity motives

(*m*=1.13, *SD*= .43). An examination of a broader sample of drinkers from the same

sample found that both enhancement and coping motives were most predictive of alcohol

use, while coping motives were most predictive of alcohol-related problems (Mohr et al.,

2018). This finding is consistent with findings within other samples (Cooper, 1994;

Gonzalez, Collins, & Bradizza, 2009; Kuntsche, Knibbe, Gmel, Rutger, & Engels, 2005;

Lac & Donaldson, 2017).

Preliminary Analyses

Prior to testing any hypotheses, the data were examined to determine whether

multilevel modeling assumptions were appropriately met. First, an examination of

descriptive statistics (e.g., range, skewness, kurtosis, Mahalanobis distance) and a visual

investigation of the data (e.g., histograms, Q-Q plots) did not indicate anything

problematic related to the distributions of errors at each level or the presence of outliers,

with the exception of the drinking variable. For this sample, there were a number of days

on which drink quantity exceeded three standard deviations above the individual's mean,

as well as a number of individuals whose mean number of drinks exceeded three standard

deviations above the group mean. Considering that this study investigated the impact of

drinking patterns, including heavy episodic drinking, potential outliers were left in for

hypothesis testing. Additional analyses exploring the removal of a number of 'outliers'

can be found in the Additional Analyses section.

As a preliminary step, unconditional random coefficient models were examined to

calculate the relative within-person and between-person variance for each study variable.

The intraclass coefficients (ICC) indicated that 59% of the variance in evening drinking,

43% in work performance, 41% in creativity, 45% in perceived self-control demands, and

71% in sleep quality occurred at the within-person level. These ICC values demonstrated

that each of the study variables exhibits variation at both the within-person and between-

person levels and supports the use of multilevel modeling. An examination of the correlation coefficients indicated that within-person drinking was not significantly correlated with any of the study variables, however at the between-person level, evening drinking was positively correlated with work performance (r=.091) and perceived self-control demands (r=.215), and negatively correlated with sleep quality (r=-.200). ICC values along with intercorrelations among the study variables are provided in Table 2.

Employees were recruited from 35 different organizations across the Northwest, as such examined outcomes may also depend on the organization individuals belong to. Intraclass correlation coefficients (ICC) were also calculated to determine how related observations are for the outcomes of interest across organizations. Values for all outcomes hovered around the generally accepted cut off of .1 indicating that outcome scores across organizations do not vary much. Even though some outcomes had ICC values slightly above the recommended cutoff (i.e., >.1), the grouping variable (i.e., organization) had unbalanced groups, which may be problematic. Multilevel modeling assumes missing data is missing at random (Hox, 2010), and that may not be the case. Considering that a representative sample from each participating organization was not attained and that the ICC values were relatively small; we can safely assume that observed variance in scores is not due to organizational effects. Hence, hypotheses were tested with only two levels.

Analytic Strategy

Given that observations from the same individual are more related than observations between individuals, a multilevel analytic strategy with days (level 1) nested within individuals (level 2) was employed. Both within-person and between-person effects were included within the same model in order to more accurately examine within-person relationships unaffected by between-person variation and vice versa (Preacher, Zyphur, & Zhang, 2010). Random intercepts were modeled, and slopes were fixed. For within-person analyses, drink quantity was person-centered, meaning it represents the deviance from an individual's mean score for each day. For between-person analyses, a score was calculated for each person by averaging total drinks across all days for which data was provided. To test the statistical significance of the hypothesized indirect effects, the Monte Carlo Method for Assessing Mediation (MCMAM) was used (Selig & Preacher, 2008). In this approach, 95% confidence intervals with 20000 repetitions were obtained using parameter estimates and their asymptotic variances and covariance. Similar to bootstrapping, random draws from the joint distributions of the parameters are simulated and the product computed. Confidence intervals that do not contain zero are considered statistically significant and indicate support for the proposed indirect effect. In line with recommendations for analyzing diary data (Wang et al., 2013) day-of-the-week was examined as a control variable. The pattern of results remained the same with or without day-of-the-week included, therefore all analyses are reported without for parsimony. In line with recommendations from Spector and Brannick (2011) no additional control

variables were examined as their inclusion may not lead to more accurate interpretations of the results.

    Statistical power. Power refers to the probability of correctly rejecting the null hypothesis allowing for meaningful examinations of observed effects (Dorey, 2010). It is a function of the significance level chosen, the population effect size, and the sample size (Hox, 2010). The methods used in multilevel analysis are asymptotic, meaning they assume the sample size is large. Power in this case is more dependent on the number of individuals (level 2) rather than the number of days within each person (level 1). As a general rule of thumb, Hox (2010) recommends at least 100 individuals across 10 or more days for greater accuracy. Our sample contained 95 individuals each with 11 days on average, suggesting this study likely had an adequate sample size to detect hypothesized relationships. However, the expected population effect is likely small, given the many factors associated with work outcomes beyond alcohol use, which limits the amount of variance that could be explained by drinking alone.

Hypothesis Testing

    Table 1 contains survey measures used within this study, Table 2 displays both within- and between-person correlations as well as descriptive statistics for all study variables, Table 3 presents results of our multilevel fixed effect model, Table 4 summarizes results of tests of indirect effects, and Table 5 presents results from additional analyses examining the multilevel fixed effect model with sleep quality as the predictor. Hypotheses 1-4 proposed that at both the within-person and between-person

levels, drinking would be negatively related to work performance (Hypothesis 1),

creativity at work (Hypothesis 2), and sleep quality (Hypothesis 4) and positively related

to perceptions of self-control demands (Hypothesis 3). No statistically significant effects

of within-person drinking were observed on any of the proposed outcomes; however

statistically significant between-person effects were observed for self-control demands

(b =0.17, p= .01) and sleep quality (b = -0.09, p= .01), providing partial support for

Hypotheses 3 and 4. These findings suggest that daily variation in drinking was not

related to work and well-being outcomes, however, individuals who tend to drink more

perceive higher levels of self-control demands and sleep less well (see Table 2).

Hypotheses 5-7 proposed that drinking would be indirectly related to work

performance (Hypothesis 5), creativity at work (Hypothesis 6), and perceived self-control

demands (Hypothesis 7) through poor sleep quality. There were no statistically

significant within-person indirect effects through sleep quality on any of the proposed

outcomes (see Table 3). However, at the between-person level, drinking was indirectly

related to work performance (*indirect effect*= -.008, 95% CI: [-.011, -.006), creativity

(*indirect effect*= -.006, 95% CI: [-.009, -.004]), and self-control demands (*indirect effect*=

.009, 95% CI [.006, .013]) providing partial support for Hypotheses 5-7. Specifically,

across individuals, a greater quantity of drinks on average was associated with poorer

sleep quality, which was linked to poorer job performance and creativity at work and

greater perceptions of self-control demands.

Additional Analyses

Variance in daily drinking. Given the complexity of these interrelationships and the numerous ways this data could be examined and interpreted, a number of additional analyses were conducted. First, lack of variability in drinking behaviors may have influenced the pattern of results. For instance, if individuals drink about the same amount every day, regardless of what that number of drinks is, their deviation score will be zero or close to zero limiting the predictive ability of drink quantity. Therefore, those with low drinking variability were removed (i.e., those with a person average day-level deviation score of less than .7), resulting in 55 individuals with 771 observations (71% of observed work days). Similarly to the hypothesized effects, both within-person and between-person drinking were not significantly related to either work performance or creativity and the statistically significant between-person effect on sleep quality disappeared. A statistically significant between-person association between drinking and perceived self-control demands was observed. While these findings suggest that low variability in drinking may not be the reason for the lack of evidence for hypothesized within-person effects, nonsignificant findings may be due to insufficient statistical power. The removal of those individuals with low variability in their daily drinking severely reduced the sample size, ultimately impacting statistical power.

Associations with sleep quality. This study found that at the between-person level, drinking was indirectly related to work performance, creativity, and perceptions of self-control demands through sleep quality, however no statistically significant within-person indirect effects were observed. This finding suggests that sleep quality is

important for understanding these associations. The association between sleep quality and

work and well-being outcomes without the inclusion of drinking was examined to

determine whether poor sleep quality was associated with daily fluctuations in these

outcomes (see Table 5). Results indicated that within-person sleep quality was

significantly positively related to work performance (b =0.08, 95% *CI: [.02, .14]*) and

significantly negatively related to perceived self-control demands (b =-0.07, 95% *CI: [-*

.14, -.01]), but not related to creativity at work (b =0.05, 95% *CI: [-.01, .13]*). At the

between-person level, sleep quality was significantly positively related to both work

performance (b =0.46, 95% *CI: [.12, .81]*) and creativity (b =0.59, 95% *CI: [.11, .1.04]*),

and significantly negatively related to SCDs (b =-1.15, 95% *CI: [-1.51, -.80]*). Given the

nonsignificant within-person indirect effects from drinking, daily sleep quality appears to

be more important in the prediction of next day work-related outcomes than daily

drinking.

Outliers. Through the examination of boxplots, potential outliers based on person

mean drinking were identified and removed (n=5), resulting in 90 individuals with 1214

days of data. All five removed individuals had greater mean drinking scores than other

individuals resulting in a more average sample of drinkers that may be more

generalizable. The same pattern of results was observed wherein within-person

associations were not statistically significant, however between-person associations were

statistically significant for both perceived self-control demands and sleep quality. This

may be because more moderate drinking does not result in disruptions to work and well-

being outcomes. In accordance with this idea, and the ESIWP model's proposition that impairment is the mechanism through which drinking is linked to work outcomes, associations may only be present for heavier drinkers. In order to test this, very "light" drinkers were removed (n= 48) retaining only those whose mean drink quantity was one or greater, resulting in the retention of 47 individuals and 587 days of data. Looking at the 'heavier' drinkers only, the same pattern of results was observed. It is important to note, that this sample did not consist of heavy drinkers, in fact the reported number of drinks is rather low for men of this age range. Four or more drinks in one day might be sufficient to detect changes in daily work and well-being outcomes, however the data included only 128 days in which more than four drinks were consumed. As a result, statistical power concerns prohibit the examination of the model within such a small sample.

Beyond work days. Due to the focus on work outcomes, a subset of workdays from the larger sample of days was utilized for hypothesis testing. However, perceived self-control demands and sleep quality are experiences that can be assessed on work and nonwork days. Considering that individuals tend to drink slightly more on non-work days, the association between drinking and self-control demands as well as sleep quality may be stronger when the sample of days is increased and nonwork days are included. Greater quantities of drinks have a higher potential to impact sleep quality and potentially result in impairment that spills over into the next day. Additional analyses were conducted with the same individuals (n=95) including all 2087 days (i.e., including work and nonwork

days). Results revealed no statistically significant association between drinking and

perceived self-control demands and sleep quality at the within-person or between-person

levels when all days were included in the analysis.

CHAPTER 5: DISCUSSION

This study investigated within-person and between-person associations between employee drinking and key work and well-being outcomes. Findings demonstrated that while person average drinking was associated with greater perceptions of SCDs and poorer sleep quality and indirectly related to work performance, creativity at work, and perceptions of SCDs through poor sleep quality, daily fluctuations in drinking were not associated with any examined work and well-being outcomes. While some research has examined associations between employee drinking and work outcomes (see Frone, 2013 for a review), these studies largely utilized designs that only allow for between-person inferences which have a number of limitations. Evidence for the level at which these associations operate has implications for organizational intervention efforts and established theoretical models.

Theoretical Implications

This study makes an important theoretical contribution to the domain of employee substance use. The ESIWP model is an established model that suggests that alcohol impairment is the mechanism through which employee drinking is linked to work outcomes, implying a within-person process. In describing the ESIWP model, Frone (2013) notes that the inability to consistently document a relationship between drinking and work productivity outcomes may be due to a lack of differentiation between on and off-the-job use and impairment. However, results of this study suggest that it may be related to a failure to account for the multilevel nature of these relationships. Alcohol

impairment is a short-term mechanism with immediate consequences at the day-level. Chronic heavy drinking however, is probably more likely to impact work outcomes through its impact on employee health and well-being over longer periods of time (Bacharach et al., 2010). Given that much of the past research in support of this framework is conducted at the between-person level, we suggest that the ESIWP model be expanded to include additional variables and mechanisms relevant for both within-person and between-person associations. This study found that sleep quality may be especially important, particularly for between-person associations. It is essential that theoretical and statistical models align in order to avoid common research fallacies.

Support was also found for an additional, thus far unexamined outcome of employee drinking, perceptions of SCDs. Typically referred to as a stressor, perceptions of SCDs are more likely to be considered an antecedent of drinking, however where this variable fits into the model likely depends on the specified level. Past research demonstrated that higher levels of trait SCDs predicted drinking (Walters et al., 2018), however support is mixed for the impact of daily perceptions of SCDs on drinking (Muraven et al., 2005; Walters et al., 2018). In other words, those who tend to feel they have to regulate their moods and thoughts more, also tend to drink more, which has been suggested to be due to low self-regulatory capacity. Thus far, no research has examined whether drinking is associated with higher perceptions of SCDs. It is possible that this effect is cyclical, wherein high levels of daily demands deplete regulatory capacity resulting in greater quantities of drinks consumed, and that drinking while attempting to

manage those demands further perpetuates the cycle of depletion of regulatory capacity. This study did not find any within-person evidence, however individuals who tend to drink more also perceive their SCDs to be greater. This is important because it suggests that those who tend to drink more, also tend to appraise their demands as more difficult to manage making this group more susceptible to strain outcomes such as burnout. Common frameworks including the ESIWP model (Frone, 2013) and the stressor vulnerability model (Armeli, Carney, Tennen, Affleck, & O'Neil, 2000) consider demands and strain antecedents to drinking, however these findings suggest that drinking may also have implications for how we perceive and manage workplace stress.

Practical Implications

Results from this study highlight the role of organizations in protecting employee well-being. Evidence for statistically significant between-person associations only aligns with the between-person focus of past research suggesting that perhaps this is the most appropriate level to examine these relationships in the work context. Between-person findings may be more useful for organizations anyhow, as the identification of individuals whose performance is hindered by a problematic typical drinking pattern could result in the provision of more resources or assistance, whereas day-to-day fluctuations in performance do not necessarily indicate that typical job performance or drinking patterns are problematic. Therefore, intervention efforts would be best focused on preventing and treating chronic heavy drinking as this type of drinking is more likely to impact workplace outcomes and to have detrimental effects on employee health and

well-being over time (Quintana, Guastella, McGregor, Hickie, & Kemp, 2013). There are a number of ways to intervene within the workplace to limit excessive alcohol consumption including limiting the physical availability of alcohol at work and the presence and enforcement of substance use policies in the workplace (Frone, 2019). Zero-tolerance policies, however, may not be effective as they may deter those who are problem drinkers from seeking treatment (NIDA, 2013). Additionally, ensuring that workplace norms do not encourage excessive or frequent drinking can also help to reduce overall drinking and intoxication (Frone, 2019). Organizations can also provide support and resources through organizationally sponsored programs and trainings to address employee well-being and alcohol use and abuse. To address alcohol abuse among military populations, the Institute of Medicine (2012) has recommended expanding access to health care, training providers to effectively screen for substance use issues, and referral to evidence-based substance use prevention and treatment interventions when necessary.

Findings also indicate the importance of sleep quality in the association between drinking and work and well-being outcomes. At the between-person level, drinking was indirectly related to work performance, creativity at work, and perceptions of SCDs through poor sleep quality. A number of workplace factors have been linked to poor sleep including shift work (Gold et al., 1992), long work shifts, long weekly working hours (Sallinen & Kecklund, 2010), consecutive work periods, reduced time between shifts, on-call or reserve status, and day-to-night or night-to-day transitions (Rosekind et al., 2010).

Organizations should try to avoid these types of working arrangements as much as possible in order to protect their employee's ability to get enough high-quality sleep. Rapidly forward rotating shifts may be better than slowly backward rotating shifts if shift work is unavoidable (Sallinen & Kecklund, 2010).

These findings may appear to suggest that daily drinking and heavy drinking episodes have no bearing on work and well-being; there are a number of reasons why, despite our findings, we do not believe this to be the case. While drinking did vary across days, within-individual drink quantities were similar, which may have limited the predictive ability of our measure of drinking. Furthermore, this sample was comprised of primarily light to moderate drinkers. On average, individuals reported having about two drinks on days when drinking. It is unlikely this quantity is enough to spill over into the workplace for most individuals. Jackson (2008) found that higher thresholds (i.e., nine or more drinks) optimally predicted more proximal outcomes of drinking such as a hangover, whereas lower thresholds (i.e., 4 or more drinks) predicted more distal outcomes such as problem drinking. This finding suggests that statistically significant between-person effects may be more easily detectable at lower quantities of drinks while statistically significant within-person effects require a much greater number of drinks, particularly if they operate through the impairment mechanism. As such, future research should examine these associations among a sample of heavier drinkers with more variance in their drinking across days.

Additionally, the work and well-being outcomes assessed in this study were quite

broad and tended not to vary much day-to-day. Given the role of self-regulatory capacity

in these relationships, contextual performance and proactive behaviors may be more

likely to reflect the effects of evening drinking within-person. Contextual performance is

characterized by helpful and cooperative job behaviors (Borman & Motowidlo, 1993)

wherein employees go above and beyond without being asked. These types of extra-role

behaviors may be foregone after an evening of drinking in order to conserve limited self-

regulatory capacity. Future research should examine outcomes that vary more day-to-day,

including more specific aspects of performance and well-being and consider the use of

more objective measures in addition to subjective measures. Certain variables may be

best measured via self-report (e.g., perceptions of demands) while others may be best

measured more objectively (e.g., sleep).

Strengths, Limitations, and Directions for Future Research

This study utilized a daily diary design over 32 consecutive days allowing for the first

comparisons of within-person and between-person effects of employee drinking in the

organizational literature. Overreliance on cross-sectional designs in this area has limited

our ability to test relevant theoretical frameworks and account for common research

fallacies. We corroborate past research that finds some associations between employee

drinking and work and well-being outcomes however, our measure was calculated by

aggregating daily within-person estimates making it more robust to common method bias

concerns (Podsakoff et al., 2003) than similar between-person examinations conducted in other studies. However, this design also has some limitations to consider.

First, due to the long duration of the data collection (i.e., 32 days), missing data is a concern. Individuals could provide up to 32 days of data, however only 22 days on average were obtained (13 work days on average), ranging from one day to 32 days per individual. It may be that employees avoid reporting heavy drinking episodes when participating in surveys associated with their workplace, or they may forget to report due to effects of a hangover after an episode of heavy drinking. It can be difficult to determine whether missing data is truly missing at random, or for a specific reason such as those outlined. However, the number of days of data obtained was not correlated with a measure of heavy drinking (i.e, the AUDIT) which may suggest that missing data is not due to a drinking problem, however it does not account for normal drinkers who may have missed a day due to an infrequent heavy drinking episode.

Furthermore, all data were self-reported. Sole reliance on self-reported data may introduce bias, however the daily diary design reduces this concern by drawing from multiple days over time (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Utilizing self-reported data only may also lead to socially desirable responding or a hesitancy to accurately report given the workplace context. Employees tend to under-report drink quantity (Stockwell et al., 2004), however, biochemical measures and collateral informant measures do not sufficiently augment self-reported drinking accuracy enough to warrant routine use (Babor, Steinberg, Anton, & Del Boca, 2000). Future research

should carefully consider the variable of interest to determine whether self-reported or more objective assessments such as blood alcohol concentration and actigraphy are more appropriate.

An additional consideration especially important for multilevel models is statistical power. Power is a function of the significance level chosen, the population effect size, and the sample size (Hox, 2010). While the sample size was adequate for the hypothesis tests, the additional analyses involved removing individuals, resulting in probable insufficient statistical power. As such, this study was unable to conclude with any confidence that low levels of drinking and low variation in drinking across days within this sample can explain why statistically significant within-person effects were not detected. Furthermore, expected population effects are likely quite small, given the many factors that influence work and well-being outcomes aside from employee alcohol use. Small effect sizes require even greater samples to detect significant effects. Coupled with a sample comprised primarily of light to moderate drinkers, many more days are needed to capture infrequent heavy drinking episodes within this sample. Future research should compare within-person and between-person associations between drinking and work and well-being outcomes using a much larger sample of individuals across a greater number of days.

Additionally, a mediation model, which implies causation, was examined despite the collection of all measures at the same time point. Given this design, it is not possible to determine causality due to an inability to separate measures temporally. It is possible that

associations operate in the opposite direction; some evidence suggests that poor sleep and high perceptions of SCDs also predict drinking (Muraven et al., 2005; Roehrs & Roth, 2001; Walters et al., 2018). Furthermore, in field research it is more difficult to rule out alternative explanations due to an inability to account for all potential confounds. However, the short lag between the events and reporting and the availability of multiple days of data for individuals increases confidence in the results. Future research should consider using a measure of alcohol consumption assessed the evening prior to the assessment of work outcomes to establish temporal ordering as well as examine reciprocal effects among associations.

Finally, this study examined these associations within a higher risk employee subpopulation, veterans of the U.S. armed forces who have re-entered the civilian workforce. Veterans tend to drink somewhat more than a typical employee population, however that was not the case within this sample. While theory indicates that the examined associations are expected to apply to employees in general, external validity is a consideration. Having data from a sample of civilian employees within the same workplaces included in this study could have helped to identify what is different or similar about this process for veterans. Employment appears to be a protective factor for veterans (Adler et al., 2011), therefore efforts to help veterans maintain employment are beneficial. Work is already underway in this arena. The SERVe project, from which this subset of data is drawn, conducted a randomized control trial to evaluate the effectiveness of an intervention to enhance successful veteran reintegration by training organizational

managers how to be more supportive of veteran employees. Findings revealed that the intervention did increase supervisor support for veterans who had higher levels of support at baseline, a finding that will hopefully spur further research in this area (Hammer, Wan, Brockwood, Bodner, & Mohr, 2019). A better understanding of risk factors for veterans who have re-entered the workforce can support more efficacious intervention and reintegration efforts.

Conclusions

This study examined associations between drinking and work and well-being outcomes comparing average and daily drinking. Despite a lack of evidence for within-person effects, a number of conditions may have limited our ability to detect effects at the day level. We believe that given a much larger sample, more specific outcome measures, and more variable or heavier drinkers that day-level effects would be apparent. This study was able to provide support for associations between person average drinking and work and well-being outcomes, particularly through the mechanism poor sleep quality. These insights have implications for the predominant framework used to understand how employee drinking is linked to work and well-being outcomes and for organizational interventions efforts. Given the link between employee drinking and work and well-being outcomes, organizations should foster environments that do not encourage excessive forms of drinking and individuals should be mindful of how their typical consumption impacts their performance at work and their overall health and well-being.

Table 1
Survey Measures
_____

Evening Drinking
Thinking back to **YESTERDAY from 5:00 pm to 11:59 pm** and **TODAY from 12:00 am to 7:59 am…**
How many drinks containing alcohol did you consume? (Note: 1 drink equals one 12 oz. can or bottle of beer, one 5 oz. glass of wine, one 12 oz. wine cooler or 1½ oz. of liquor straight or in a mixed drink.)

                                                    Response Options: *0* to *More than 8*

Subjective Work Performance
How do these statements apply to your experience at work **TODAY**?
1. I performed my job well.
2. Today I was creative at work.

                                          Response Options: (1) *Not at all* to (5) *Extremely*

Self-Control Demands
At any point TODAY, did you…
1. Have to manage your moods?
2. Have to control your thoughts?
3. Deal with stress?

                                        Response Options: (1) *Not at all* to (5) *A great deal*

Sleep Quality
The following questions ask about your sleep. Please think of your experience of sleep over the **PAST 24 HOURS (or since the previous survey).**
How would you rate your last night's sleep quality overall?

                                          Response Options: (1) *Very bad* to (4) *Very good*

Table 2

Multilevel Descriptive Statistics and Bivariate Correlations

Variables	Mean	SD_w	SD_b	ICC$_1$	1	2	3	4	5
1. Drink Quantity	1.43	1.27	1.23	.586	-	.091**	-.033	.215**	-.200**
2. Work Performance	3.77	0.57	0.71	.433	.030	-	.756**	-.140**	.303**
3. Creativity at Work	3.05	0.74	0.97	.405	.006	.413**	-	-.150**	.314**
4. Self-Control Demands	1.93	0.73	0.76	.453	.007	-.063*	-.007	-	-.496**
5. Sleep Quality	2.73	0.59	0.41	.708	-.006	.081*	.046	-.058*	-

Note. N_{day} = 1283; N_{person} = 95. Means are at the between-person level (level 2). ICC$_1$ shows the proportion of variance accounted for at level 1 (day level). Within-person correlations are below the diagonal, and between-person correlations are above. Correlations for level-1 calculated with N_{day}; level-2 were calculated with N_{person}

Table 3

Multilevel Models Predicting Workplace Outcomes from Drink Quantity: Fixed Effect Parameter Estimates

	Model 1: Work Performance		Model 2: Creativity		Model 3: Self-Control Demands		Model 4: Sleep Quality	
	Estimate (SE)	p	Estimate (SE)	p	Estimate (SE)	p	Estimate (SE)	p
Intercept	3.75 (.110)		3.03 (.152)		1.92 (.129)		2.78 (.066)	
Within-Person Drink Quantity	.014 (.013)	.151	.003 (.018)	.424	.004 (.017)	.399	-.003 (.014)	.418
Between-Person Drink Quantity	.048 (.066)	.231	-.033 (.091)	.357	.169 (.077)*	.014	-.093 (.039)**	.009
Residual Variance	.350 (.591)		.599 (.774)		.539 (.734)		.364 (.604)	

Note. N_{day} = 1283; N_{person} = 95. *SE* = standard error. Models are random intercept models with fixed slopes. Average number of observations per person = 13.51.
  *$p<.05$. **$p<.01$.

Table 4

Indirect Effect of Drink Quantity on Workplace Outcomes Through Sleep Quality

Drinks→ Sleep Quality	Model 1: Work Performance		Model 2: Creativity		Model 3: Self-Control Demands	
	Est.	95% CI	Est.	95% CI	Est.	95% CI
Within-Person Indirect Effect	-.000	(-.001, .000)	-.000	(-.001, .000)	.000	(-.001, .001)
Between-Person Indirect Effect	-.008*	(-.011, -.006)	-.006*	(-.009, -.004)	.009*	(.006, .013)

Note. N_{day} = 1283; N_{person} = 95. Est.= Estimate. 95% CI= 95% confidence interval estimates. Confidence intervals calculated using the Monte Carlo Method for Assessing Mediation (MCMAM) utilizing 20000 iterations. Models are random intercept models with fixed slopes. Average number of observations per person = 13.51.
  *p<.05. **p<.01.

Table 5

Multilevel Models Predicting Workplace Outcomes from Sleep Quality: Fixed Effect Parameter Estimates

	Model 1: Work Performance		Model 2: Creativity		Model 3: Self-Control Demands	
	Estimate (SE)	*p*	Estimate (SE)	*p*	Estimate (SE)	*p*
Intercept	2.58 (.477)		1.39 (.661)		5.22 (.499)	
Within-Person Sleep	.078 (.028)**	.003	.055 (.037)	.070	-.072 (.035)*	.021
Between-Person Sleep	.456 (.175)**	.005	.591 (.245)**	.007	-1.148 (.183)**	.000
Residual Variance	.347 (.589)		.598 (.773)		.536 (.732)	

Note. N_{day} = 1283; N_{person} = 95. *SE* = standard error. Models are random intercept models with fixed slopes. Average number of observations per person = 13.51.
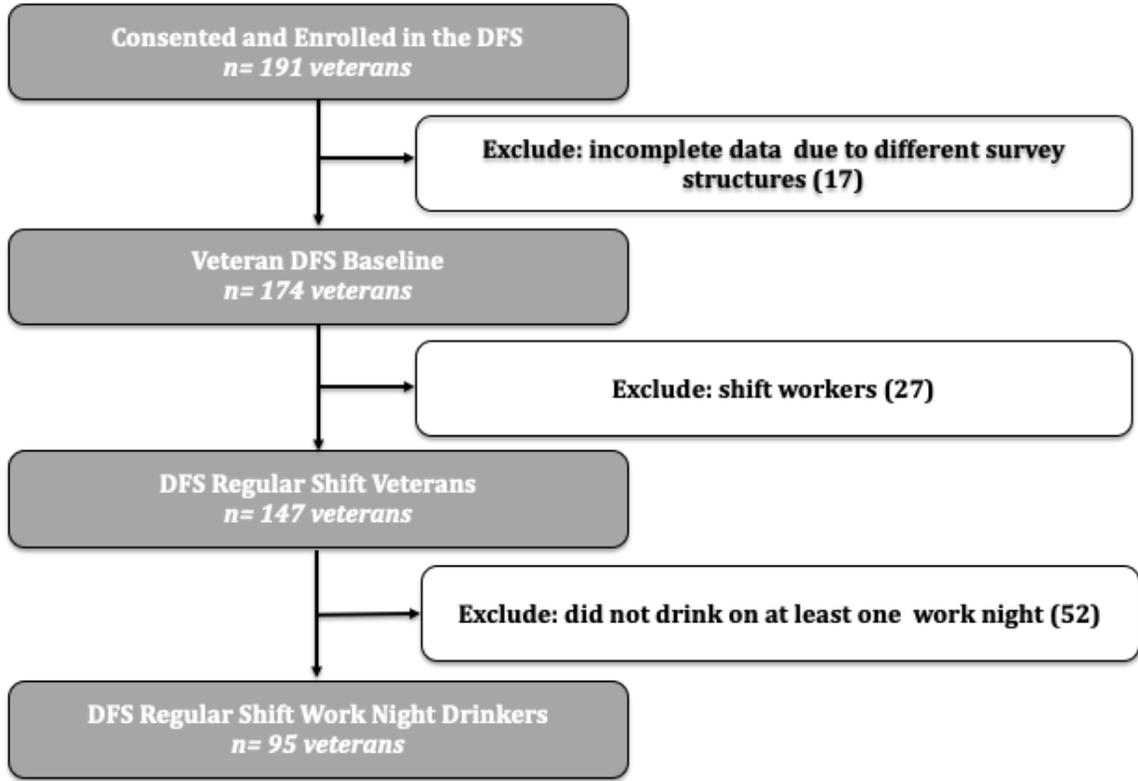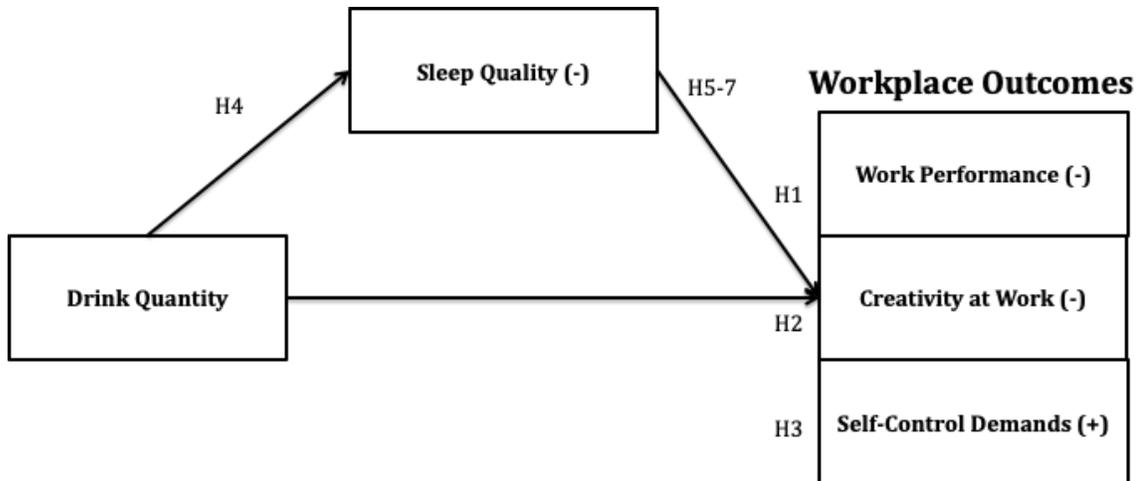*p<.05. **p<.01.

Figure 1. Consort Diagram

Figure 2. Hypothesized Conceptual Model

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