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Investigating Relationships among Work, Family, and Sleep: Cross-Sectional, Daily, and Intervention Effects

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Investigating Relationships among Work, Family, and Sleep: Cross-Sectional, Daily, and Intervention Effects

by

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Abstract

Few studies to date have investigated associations among work, family, and sleep outcomes. The following dissertation includes three studies that attempt to further understanding of such relationships by utilizing data from information technology workers within the Work, Family, and Health Network study. In Study 1, which is published in the Journal of Occupational Health Psychology, associations between work-to-family conflict, family-to-work conflict, family-supportive supervisor behaviors, and sleep outcomes, measured both subjectively and objectively, are examined in a cross-sectional sample. Study 2 investigates associations among work-to-family conflict, family-supportive supervisor behaviors, and subjective sleep outcomes within a seven-day daily diary framework. Furthermore, workplace characteristics are examined as moderators of these relationships. Study 3 explores the effect of a work-family intervention on sleep outcomes at the 18-month follow-up time point, in addition to mediators of the intervention effect on sleep outcomes over time.

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Chapter 1: Investigating Relationships among Work, Family, and Sleep: Cross-Sectional, Daily, and Intervention Effects

It is widely understood that pathology is not the only precursor to an individual experiencing disrupted sleep. Lifestyle and societal demands on the sleep-wake schedule additionally contribute to sleep health (American Sleep Disorders Association, 1997). In particular, work and family experiences have the potential to substantially disrupt and prevent sleep. As few previous studies have considered these relationships, there is a need for future research to identify the specific work-family predictors that influence sleep, the processes by which they do so, and aspects of the contextual surroundings that facilitate favorable effects and protect against those that are unfavorable, all so that future interventions can be optimally designed to improve sleep through the appropriate pathways.

In general, inadequate sleep is experienced by a majority of the population at alarming rates. According to a recent survey conducted by the Centers for Disease Control and Prevention (2011), of 74,571 individuals in 12 states, 35% report getting less than seven hours of sleep on average, which is below the recommended ideal number of hours of sleep. This same study found that 48% of participants reported snoring, 38% report unintentionally falling asleep during the day at least once during the past month, 5% reported nodding off or falling asleep while driving in the last, month, pointing to the extensive sleep deficiency experienced in the population. Therefore, fatigue has momentous consequences for individuals and organizations. However, sleep has not been a typical variable included in organizational research, in terms of individual or organizational well-being.

Insufficient sleep quality and inadequate sleep quantity have been associated with obesity, diabetes (e.g., Buxton & Marcelli, 2010; Cappuccio, D'Elia, Strazzullo, & Miller, 2010), cardiovascular disease (e.g., Buxton & Marcelli, 2010; Mallon, Broman, & Hetta, 2002; Wingard & Berkman, 1983), and premature mortality (e.g., Mallon, Broman, & Hetta, 2002; Wingard & Berkman, 1983). Given these serious consequences, in their 2011 National Sleep Disorders Research Plan, the National Institutes of Health have specified future research on antecedents of inadequate and insufficient sleep to be a primary goal for sleep researchers in the coming years: "Identify genetic, pathophysiological, environmental, cultural, lifestyle factors and sex and gender differences contributing to the risk of sleep and circadian disorders and disturbances, and their role in the development and pathogenesis of co-morbid diseases, and disability" (pp. 13). Furthermore, this same document additionally lists prevention efforts as a primary avenue for future research: "Improve prevention, diagnosis, and treatment of sleep and circadian disorders, chronic sleep deficiency, and circadian disruption, and evaluate the resulting impact on human health" (pp. 17). Thus, organizational psychologists may be especially valuable by identifying environmental factors, specifically those pertaining to work and family, which influence sleep, while also evaluating workplace interventions that can help prevent chronic sleep deficiency.

Statement of Purpose

Through a series of three studies, the proposed dissertation utilizes data from the Work, Family, and Health Network study to examine how work, family, and sleep are interrelated. The current research aims to inform future intervention work targeting work-family experiences, such as work-family conflict, and subsequently proximal sleep

outcomes and distal chronic illness outcomes. Through a better understanding of the specific factors that influence sleep, in addition to moderators of this process, systematic organizational change initiatives can be designed and implemented effectively within varying workplace contexts. This body of work is motivated by three overarching research questions:

1) Do work-family factors influence aspects of sleep?
2) What characteristics of the work environment facilitate favorable work-family effects on sleep and protect against unfavorable work-family effects on sleep?
3) Can organizational interventions targeting work-family stress improve sleep? By what mechanisms does this occur?

Linking Work-Family Conflict and Sleep: Conservation of Resources Theory

In order to answer the abovementioned research questions, the present studies utilize Conservation of Resources (COR; Hobfoll, 1989) Theory as a guiding framework linking work-family experiences and sleep. Below, I define relevant constructs and broadly address how work-family conflict and family-specific support from supervisors can impact sleep outcomes, by drawing on the major tenets of COR theory.

Greenhaus and Beutell (1985) have defined work-family conflict as a form of inter-role tension where the demands of the work role are incompatible with the demands of the non-work role, and vice versa. Thus, conflict of this nature can occur bi-directionally, from work to family (WTFC) or from family to work (FTWC). These two directions are positively and reciprocally related (Frone, Russell, & Cooper, 1992), although meta-analytic work does give evidence for discriminant validity between these

two constructs (Mesmer-Magnus & Viswesvaran, 2005). Based on a review of the literature, Frone et al. (1992) suggest that there are three types of work-family conflict: time-based, strain-based, and behavior based. Given that time is a limited resource, time-based conflict results when an individual is not able to devote the desired amount of time to one domain because the opposite domain has required more of their time. For example, long work hours are likely to interfere with the time an individual is able to spend with their family, friends, or others within the non-work domain. Strain-based conflict occurs when the strain experienced as a result of stressful conditions in one role interferes with an individual's performance in the opposite role. Strain resulting from negative interactions with coworkers or supervisors may inhibit individuals from performing adequately as a caregiver to children or aging parents because they are preoccupied with their work responsibilities or stressful situations they encountered during their workday. Lastly, behavior-based conflict is experienced when an individual has difficulty transitioning between appropriate roles for a given domain. As such, authoritative behavior may help an individual to succeed in a management role, but this same behavior may also create difficulty at home if used with a spouse or partner. In the remainder of this manuscript, I will primarily focus on the concepts of strain-based and time-based conflict, rather than behavior-based conflict, given their applicability to sleep and the research questions at hand.

As such, work-family conflict may have unique relationships with different aspects of sleep. Sleep has been primarily defined in the literature in terms of both quantity and quality (e.g., Barnes, 2012). Sleep quantity refers to the duration of time an individual remains in a sleeping state, while sleep quality refers to an overall evaluation

of the sufficiency of sleep, in addition to difficulty initiating or maintaining sleep a night (e.g., Harvey, Stinson, Whitaker, Moskovitz, & Virk, 2008). Both of these constructs are distinct from fatigue, an outcome of insufficient or inadequate sleep, and sleepiness, a subjective report of one's desire to sleep (Van Dongen & Dinges, 2005).

COR theory (Hobfoll, 1989) suggests that strain results from a loss of resources, the threat of resource loss, or a lack of resource gain after the investment of resources. Resources refer to those conditions (e.g., valued work role), objects (e.g., home), personal resources (e.g., self-esteem, mastery), and energies (e.g., time, money) that the individual values and strives to obtain, maintain, and protect. Thus, work-family conflict, a stressor, is likely to result in a loss of resources, primarily valued work roles, home roles, and time. Given the propositions of COR theory, these instances of resource loss are likely to result in strain and a lack of time that prevents individuals from attaining sufficient sleep quality and adequate amounts of sleep.

The work-family conflict literature has been heavily influenced by the scarcity hypothesis, suggesting that human energy is a limited resource and that individuals tend to make use of this resource to a greater degree when engaging in multiple roles (Goode, 1960), such as work and family. Hobfoll and Shirom (2000) have suggested that COR theory is particularly applicable to the work-family interface, due in large part because of this focus on limited resources. For example, when an individual experiences strain-based work-family conflict such that he/she is preoccupied or distressed by work when at home, home performance is likely to be impaired and his/her valued family role is threatened. The individual may experience distress, worry, or rumination, that in turn can prevent an individual from attaining quality sleep. These individuals may have difficulty

initiating or maintaining sleep throughout the night and may awake feeling unrested. Alternatively, time-based WTFC conflict may occur when work time cuts into family time and individuals must therefore devote additional time to the family domain in order to preserve relationships and maintain their valued role as a family member. Such efforts are likely to cut into sleep time, resulting in lower sleep durations. FTWC may also impact both sleep quality and quantity. For example, individuals experiencing strain-based FTWC may experience distress because their preoccupation with family life while at work impairs their work performance and threatens their valued role as an employee. Such distress may prevent an individual from attaining adequate sleep quality if the individual has difficulty falling asleep or wakes up throughout the night. Lastly, time-based FTWC may also occur, for example, if individuals feel obligated to put additional time resources back towards work to make up for lost time that was devoted to family. Thus, time is likely to be borrowed from sleep time. The limited amount of past research that has been conducted on the relationship between work-family variables and sleep supports such phenomena.

Work-family conflict as a source of resource loss. Barnes et al. (2012) found that time spent working is negatively associated with self-report sleep time, but especially so under conditions of high amounts of time spent with family. Although this is evidence of time-based work-family conflict, Barnes et al. did not directly measure work-family conflict. Other studies have found a relationship between work-family conflict and sleep-related constructs. For example, past research supports relationships between high levels of WTFC and FTWC and poor self-reported sleep quality (Nylen, Melin, & Laflamme, 2007; Sekine, Chandola, Martikainen, Marmot, & Kagamimori, 2006). Similarly, Britt

and Dawson (2005) found a negative relationship between self-report hours of sleep and soldiers' work-family conflict. A study conducted by Lallukka, Rahkonen, Lahelma, and Arber (2010) found that work-family conflict was strongly associated with self-report sleep complaints. Previous longitudinal research suggests that work-family conflict influences self-report sleep quality, while the reverse relationship has not been supported (i.e., sleep quality does not influence work-family conflict) (Butts, Eby, Allen, & Muilenburg, 2013). However, the majority of these reviewed studies are cross-sectional in nature and there is a need for future research to examine associations between work-family conflict and sleep over time.

FSSB as a resource. We argue that family-specific supervisor support is a resource especially relevant in predicting sleep quality and quantity. Family-supportive supervisors empathize with an employee's desire to seek balance between work and family responsibilities (Thomas & Ganster, 1995). Hammer et al. (2009) define FSSB as a multidimensional superordinate construct consisting of emotional support and instrumental support concerning family demands, in addition to role modeling behavior and creative work-family management.

COR theory suggests that stressful situations may be attenuated when the individual perceives that they have the necessary resources to cope with a stressor (Hobfoll, 1989). As work-family stressors deplete resources, as suggested by Hobfoll and Shirom (2000), social support acts a protective factor within this process. These authors make the distinction that social support is a condition resource, but the act of being socially supported also results in access to objects, conditions, personal characteristics, and energy resources. Furthermore, those individuals with greater

resources are less vulnerable to resource loss and more likely to experience resource gain because individuals must use resources they have to offset resource loss, protect resources, and gain new resources, such as when an individual has a supportive supervisor.

In this way, FSSB is likely to directly impact sleep because family-supportive supervisors provide individuals with resources that can improve sleep quality and sleep duration. For example, family-supportive supervisors have the ability to change employees' work schedules on a daily basis, implement creative management practices for employees to better accommodate non-work life, role model positive ways of integrating work and non-work life, and discuss with employees the difficulties experienced when trying to navigate work and non-work conflicts. Thus, family-supportive supervisors have the ability to create opportunities for employees to better manage work and family time demands, leaving employees with more adequate periods of time for sleep, in addition to providing employees with emotional support for work and non-work demands that is likely to result in less rumination or worry by the employees, which can impact aspects of sleep quality.

I argue that FSSB can also be examined as a moderator, drawing on Hobfoll's (1989) COR framework. As suggested by Cohen and Wills (1985), social support can act as a protective factor in the face of stressful experiences. As such, in the presence of work-family conflicts, FSSB is also likely to have a buffering effect, protecting against further resource loss. Hobfoll and Shirom (2000) suggest that work and family stressors interact to deplete resources, while resources from work, like social support, act to limit this resource depletion. Family-supportive supervisors provide employees with resources

to better cope with work-family conflict, such as emotional support or instrumental scheduling changes, thereby lessening the impact on both sleep quality and quantity.

While general supervisor support has been found to be positively linked with employee sleep adequacy (Buxton et al., 2009; Sorensen et al., 2011), no studies to date have examined the association between the construct of FSSB and employee sleep. One study has examined the relationship between manager practices related to family demands and employee sleep. Berkman, Buxton, Ertel, and Okechukwu (2010) explored the relationships between the work-family interface and sleep duration. Specifically, the researchers examined whether employees with supportive managers experienced an increase in sleep duration in a sample of 393 employees and 45 managers working in four extended care facilities. Employee sleep was assessed using objectively measured actigraphy methods to determine mean minutes of sleep per day over seven days. Separate qualitative data from employees' supervisors, in the form of semi-structured interviews, were also analyzed. Managers were given a work-family balance score based on their openness and creativity in dealing with their employees' work and family demands. Cross-sectional results from this study showed that managers' attitudes and practices were related to employees' health. Employees who had managers scoring higher on support for work-family balance also slept almost 30 minutes longer on average than employees with managers scoring lower on support for work-family balance. This study suggests that managers' support for work and family issues is a critical factor in promoting employee health, especially sleep.

In summary, a handful of primarily correlational studies have found evidence for the association between work-family conflict and sleep, suggesting that it's a fruitful

avenue for future research. Moreover, FSSB has been linked with sleep outcomes and COR theory suggests that FSSB is also likely to act as moderator to the WFC and sleep link. Given that the majority of previous research on this topic has employed cross-sectional, self-report designs, below I review alternative methodologies that may be particularly useful in future studies.

Alternative Methods for Studying Work-Family Experiences and Sleep

Most research examining the associations between work experiences and sleep has used respondents' global self-reports of sleep characteristics, often asking participants to report general sleep quantity and quality over the past month. However, additional methodologies may further understanding of sleep constructs and their relationship to organizational factors, especially work-family variables. These alternative methodologies include objective methods, daily self-report methods, and intervention research. All three of these methodologies are relatively absent from the current literature. Thus, the current body of work makes use of these three alternative methodologies in order to contribute to the literature on this topic.

Objective methods. To date, a large majority of research on the work-family interface has examined the relationship between work-family variables and health outcomes (Eby, Casper, Lockwood, Bordeaux, & Brinely, 2005). However, those studies that have examined physical health have primarily relied on self-report symptom checklists or ratings of overall health. Few studies have collected objective health data, such as measures of sleep, blood pressure, heart rate, and body mass index (BMI). Scholars have called for the use of objective measures of health to be included in

organizational and occupational health psychology research (e.g., Greenhaus, Allen, & Spector, 2006; Hurrell, Nelson, & Simmons, 1998; Liu, Spector, & Jex, 2005).

Sleep, in particular, has rarely been measured using objective methods. Objectively-measured actigraphy can be used to assess sleep quality and quantity (Buxton, Klein, Whinnery, Williams, & McDade, in press). Actigraphy represents a reliable and valid objective measure of sleep not used for the diagnosis of sleep disorders (Ancoli-Israel et al., 2003; Marino et al., 2013). Sleep monitor actigraphs are wrist-watch size devices containing an accelerometer, continuously measuring movement as a proxy for waking activity (Ancoli-Israel et al., 2003; Barnes, 2012). Actigraphic *total sleep time*, or objectively-measured quantity, can be derived from actigraphic periods of less frequent movement, indicating sleep, throughout a 24 hour period. Alternatively, actigraphic *WASO* (wake after sleep onset), or objectively-measured quality, refers to the average amount of time spent awake per sleeping period, as evidenced by actigraphically-measured wrist movement patterns.

Diary methods. In addition to actigraphy data, daily diary data may be particularly useful for measuring both daily work-family experiences and sleep in future research. Daily diary methods involve requesting that participants provide self-reports on consecutive days during their typical daily experiences (Reis, 2012), thereby "capturing life as it is lived" (Bolger, Davues, & Rafaeli, 2003, p. 580). This method allows researchers to capture within-person processes, in addition to the more common between-person associations. Reis has suggested that while retrospective surveys concern reconstructed experience, daily life measures capture ongoing experience. The author further explains that diary reports should not be a substitute for retrospective reports, if an

individual's reflective experience is also of interest. Instead, diary reports can be utilized to complement retrospective reports and further illuminate the processes of interest. Additionally, if the individual's reflective experience is not of interest, diary methods can be used to collect data that is not as subject to retrospective bias.

As explained by Almeida and Davis (2011), research designs should reflect that stress is a process that occurs within each individual, rather than at a more general population level. As such, both the stressor of work-family conflict and the strain outcomes associated with sleep are dynamic; individuals' perceptions of conflict, supervisor support, and sleep characteristics can vary across days within an individual. Furthermore, retrospective bias may play a role in limiting the usefulness of retrospective reports of sleep. Sleep may be more accurately measured at the daily level.

Intervention methods. Work-family scholars have argued that a lack of rigorous experimental designs have resulted in an inability to draw conclusions about the effectiveness of work-family policies and initiatives (e.g., Kelly et al., 2008). Moreover, few studies have examined the processes by which interventions reduce work-family conflict and in turn improve health (King et al., 2012). Thus, there is a need for future research to utilize randomized controlled trials in order to better understand the relationship between work-family policies and practices and health outcomes, such as sleep. One particularly promising work-family intervention that has shown initial success with low-wage grocery store workers includes training supervisors to be more supportive of employee family demands (Hammer, Kossek, Anger, Bodner, & Zimmerman, 2011). Results from this study indicate that when employees experienced high levels of work-family conflict, the intervention had beneficial effects on employee job satisfaction,

turnover intentions, and physical health, through employee perceptions of family-supportive supervisor behaviors. Hammer and colleagues have called for future research to examine additional outcomes that are impacted by such training programs.

Within the sleep literature, few studies have examined interventions targeted at work characteristics. For example, a recent review of the literature identified only three interventions studies that aimed to improve participant sleep, through the improvement of workplace characteristics, in addition to only 16 other studies that evaluated longitudinal relationships between workplace characteristics and sleep (Van Laethem, Beckers, Kompier, Dijksterhuis, & Geurts, 2013). The first of these intervention studies found that by increasing employees' control over their working time, employees attained almost an hour extra sleep on nights before work (Moen, Kelly, Tranby, & Huang, 2011). The second study did not find favorable effects on sleep outcomes twelve months after implementing an intervention targeting adverse psychosocial work factors (i.e., psychological demands, decision latitude, social support, and effort-reward imbalance) (Bourbonnais, 2006). The third study aimed to increase decision latitude, social support, contacts between management and staff, improve the shift system, and potentially obtain meals on-site (Wahlstedt & Edling, 1997). The authors found that a significant increase in skill discretion and authority over decisions negatively correlated with sleep difficulties, while increased reported contact with teammates and supervisors also negatively correlated with sleep difficulties. Therefore, there is a need for future studies examining the relationship between work-family interventions and changes in sleep outcomes, using rigorous designs.

Summary and Proposed Studies

Although work-family conflict has been extensively studied in the organizational literature, little research has examined the link between work-family conflict and sleep. Furthermore, FSSB has yet to be evaluated as a moderator of this relationship and only a handful of studies have examined FSSB as a predictor of sleep. Additionally, those studies that have evaluated the links between work-family conflict and sleep and FSSB and sleep have generally examined such relationships solely at the between-person level and have failed to investigate potential moderators. Objective sleep methods, daily diaries, and interventions should all be utilized to further understanding of these relationships and triangulate existing relevant results. Thus, the following proposed three studies use these alternative methodologies to investigate these research questions and expand upon the current literature. The utilization of such alternative methods allows for a more valid and thorough understanding of the relationships of interest. As a result, organizational researchers will be able to more effectively draw upon these results in order to design successful interventions targeting sleep and consequent chronic illness.

The first manuscript, which is published in the Journal of Occupational Health Psychology (Crain, Hammer, Bodner, Kossek, Moen, Lilienthal, & Buxton, 2014), investigates the link between work-family conflict, family-supportive supervisor behaviors (FSSB), and both self-report sleep (i.e., sleep insufficiency, insomnia symptoms, sleep duration) and objective actigraphic sleep outcomes (i.e., total sleep time, wake after onset latency) in cross-sectional relationships. With a sample of information technology workers, I find that WTFC is significantly related to self-report and objective sleep outcomes in hierarchical analyses, and that WTFC, FTWC, and FSSB, when

entered as a block of predictors, together account for significant variance in sleep outcomes, over and above control variables. No moderating effects of FSSB are evident. Thus, this study addresses the first research question proposed by uncovering the specific work-family factors that influence sleep.

The second study in my dissertation builds off of this initial work by incorporating daily diary methodology (Crain, Hammer, Lee, Almeida, Bodner, Johnson, & Perry, in progress). Most research examining the associations between work experiences and sleep has used respondents' global reports of sleep characteristics, often asking participants to report general sleep quantity and quality over the past month. However, sleep is a dynamic context; individuals' sleep characteristics can vary across days depending on the daily threat or loss of resources. Motivated by the need to include this alternative methodology, this manuscript examines the daily relationship between WTFC and sleep outcomes and FSSB and sleep outcomes in the information technology industry. Stable, environmental workplace characteristics are also examined as moderators of the work-family conflict— and FSSB—sleep link. Therefore, the second study in this series of papers addresses the first and second aforementioned research questions.

After having established the role of between- and within-person work-family conflict and FSSB as predictors of sleep, in addition to workplace characteristics as moderators of these relationships, I intend to examine these phenomena within an intervention framework. The third study in this series of papers addresses this work's third research question and examines the effects of an organizational work-family intervention on sleep outcomes at the 18-month follow-up data collection, in addition to

mediators of the intervention effects. The first intervention paper from the larger Work, Family, and Health Network study finds that the intervention increased employee actigraphically-measured total sleep time and increased self-reported sleep insufficiency at the 12-month follow-up (Olson et al., 2015). Furthermore, the intervention affected sleep insufficiency through reductions in WTFC. The follow-up paper, and my third study in this dissertation, will be an extension of this first paper where I will be examining the intervention's effect on an additional time point, taking into account mechanisms of the intervention on sleep outcomes.

Chapter 2: Work-Family Conflict, Family-Supportive Supervisor Behaviors (FSSB), and Sleep Outcomes[1]

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Abstract

Although critical to health and well-being, relatively little research has been conducted in the organizational literature on linkages between the work-family interface and sleep. Drawing on Conservation of Resources theory, we use a sample of 623 information technology workers to examine the relationships between work-family conflict, family-supportive supervisor behaviors (FSSB), and sleep quality and quantity. Validated wrist actigraphy methods were used to collect objective sleep quality and quantity data over a one week period of time, and survey methods were used to collect information on self-reported work-family conflict, FSSB, and sleep quality and quantity. Results demonstrated that the combination of predictors (i.e., work-to-family conflict, family-to-work conflict, FSSB) was significantly related to both objective and self-report measures of sleep quantity and quality. Future research should further examine the work-family interface to sleep link and make use of interventions targeting the work-family interface as a means for improving sleep health.

Keywords: work-family conflict, family-supportive supervisor behaviors, sleep, actigraphy, conservation of resources theory

Work-Family Conflict, Family-Supportive Supervisor Behaviors (FSSB), and Sleep Outcomes

The interconnectedness between work and family has been well documented in the organizational literature (Crain & Hammer, 2013; Hammer & Zimmerman, 2011). However, work-family research has largely failed to consider other life domains (e.g., community involvement, leisure, recovery) that may compete with, or compliment, work and family roles and responsibilities. Recent research suggests that sleep is an additional domain that should be evaluated alongside those of work and family, given that they all vie for an individual's finite amount of time (Barnes, Wagner, & Ghumman, 2012). Barnes et al. have found that work time is negatively related to sleep time, but especially so under conditions of high family time. These authors have called for future research to examine sleep within stress-based models of work-family conflict.

According to a recent survey of 74,571 individuals in 12 states, 35% report getting less than seven hours of sleep on average per night (Centers for Disease Control and Prevention, 2011). Other epidemiological studies suggest that the shortest sleep durations are experienced by professional-level/management employees (e.g., Jackson, Redline, Kawachi, Williams, & Hu, 2013). However, previous research indicates that both short (less than seven hours per night) and long sleep (more than eight hours) are positively associated with chronic disease in the United States, including obesity, diabetes, hypertension, and cardiovascular disease (e.g., Buxton & Marcelli, 2010). Other research indicates that lost work performance due to insomnia may account for up to $63.2 billion dollars per year in the United States (Kessler et al., 2011). Given these unfavorable outcomes, scholars have called for future organizational research to

investigate how work experiences influence employee sleep (Barnes, 2012), while there has been a more general call in the sleep literature to uncover those mechanisms that are responsible for deficient sleep (Luyster, Strollo, Zee, & Walsh, 2012).

Drawing on the Conservation of Resources (COR) theory (Hobfoll, 1989), the current study investigates how work-family conflict is associated with sleep quality and quantity. Family-supportive supervisor behaviors (FSSB) are also examined as an antecedent of sleep quality and quantity and moderator of the relationship between work-family conflict and sleep outcomes. See figure 2.1 for a model of these relationships.

This study makes three important theoretical contributions and one important methodological contribution to the organizational literature. First, we extend COR theory beyond waking experience and investigate the impact of work-family conflict on sleep outcomes. Although COR theory has been used widely in the work-family literature, research that has utilized COR theory has failed to incorporate aspects of sleep as outcome variables. As such, Barnes et al. (2012) have called for future research incorporating stress-based models of conflict in relation to sleep. Although a few studies have examined and found a relationship between work-family conflict and sleep constructs, they have generally failed to incorporate guiding theoretical frameworks (e.g., Lallukka, Rahkonen, Lahelma, & Arber, 2010; Sekine, Chandola, Martikainen, Marmot, & Kagamimori, 2006) and have not explored additional variables that may be implicated in the relationship. Given that Hobfoll and Shirom (2000) suggest that social support is a primary resource and source of future resources that can offset the loss of other resources, we utilize the COR framework to motivate the inclusion of FSSB within our model.

Concerning our second theoretical contribution, we examine FSSB as both an antecedent of sleep quality and quantity and a moderator of the relationship between work-family conflict and sleep outcomes within the COR framework. We extend previous propositions that social support is a primary resource and source of future resources (e.g., Hobfoll & Shirom, 2000) by focusing on family-specific support from supervisors. We argue that FSSB is particularly appropriate for inclusion in our model because the construct reflects supervisor behaviors associated with emotional support, instrumental support, role modeling, and creative work-family management (Hammer, Kossek, Bodner, Yragui, & Hanson, 2009), all of which allow employees to better attend to competing work and family demands. When work and family demands are more manageable for employees, employees are also more likely to also attain adequate and sufficient sleep, both because they have more time for sleep and experience less strain that may affect sleep quality. Thus, we argue that this specific form of social support from supervisors is ideal for investigation within the current study.

The third theoretical contribution results from the incorporation of both sleep quality and sleep quantity into the current study as health outcomes. The limited studies on this topic have generally included only one sleep construct or the other. For example, Lallukka, et al. (2010) examined sleep complaints, or aspects of sleep quality, but did not assess sleep quantity with their sample, while Berkman, Buxton, Ertel, & Okechukwu (2010) examined the relationship between manager support for employee family demands and sleep quantity, but did not assess sleep quality. We argue that sleep quality and sleep quantity are particularly sensitive to resource loss brought about by work-family stressors and social support because, as types of health outcomes, they are uniquely affected by

both strain and a lack of time. Thus, we attempt to add to the current literature by *creating a consensus* (Grant & Pollock, 2011) around the relationship between work-family conflict, FSSB, and sleep by assessing both sleep quality and sleep quantity within one sample. As a result, we are able to show how these predictors of interest may be differentially related to the separate sleep constructs.

Finally, the study makes a methodological contribution by including objective measures of sleep, in addition to the more common self-report measures of sleep. By doing so, we also attempt to create consensus around the work-family conflict, FSSB, and sleep quantity and quality relationships through the use of multiple methods. The organizational and occupational health psychology literature has emphasized the importance of increased utilization of objective measures of health (e.g., Greenhaus, Allen, & Spector, 2006; Hurrell, Nelson, & Simmons, 1998), such as those measuring sleep. The primary advantage of using such objective measures is that they are not subject to self-report bias (Blascovich, 2000). We address this call by including objective measures of sleep and also triangulate these measures with self-report measures, since the latter is likely to be more prevalent in organizational studies. We utilize actigraphy as an objective outcome measure of sleep quality and quantity and add to the dearth of existing organizational literature that has included sleep variables, albeit almost entirely self-report (for exceptions see Berkman et al., 2010; Ertel, Berkman, & Buxton, 2011; Pereira, Meier, & Elfering, in press). This is the first study, to our knowledge, that has examined the relationship between work-family conflict and actigraphic measures of sleep. Although previous research has found a relationship between work-family conflict and self-reported sleep, self-reported and objective sleep measures have thus far been

generally uncorrelated (Grandner, Kripke, Yoon, & Youngstedt, 2006), suggesting that they represent unique constructs or have differing biases.

Sleep

Until recently, sleep has largely been neglected in the occupational health and industrial/organizational psychology literature (e.g., Krauss, Chen, DeArmond, & Moorcraft, 2003). Research from other disciplines suggests that negative workplace factors, such as low supervisor support, harassment at work, poor ergonomic practices, and job title (i.e., being a staff nurse rather than an assistant nurse manager, clinical nurse specialist, patient care associate, or operations coordinate), are related to deficient sleep (Sorenson et al., 2011b). Additionally, recent exceptions within the organizational literature include investigation into relationships among sleep and self-regulation (Barber, Grawitch, & Munz, 2013; Barnes, 2012), unethical conduct (Barnes, Schaubroeck, Huth, & Ghumman, 2011), and affect (Sonnentag, Binnewies, & Mojza, 2008). Although a number of different ways of operationalizing sleep have been utilized, sleep has been primarily defined in the literature in terms of both quality and quantity (Barnes, 2012).

Sleep quality. Sleep quality refers to an overall evaluation of the sufficiency of sleep, in addition to difficulty initiating or maintaining sleep at night, both of which have sometimes been referred to as insomnia symptoms (e.g., Harvey, Stinson, Whitaker, Moskovitz, & Virk, 2008). In the biomedical sleep literature, Buxton et al. (2009) found that a lack of job strain and increases in supervisor support were related to increases in self-reported adequate or sufficient sleep. Karasek (1979) found that male workers with jobs low in decision latitude and high in demands were likely to report insomnia symptoms. As part of the Helsinki Heart Study, researchers found strong main effects for

job demands and job control on self-reported insomnia in a large sample of male employees (Kalimo, Tenkanen, Harma, Poppius, & Heinsalmi, 2000). Work environments with high job demands and low job control have been found to be related to self-reported sleep complaints a year later (de Lange et al., 2009). Similarly, increases in control over work schedule have been related to increased sleep quality over a six-month period (Moen, Kelly, Tranby, & Huang, 2011). It has also been found that individuals have a greater risk of self-reported insomnia with increased job strain and decreased job control and social support (Nomura, Nakao, Takeuchi, & Yano, 2009). Self-reported insomnia and insufficient sleep have also been related to decreased productivity, performance, and safety practices (e.g., Kessler et al., 2011; Rosekind, Gregory, Mallis, Brandt, Seal, & Lerner, 2010). Additionally, daily emotional labor has been found to predict nighttime insomnia, partially mediated by anxiety (Wagner, Barnes, & Scott, in press).

Within the work-family and recovery literature, psychological detachment from work and control have been positively related to sleep quality (Sonnentag & Fritz, 2007). Similarly, an intervention designed to increase employees' recovery experiences, such as psychological detachment from work, relaxation, mastery experiences, and control during off-job time, increased sleep quality one week and two weeks after the training program (Hahn, Binnewies, Sonnentag, & Mojza, 2011). Lastly, Williams, Franche, Ibrahim, Mustard, and Layton (2006) found evidence for positive family-to-work spillover being associated with better sleep quality.

Sleep quantity. Sleep quantity refers to the duration of time an individual remains in a sleeping state (Harvey et al., 2008). Shift work (Costa, 1996) and overtime

work (Dahlgren, Kecklund, & Akerstedt, 2006) have been associated with decrements in sleep quantity, while increases in employees' control over their working time has been associated with almost an hour extra sleep on nights before work (Moen et al., 2011). Occupational stressors, such as effort-reward imbalance, job strain, and job demands, have also been linked with short self-reported sleep duration (e.g., Utsugi et al., 2005). In the following sections, we review theory and past research motivating the current study of work-family conflict and sleep quality and quantity.

Theoretical Rationale and Hypothesis Development

Conservation of resources theory. COR theory (Hobfoll, 1989) suggests that strain results from a loss of resources, the threat of resource loss, or a lack of resource gain after the investment of resources. Resources refer to those conditions (e.g., valued work role), objects (e.g., home), personal resources (e.g., self-esteem, mastery), and energies (e.g., time, money) that the individual values and strives to obtain, maintain, and protect. Thus, work-family conflict, a stressor, is likely to result in a loss of resources, primarily valued work roles, home roles, and time. Given the propositions of COR theory, these instances of resource loss are likely to result in strain and a lack of time that prevents individuals from attaining sufficient sleep quality and adequate amounts of sleep.

Work-family conflict as a source of resource loss. Greenhaus and Beutell (1985) have defined work-family conflict as a form of inter-role tension where the demands of the work role are incompatible with the demands of the family role, and vice versa. Thus, conflict of this nature can occur bi-directionally, from work to family (WTFC) or from family to work (FTWC). These two directions are positively and reciprocally

related (Frone et al., 1992), although meta-analytic work does provide evidence for discriminant validity between these two constructs (Mesmer-Magnus & Viswesvaran, 2005). Based on a review of the literature, Frone et al. (1992) suggest that there are three types of work-family conflict: time-based, strain-based, and behavior-based. Given that time is a limited resource, time-based conflict occurs when an individual is not able to devote the desired amount of time to one domain because the opposite domain has required more of their time. For example, long work hours are likely to interfere with the time an individual is able to spend with their family or friends. Strain-based conflict occurs when the strain experienced as a result of stressful conditions in one role interferes with an individual's performance in another role. For example, strain resulting from negative interactions with coworkers or supervisors may inhibit individuals from performing adequately as a caregiver to children or aging parents. Lastly, behavior-based conflict is experienced when an individual has difficulty transitioning between appropriate roles for a given domain. For example, authoritative behavior may help an individual to succeed in a management role, but this same behavior may also create difficulty at home if used with a spouse or partner. In the remainder of this paper, we primarily focus on the concepts of strain-based and time-based conflict, given their applicability to the research questions at hand.

The work-family conflict literature has been heavily influenced by the scarcity hypothesis, which suggests that human energy is a limited resource and that individuals tend to make use of this resource to a greater degree when engaging in multiple roles (Goode, 1960), such as work and family. Hobfoll and Shirom (2000) have suggested that COR theory is particularly applicable to the work-family interface, due in large part

because of this focus on limited resources. For example, when an individual experiences strain-based WTFC such that they are preoccupied or distressed by work when at home, their home performance is likely to be impaired. The individual may experience distress, worry, or rumination, which in turn can prevent an individual from attaining quality sleep. These individuals may have difficulty initiating or maintaining sleep throughout the night and may awake feeling unrested. Alternatively, time-based WTFC may occur when work time cuts into family time and individuals must therefore devote additional time to the family domain in order to preserve their relationships and maintain their valued role as a family member. Such efforts are likely to cut into sleep time, resulting in lower sleep durations. FTWC may also impact both sleep quality and quantity. For example, individuals experiencing strain-based FTWC may experience distress because their preoccupation with family life while at work impairs their work performance and threatens their valued role as an employee. Such distress may prevent an individual from attaining quality sleep if the individual has difficulty falling asleep or wakes up throughout the night. Lastly, time-based FTWC may also occur, for example, if individuals feel obligated to put additional time resources back towards work to make up for lost time that was devoted to family. Thus, time is likely to be borrowed from sleep time. The limited amount of past research that has been conducted on the relationship between work-family variables and sleep supports such a link.

For example, Barnes et al. (2012) found that time spent working is negatively associated with self-report sleep time, but especially under conditions of high amounts of time spent with family. Other studies have found a relationship between work-family conflict and sleep-related constructs. For example, past research supports relationships

between high levels of WTFC and FTWC and poor self-reported sleep quality (Nylen, Melin, & Laflamme, 2007; Sekine et al., 2006). Similarly, Britt and Dawson (2005) found a negative relationship between self-report hours of sleep and soldiers' work-family conflict. A study conducted by Lallukka et al. (2010) found that work-family conflict was strongly associated with self-report sleep complaints. Although our data is cross-sectional and we cannot assume causality, previous research suggests that work-family conflict influences self-report sleep quality, while the reverse relationship has not been supported (i.e., sleep quality does not influence work-family conflict) (Butts, Eby, Allen, & Muilenburg, 2013). Other longitudinal studies found that reduced individual-level and team-level WTFC was associated with increases in perceptions of adequate time for healthy sleep (Moen, Fan, & Kelly, 2013) and that reducing WTFC promotes longer sleep duration (Moen et al., 2011).

While a handful of studies examine the work-family conflict to sleep link (e.g., Lallukka et al., 2010; Sekine et al., 2006), these studies do not measure aspects of both sleep quality and sleep quantity in the same study. Additionally, none of these studies measure sleep objectively. Given this past research, in addition to propositions from COR theory, we hypothesize the following:

Hypothesis 1a: Employee WTFC will be negatively related to sleep quality and sleep quantity.

Hypothesis 1b: Employee FTWC conflict will be negatively related to sleep quality and quantity.

The role of FSSB in providing resources and protecting against work-family conflict resource loss. We argue that family-specific supervisor support is a resource

especially relevant in predicting sleep quality and quantity. Family-supportive supervisors empathize with an employee's desire to seek balance between work and family responsibilities (Thomas & Ganster, 1995). Hammer et al. (2009) define FSSB as a multidimensional superordinate construct consisting of emotional support and instrumental support concerning family demands, in addition to role modeling behavior and creative work-family management. Recent research has provided evidence for the importance of family-supportive supervisor behavior (FSSB) in reducing work-family conflict (Kossek, Pichler, Hammer, & Bodner, 2011).

COR theory suggests that stressful situations may be attenuated when the individual perceives that they have the necessary resources to cope with a stressor (Hobfoll, 1989). As work-family stressors deplete resources, as suggested by Hobfoll and Shirom (2000), social support acts a protective factor within this process. These authors make the distinction that social support is a condition resource, but the act of being socially supported also results in access to objects, conditions, personal characteristics, and energy resources. Furthermore, those individuals with greater resources are less vulnerable to resource loss and more likely to experience resource gain because individuals must use resources they have to offset resource loss, protect resources, and gain new resources, such as when an individual has a supportive supervisor.

In this way, FSSB is likely to directly impact sleep because family-supportive supervisors provide individuals with resources that can improve sleep quality and sleep duration. For example, family-supportive supervisors have the ability to change employees' work schedules on a daily basis, implement creative management practices

for employees to better accommodate non-work life, role model positive ways of integrating work and non-work life, and discuss with employees the difficulties experienced when trying to navigate work and non-work conflicts. Thus, family-supportive supervisors have the ability to create opportunities for employees to better manage work and family time demands, leaving employees with more adequate periods of time for sleep, in addition to providing employees with emotional support for work and non-work demands that is likely to result in less rumination or worry by the employees, which can impact aspects of sleep quality.

While general supervisor support has been found to be positively linked with employee sleep adequacy (e.g., Buxton et al., 2009; Sorensen et al., 2011b), no studies to date have examined the association between the construct of FSSB and employee sleep. One study has examined the relationship between manager practices related to family demands and employee sleep. Berkman et al. (2010) found that employees who had managers scoring higher on supportive work-family practices, slept almost 30 minutes longer a night on average, as measured by actigraphy. These studies suggest that manager support for work and family issues is a critical factor in promoting employee health, especially sleep. Therefore, we hypothesize the following:

Hypothesis 2: FSSB will be positively related to sleep quality and quantity.

Although Berkman et al. (2010) investigated the direct effect of family-specific social support on sleep, we argue that FSSB can also be examined as a moderator, drawing on Hobfoll's (1989) COR framework. As suggested by Cohen and Wills (1985), social support can act as a protective factor in the face of stressful experiences. As such, in the presence of work-family conflicts, FSSB is also likely to have a buffering effect,

protecting against further resource loss. Hobfoll and Shirom (2000) suggest that work and family stressors interact to deplete resources, while resources from work, such as supportive managers, act to limit this resource depletion. Family-supportive supervisors provide employees with resources to better cope with work-family conflict, such as emotional support or instrumental scheduling changes, thereby lessening the impact on both sleep quality and quantity. Thus, the following is hypothesized:

Hypothesis 3a: FSSB will moderate the negative relationship between WTFC and sleep quality and sleep quantity, such that the relationships will be attenuated under conditions of high FSSB.

Hypothesis 3b: FSSB will moderate the negative relationship between FTWC and sleep quality and quantity, such that the relationships will be attenuated under conditions of high FSSB.

Methods

Participants and Procedure

The present investigation uses baseline data from a study conducted by the Work, Family, and Health Network (WFHN). By using a range of methods to collect data at the organization, work site, manager, employee, and family levels, the study aims to increase understanding of the importance of workplace practices and policies to work, family, and health outcomes (see Bray et al., 2013; King et al., 2012). The current research used a sample of employees located in teams within the information technology division of a large Fortune 500 firm. Trained field interviewers administered face-to-face computer-assisted personal interviews (CAPI) with employees beginning in September 2009 and ending in September 2010. Employees completed a 60 minute interview at the worksite

and received a $20 incentive. Immediately following the CAPI, interviewers introduced the actigraphy data collection process and requested participation for an additional $20 incentive. If the participant agreed, the interviewer instructed them to wear the sleep monitor actigraph (Spectrum, Respironics/Philips, Murrysville PA) on their non-dominant wrist at all times for the next week except in situations where the watch could be damaged (e.g., excessive impact, extreme temperatures). Of the total 1182 eligible employees, 823 employees completed the CAPI interview (69.6% response rate); 61% of the employees were male and 39% were female; 71% percent were white; average employee age was 46 years (*SD* = 8.38); 79% were married or cohabitating; and 56% had children living in the home. Out of all eligible employees, 655 employees completed the actigraphy data collection, while a total of 637 employees had valid actigraphy data for three or more days out of seven possible days, the criterion considered reliable and valid for participant data (Marino et al., 2013). On average, participants had 6.57 days of valid actigraphy. In order to ensure that both samples were equivalent, we have restricted our self-report analyses to the same sample of individuals who also provided valid actigraphy data. After listwise deletion, the final self-report and objective actigraphic sleep analyses were conducted on a sample of 623 individuals.

Measures

W**ork-family conflict.** Employee WTFC and FTWC were measured using both of the five item subscales developed by Netemeyer, Boles, and McMurrian (1996). Items were rated on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores indicated greater WTFC and FTWC. A sample item from the WTFC scale reads, "The demands of your work interfere with your family or personal time," while a sample item

from the FTWC scale reads, "The demands of your family or personal relationships interfere with work-related activities." The reliability estimate for the work-to-family subscale was α = .92, while the reliability estimate for the family-to-work subscale was α = .83.

Family-supportive supervisor behaviors-short form (FSSB-SF). Recently, the FSSB-short form was validated as a way to measure the superordinate FSSB construct (Hammer, Kossek, Bodner, & Crain, 2013). This is a parsimonious measure that is reliable and valid. Furthermore, little information is lost when measuring the overall superordinate construct of FSSB with the short form rather than the original long form. Items were rated on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores indicated greater FSSB. A sample item reads, "Your supervisor makes you feel comfortable talking to him/her about your conflicts between work and non-work." The overall reliability estimate for the scale was α = .88.

Sleep. In general, few standardized self-report measures of sleep exist. However, the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) is the most widely utilized scale (Grandner et al., 2006). Advantages of this set of questions include that it is brief, relatively easy to administer, and includes a variety of sleep dimensions (Buysse et al.). Although an overall quality score can be derived, individual items and combinations of items can be used to determine scores on separate components such as duration and insomnia. By separating such dimensions from the global sleep quality construct, one can determine how work and non-work predictors may differentially influence separate aspects of self-reported sleep. When measuring sleep,

organizational scholars have tended to use PSQI global scores, as opposed to component scores, sleep diaries, or objective actigraphic measurements (e.g., Williams et al., 2006).

Disadvantages of this scale include that it has a fairly complicated scoring scheme and was validated with a clinical sample. More recent validation work with non-clinical samples suggests that while PSQI global scores correlate well with sleep diaries, they do not correlate with objectively-measured actigraphic sleep variables (Grandner et al., 2006). When broken down into component scores, the PSQI's sleep duration component has been found to correlate negatively with actigraphic total sleep time (Grandner et al.). Other reviews (e.g., Sadeh, 2011) suggest that while actigraphy corresponds to self-reported sleep schedule parameters, there is very little agreement between actigraphy and self-reported sleep quality parameters. Actigraphic measurements of sleep are likely to be more valid than self-report measurements of sleep, given that actigraphy for both sleep/wake on a minute by minute basis over the sleep period, as well as for WASO, has been more extensively validated against polysomnographic recordings, the gold-standard measurement of sleep (e.g., Marino et al., 2013). Sleep scholars, such as Tryon (2004), have reviewed past actigraphy validation studies and concluded that actigraphy is a valid indicator of sleep-wake, based on the levels of percent error between actigraphy and polysomnography. These levels are similar to those found in accepted medical, intelligence, and personality tests. In light of this information, we include both self-report component scores for quality (i.e., sleep insufficiency, insomnia symptoms) and quantity (i.e., sleep duration) and objective actigraphic measurements of sleep quality (i.e., WASO) and quantity (i.e., total sleep time) in the current work. Although objective actigraphic methods may be more accurate than self-reports, it may be less feasible for

organizational scholars to implement objective actigraphic methods and so we include both self-report and objective actigraphic sleep in order to motivate future research on sleep in general.

Self-reported sleep insufficiency. Sleep insufficiency, a measure of sleep quality, was measured using one item (Buxton et al., 2009; Buxton et al., 2012). As a measure of sleep insufficiency, participants were asked, "How often during the past four weeks did you get enough sleep to feel rested upon waking up?" Items were rated on a scale from 1 (*never*) to 5 (*very often*). After reverse scoring, higher scores indicated greater sleep insufficiency.

Self-reported sleep duration. Sleep duration, a measure of sleep quantity, was measured using two items from the PSQI (Buysse et al., 1989). As a measure of sleep duration, participants were asked, "Over the past four weeks, what time did you usually turn the lights off to go to sleep?" and "Over the past four weeks, what time did you usually get out of bed?" Sleep duration (i.e., the number of hours slept) was computed from these two times indicated by the participants.

Self-reported insomnia symptoms. Insomnia symptoms, a measure of sleep quality, were measured using two items from the PSQI (Buysse et al., 1989). As a measure of insomnia symptoms, participants were asked, "During the past four weeks, how often could you not get to sleep within 30 minutes?" and "During the past four weeks, how often did you wake up in the middle of the night or early morning?" Items were rated on a scale from 1 (*never*) to 4 (*three or more times a week*), with higher scores indicating more frequent insomnia symptoms. The two scores were then averaged for an overall insomnia symptoms score.

Sleep duration and quality directly-measured using actigraphy. Sleep has rarely been measured using objective methods. Objectively-measured actigraphy can be used to assess sleep quality and quantity (Buxton, Klein, Whinnery, Williams, & McDade, 2013). Actigraphy represents a reliable and valid objective measure of sleep not used for the diagnosis of sleep disorders (Ancoli-Israel et al., 2003; Marino et al., 2013). Sleep monitor actigraphs are wrist-watch size devices that contain an accelerometer, continuously measuring movement as a proxy for waking activity (Ancoli-Israel et al., 2003; Barnes, 2012).

Actigraphic *total sleep time*, or objectively-measured quantity, can be derived from actigraphic periods of less frequent movement, indicating sleep, throughout a 24 hour period. Alternatively, actigraphic *WASO* (wake after sleep onset), or objectively-measured quality, refers to the average amount of time spent awake per sleeping period, as evidenced by actigraphically-measured wrist movement patterns. Following data collection, data from each participant's actiwatch was uploaded to databases (Respironics Actiware sleep scoring program version 5.71) and analyzed by at least two members of the study's actigraphic scoring team using a recently validated and standard algorithm (Marino et al., 2013). Scorers determined a) the validity of each recording, b) the validity of each day of the recording, and c) manually inserted sleep periods (main sleep intervals and naps) based on study-specific standard sleep criteria applied similarly to all recordings. In short, a recording was determined to be invalid if there was a device malfunction indicated by constant false activity on the recording or if the data were unable to be retrieved. Certain days within the recording were determined to be invalid if a watch error occurred, such as false activity patterns characteristic of a failing battery, or

if the participant did not comply with the study's actigraphic procedures (i.e., greater than four hours of actiwatch off-wrist time throughout the day, or an off-wrist period greater than 60 minutes within 10 minutes of the determined beginning or end of the main time in bed period for that day). If there were no discrepancies between at least two scorers on determining whether the recording was valid, the number of valid days, and the cut time used to define 24-hour days, the analyses were then checked to ensure that all scorers had determined the recording had the same number of sleep periods and had labeled each sleep period as a main sleep or nap identically. Lastly, each of the sleep periods were checked on an interval-by interval-basis. Any corresponding intervals that exceeded a 15 minute difference in length or exceeded 15 minutes of either total sleep time or WASO were rescored.

The Actiware sleep scoring program separates an actigraphy recording into 30 second segments of time, or epochs, and calculates a total activity count based on the epoch being evaluated. Figure 2.2 represents the calculation method used. If the total activity count exceeded the wake threshold level determined by the researchers (i.e., medium wake threshold level selection uses a wake threshold value of 40 total activity counts), then the epoch was labeled "wake". If the total activity count was below the set wake threshold level, the epoch was labeled "sleep". Thus, the initial total sleep time measurement was the total number of epochs determined to be sleep multiplied by the set epoch length, while the initial WASO measurement was the total number of epochs determined to be wake multiplied by the set epoch length. For the purposes of the current investigation, these initial values for total sleep time and WASO were further modified to account for the total number of valid days. Actigraphic total sleep time was computed as

the average amount of sleep attained per day in minutes (including naps). Thus, the total amount of time scored as sleep over the course of the study was divided by the total number of valid days. Actigraphic WASO was computed as the average amount of time spent waking during nightly sleep in minutes, with the total amount of time scored as wake being divided by the total number of valid days.

Control variables. Several control variables were selected based on theory and past research. Race was coded dichotomously as white versus non-white, and included based on past research indicating that poorer sleep is experienced by minorities (e.g., Hale & Do, 2007; Kingsbury, Buxton, Emmons, & Redline, in press; Mezick et al., 2008). Gender was coded as male versus female. Gender has been related to both sleep quality and duration, with women experiencing poorer sleep (e.g., Reyner, Horne, & Reyner, 1995). Participants also reported on the number of children they had living in their home four or more days a week. This also was motivated by past research that suggests that perceptions of work-family conflict are generally higher among individuals with children in the home (e.g., Eby et al., 2005). Work schedule referred to either daytime shift or other shift, as shiftwork is commonly reported with disturbed sleep (e.g., Akerstedt, 2003).

Analytic Strategy

Given that participating employees worked within work groups under the supervision of managers, intraclass correlations (ICC) were calculated to determine the degree of dependency within work groups, using manager as the nesting variable. ICCs for all sleep outcomes ranged from .01 to .03. Although these ICCs are very low, we attempted multilevel modeling as a conservative approach to analyzing the data.

However, we experienced convergence issues in a majority of the models due to very little or no variance between managers with respect to employee sleep outcomes. The insomnia, sleep duration, and total sleep time models did not converge. Additionally, out of the models that did converge, the random intercept for sleep insufficiency was not significant (B = .003, p = .87) and the random intercept for WASO was not significant (B = .43, p = .93). Thus, all analyses were conducted using standard ordinary least squares regression techniques that ignore the very small levels of dependency within groups. All analyses were conducted in SPSS, Version 19.

As demonstrated below, many of our predictor variables of interest were correlated with each other, which is likely to lead to non-significant unique effects within a block of added predictors. We therefore use hierarchical multiple regression, with a particular interest on the ΔR^2 and ΔF values for each block of predictors (e.g., work-family interface variables) rather than exclusively on the significance of individual parameters, since the ΔR^2 and ΔF is not subject to this problem. Thus, we assess and focus on the incremental predictive utility of all variables in successive blocks.

The variables were entered into the regression equations in three blocks/steps. First, the control variables were entered. Second, the centered scores for WTFC, FTWC, and FSSB were entered, representing the work-family interface variables in Hypotheses 1 and 2 as well as supervisor support. Third, the WTFC by FSSB interaction term and FTWC by FSSB interaction term were entered, representing interactive effects among work-family interface variables in Hypotheses 3a and 3b.

Results

Table 2.1 shows descriptive statistics and inter-correlations among all study variables. On average, this sample experienced around 44 minutes per night of waking time after sleep onset based on actigraphic data, although this varied among participants (*SD* = 16.83), and there was a moderate correlation (*r* = .41) between participants' self-reported sleep time (i.e., 7.26 hours on average, *SD* = .95 hours) and their actigraphically-reported sleep time, (i.e., 433.70 minutes or 7.23 hours on average, *SD* = 55.60 minutes or .93 hours).

As predicted, race, gender, number of children, and work schedule were all significantly related to the sleep variables. Additionally, WTFC, FTWC, and FSSB were all significantly correlated with each other in the expected directions. WTFC was significantly and positively correlated with FTWC and significantly and negatively correlated with FSSB, while FTWC and FSSB were significantly and negatively correlated. Furthermore, WTFC was significantly related to sleep insufficiency, insomnia, and sleep duration in the expected directions, while FTWC was significantly related to both sleep insufficiency and sleep duration in the expected directions. FSSB was significantly associated with sleep insufficiency, insomnia, and sleep duration in expected directions. No significant relationships were seen between these work-family predictors and actigraphic outcomes. Note some of the small correlations among the sleep variables suggesting that they may tap different constructs. For example, the sleep quality measures (i.e., sleep insufficiency, insomnia, WASO) correlated only between .00 and .28 with each other. Although self-reported sleep duration and actigraphic total sleep

time had very similar means and standard deviations, they only correlated .40 with each other.

Hypothesized Results

We hypothesized that employee WTFC and FTWC would be positively related to self-reported sleep insufficiency, self-reported insomnia symptoms, and objectively-measured WASO, while being negatively related to self-reported sleep duration and objectively-measured total sleep time. Additionally, we hypothesized that FSSB would be negatively associated with self-reported sleep insufficiency, self-reported insomnia symptoms, and objectively-measured WASO, while being positively associated self-reported sleep duration and objectively-measured total sleep time. Results from the WTFC analyses can be found in Tables 2.2 and 2.3 for sleep quality and sleep quantity measures, respectively. Rather than discuss each model results sequentially, we present the results thematically as they relate to the study hypotheses. As previously mentioned, we report the ΔR^2 and ΔF values for blocks of predictors in tables 2.2 and 2.3 because of the significant correlations among study predictors.

Sleep quality. As displayed in Table 2.2, we find that the ΔF is significant for the block of predictors in Step 2 (i.e., WTFC, FTWC, FSSB) with the two self-reported sleep quality measures, sleep insufficiency ($\Delta R^2 = .08$, $\Delta F = 19.22$, $p < .001$) and insomnia symptoms ($\Delta R^2 = .03$, $\Delta F = 7.09$, $p < .001$), but not actigraphic WASO ($\Delta R^2 = .00$, $\Delta F = .81$, $p = .49$). Thus, there appears to be significant variance in self-report sleep quality variables accounted for by the predictors.

In support of these findings regarding sleep quality measures, WTFC was significantly and positively associated with sleep insufficiency ($B = .24$, $t(623) = 5.92$, p

< .001) and insomnia symptoms (B = .13, t(621) = 3.56, p < .001), but not WASO (B = .34, t(622) = .44, p = .66). However, FTWC was not significantly associated with sleep insufficiency (B = .06, t(623) = 1.06, p = .29), insomnia symptoms (B = -.01, t(621) = -.17, p = .83), or WASO (B = -1.72, t(622) = -1.58, p = .12), despite the significant positive bivariate correlation between FTWC and sleep insufficiency. Similarly, FSSB was not significantly related to sleep insufficiency (B = -.05, t(623) = -1.16, p = .25), insomnia symptoms (B = -.05, t(621) = -1.12, p = .26), or WASO (B = -.10, t(622) = -.12, p = .90), despite the significant negative bivariate correlation between FSSB and sleep insufficiency and insomnia symptoms. Concerning sleep quality, our results partially support *hypotheses 1a*, *1b*, and *2*.

Lastly, we model results relating to the moderating effect of FSSB on the relationships between WTFC and FTWC and sleep quality measures. The addition of the two interaction terms in step 3 was not significant (min. p-value = .35) for any of the three sleep quality measures, and none of the hypothesized interactions themselves were statistically significant (min. p-value = .16). With respect to sleep quality, our results do not support *hypothesis 3*.

Sleep quantity. As displayed in Table 2.3, our results indicate that significant variance in self-reported sleep duration is accounted for by work-family predictors in Step 2, beyond control variables (ΔR^2 = .02, ΔF = 5.35, p = .001), although significant results are not found for actigraphic total sleep time (ΔR^2 = .01, ΔF = 2.06, p = .11). There appears to be significant variance in self-report sleep quantity accounted for by work-family predictors.

In support of these findings, WTFC was significantly and negatively associated with sleep duration (B = -.11, t(623) = -2.48, p = .01) and actigraphic total sleep time (B = -5.41, t(623) = .-2.13, p = .03). However, FTWC was not significantly associated with sleep duration (B = -.05, t(623) = -.70, p = .45) or actigraphic total sleep time (B = .84, t(623) = .23, p = .82), despite the significant negative bivariate correlation between FTWC and sleep duration. Similarly, FSSB was not significantly related to sleep duration (B = .07, t(623) = 1.36, p = .18) or actigraphic total sleep time (B = -2.83, t(623) = -1.01, p = .31), despite the significant negative bivariate correlation between FSSB and sleep duration. Concerning sleep quantity, our results partially support *hypotheses 1a*, *1b*, and *2*.

Finally, we report model results relating to the moderating effect of FSSB on the relationships between WTFC and FTWC and sleep quantity measures. The addition of the two interaction terms in Step 3 was not significant (min. p-value = .31) for either of the sleep quantity measures and none of the hypothesized interactions themselves were statistically significant (min. p-value = .48). Thus, when evaluated with respect to sleep quantity, *hypothesis 3* was not supported.

Our results provide partial evidence supporting hypotheses *1a*, *1b*, and *2*. Although significant direct effects are only found with WTFC on sleep quality and quantity outcomes within our regression models, correlations among study predictors are likely contributing to the non-significant unique effects of FTWC and FSSB[2]. As such,

[2] The authors conducted additional analyses with sleep outcomes regressed on WTFC and FSSB in the first set of models and sleep outcomes regressed on FTWC and FSSB in the second set of models. By including WTFC and FTWC in separate models, significant relationships were found between FTWC and sleep insufficiency and sleep duration, while FSSB was significantly related to sleep insufficiency. Relationships between WTFC and sleep outcomes were similar to those mentioned in the results section.

we find that this combination of predictors accounts for significant variance in sleep quality and quantity models. However, no support is found for moderating effects with *hypotheses 3a* or *3b*.

Discussion

This study evaluated the relationships among work-family conflict, FSSB, and sleep outcomes within the COR framework. Our results show that a combination of constructs predicts both self-reported and objective sleep quality and quantity. We add to Barnes et al.'s (2012) and Lallukka et al.'s (2010) findings by using objective and subjective measurements of both sleep quality (i.e., self-reported sleep insufficiency, self-reported insomnia symptoms, objectively-measured WASO) and sleep quantity (i.e., self-reported sleep duration, objectively-measured total sleep time), with a measure of FSSB, and examining the relationship between work-family conflict and sleep in a stress framework. Our findings indicate that the threat and loss of resources, brought on by work-family conflict, extends beyond waking experience and impacts aspects of sleep.

Regarding actigraphic outcomes, only total sleep time was found to be significantly related to WTFC and the combination of work-family predictors did not account for significant variance in actigraphic WASO or total sleep time. One explanation for this is that relationships between self-report work-family conflict and self-report sleep outcomes are likely to be subject to common method bias, thereby inflating the correlations between independent and dependent variables (Podsakoff, MacKenzie, Jeong-Yeon, & Podsakoff, 2003), and thus making it more difficult to detect an effect with objective outcomes in general. Additionally, WASO is subject to more

measurement error than total sleep time (Marino et al., 2013), which may explain why WTFC was related with total sleep time, but not WASO.

In contrast to our significant results with objectively-measured total sleep time, we did not find any support for work-family conflict or FSSB being related to objectively-measured WASO, despite relationships between these variables and self-report indicators of sleep quality (i.e., self-reported sleep insufficiency and insomnia symptoms). These results are in alignment with previous research that has found perceived stress to be associated with poor self-reported sleep, but not objectively-measured actigraphic assessments (Tworoger, Davis, Vitiello, Lentz, & McTiernan, 2005). It is possible that common method bias may play a role in these differential findings from both our study and Tworoger et al.'s study. Alternatively, WASO may represent a sleep quality construct that is altogether unique from self-reported sleep insufficiency and insomnia symptoms. WASO is an empirical measure of the amount of time spent awake during a sleep period after having fallen asleep, and is highly related to inhibitory GABA neurotransmitter levels in insomniacs (Winkelman et al., 2008). Thus, it does not directly map on to the construct of sleep self-reported insufficiency (i.e., the extent to which one does not feel rested upon awakening).

Additionally, we did not find significant relationships between FSSB and sleep quantity. This is in contrast to previous work conducted by Berkman et al. (2010), who found a significant association between manager work-family balance scores and actigraphically-measured total sleep time. Although Berkman and colleagues' conceptualization of managers' practices related to work-family balance is similar to Hammer et al.'s (2013) construct of FSSB, there are some distinctions that may be

responsible for the differing results. Berkman et al.'s measure of supervisor support was created by coding supervisor openness and creativity with regard to employee family demands in qualitative interview transcripts. These aspects of openness and creativity appear to reflect the instrumental support and creative work-family management items within Hammer et al.'s FSSB-SF scale. It may be the case that these dimensions from Hammer et al.'s (2009) long-form scale are better predictors of sleep quantity. Moreover, Berkman et al.'s study was conducted in a sample of extended care facilities, rather than in a professional-level industry. As we discuss in further detail below, interactions between supervisors and employees may be qualitatively different in an hourly workforce.

No significant interaction effects were found between work-family conflict and FSSB on sleep outcomes. These findings were unexpected, given prior research that has found evidence for social support acting as a moderator on the relationship between stressors and well-being (Cohen & Wills, 1985) and between workplace stressors and strains (Viswesvaran, Sanchez, & Fisher, 1999), in addition to predictions from COR theory (Hobfoll, 1989). Other research suggests that moderating effects are most likely to be found when stressors, resources, and strains all match in terms of being cognitive, emotional, or physical (de Jong & Dormann, 2006), giving some explanation to our results with sleep as a purely physical outcome and work-family conflict and FSSB being more cognitive and emotionally oriented.

Limitations and Future Directions

While we contribute to current theory by investigating how the threat or loss of resources impacts sleep, by examining FSSB as a resource, and by including both sleep

quality and sleep quantity in our study, in addition to contributing methodologically with the use of both self-report and objective measures of sleep, there are a few limitations that should be addressed and discussed. First, the self-report sleep measures asked participants to report on the previous four weeks of sleep while the objective measures of sleep were taken the week after the self-report scales were completed. Therefore, the self-report and objective measurements of sleep are not taken from the same timeframe and could have contributed to differential effects for these outcomes. The work-family conflict items referred to the previous six months, while the FSSB items referred to the previous four weeks. While overlapping, these referent time frames do not share the same level of specificity. Moreover, actigraphy data collection lasted for one week. It is likely that more reliable estimates of actigraphy could have been obtained, had the measurement window been longer.

Additionally, this study is cross-sectional in nature, making it difficult to determine causal influences of variables. It is possible that employees experience greater levels of work-family conflict as a result of inadequate and insufficient sleep, however, this directional relationship was not supported in a recent conference presentation by Butts et al. (2013). Future research should attempt to examine these relationships in a longitudinal design whereby the direction of relationships among WTFC, FTWC, FSSB, and the different sleep measures of quality and quantity can be determined. Furthermore, it may be the case that the effects of work-family conflict manifest differentially day to day. Since work-family conflict, perceptions of FSSB, and aspects of sleep can vary depending on the day of the week, work schedule, or family schedule, future studies may include a daily diary component to data collection.

For the current study, we utilized the FSSB-SF (Hammer et al., 2013). Given the advantages of using this scale, in addition to the fact that we faced time constraints with survey administration, we opted to use the short form for this study. However, it is possible that additional direct effects or moderating effects may have been found had we been able to measure the four dimensions of FSSB separately (i.e., emotional support, instrumental support, role modeling behavior, creative work-family management). Future research should further address the linkages between FSSB and sleep.

Additional mechanisms/mediators contributing to these findings should be explored in future research. Actual sleep preparatory behaviors such as sleep scheduling and activities before sleep, also known as sleep hygiene (e.g., Gellis & Lichstein, 2009), are likely to be influenced by work-family conflict and are likely to impact actual sleep outcomes. For example, negative health behaviors are frequently implicated in chronic health outcomes such as exercise behaviors and cardiovascular disease, eating behaviors and obesity, and smoking behaviors and lung cancer. Such health behaviors have also been recognized as occurring in response to stress, and more specifically in response to psychosocial job stressors (e.g., NIOSH Research Compendium, 2012). More recently, negative health behaviors have been associated with the stress associated with work-family conflict, and specifically poor eating and exercise behaviors (e.g., Allen, Shockley, & Poteat, 2008; Lallukka et al., 2010). To our knowledge, no research has examined the relationship between work-family conflict and negative sleep behaviors, which may ultimately mediate the relationship between work-family conflict and both objective and self-report sleep quantity and quality outcomes.

Work-family scholars should attempt to replicate this study in other organizations and industries to determine under what conditions work-family conflict and FSSB influence employee sleep quantity and quality. Supervisors and employees may interact very differently in this IT industry, given the use of technology. For example, members of the supervisor—employee dyad may interact less frequently in person, but more frequently online over email and conference calls, which may either result in supervisors providing employees with more or less family-specific support, or different types of family-specific support. Accordingly, Barsade and Gibson (2007) have called for future research to investigate the organizational implications of emotions being conveyed through text-based means. Perhaps the absence of findings with regard to FSSB is indicative of this type of industry and little interpersonal contact between supervisors and employees.

Actigraphic and self-report measures of sleep, in addition to different aspects of sleep quality and quantity, should continue to be used in conjunction in future organizational and work-family interface studies. Our results indicated that there were somewhat small to modest relationships between the different sleep quantity and quality outcomes, in line with past research. For example, self-report and objective sleep quality measures correlated between .00-.12, while self-report and objective sleep quantity correlated .41. This suggests that each measure captures distinguishable aspects of sleep quality and quantity. Thus, there is a need for organizational scholars to include multiple measurements of the different components of sleep quality and quantity in future studies and further determine how the different measures and methodologies are related to work-family interface variables.

In conclusion, we find that work-family constructs are associated with multiple aspects of sleep quality and quantity. Given the relationship between insufficient and inadequate sleep and chronic health outcomes, we argue that work-family scholars have an opportunity to contribute to the prevention of disease. There has been a call in the literature for work-family interventions to be implemented as a means for reducing negative health behaviors and associated chronic health outcomes experienced by workers (Hammer & Sauter, in press; Sorenson et al., 2011a). Future studies should continue to examine further the work-family interface—sleep link, and implement worksite interventions targeting proximal work-family variables and distal sleep outcomes.

Table 2.1

Correlations Between Study Variables

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. Race	.52	.50	—										
2. Gender	.31	.46	.20	—									
3. Number of Children	.99	1.08	-.10	-.07	—								
4. Work Schedule	.62	.49	.32	.27	.08	—							
5. WTFC	3.06	.94	.06	.08	.05	-.17	.92						
6. FTWC	2.12	.63	.00	-.03	.15	-.03	.37	.83					
7. FSSB	3.76	1.23	-.01	-.06	-.01	.01	-.38	-.15	.88				
8. Sleep Insufficiency	2.81	.90	.01	.06	.10	-.04	.28	.15	-.12	—			
9. Insomnia	2.70	.77	.10	.12	-.05	-.05	.18	.04	-.06	.28	—		
10. Act. WASO	44.12	16.83	-.20	-.01	-.09	-.01	-.03	-.07	.01	.00	.12	—	
11. Sleep Duration	7.28	.95	.05	.07	-.11	.12	-.15	-.09	.06	-.18	.10	.13	—
12. Act. Total Sleep Time	433.70	55.60	.19	.22	-.09	.08	-.07	-.05	-.03	-.07	.12	.10	.41

Note. WTFC = Work-to-Family Conflict; FTWC = Family-to-Work Conflict; FSSB = Family-Supportive Supervisor Behavior; Act. WASO = Actigraphic Wake After Sleep Onset; Act. Total Sleep Time = Actigraphic Total Sleep Time. Race (1 = White, 0 = Other); Gender (0 = Male, 1 = Female); Work Schedule (0 = Other, 1 = Daytime); WTFC (scale: 1-5); FTWC (scale: 1-5); FSSB (scale: 1-5); Sleep Insufficiency (scale: 1-5); Insomnia (scale: 1-4).
Reliabilities (Cronbach's α) are on the diagonal in parentheses.
All values greater than |.08| are significant at the .05 level.

Table 2.2

Effect of Work-Family Conflict and FSSB on Sleep Quality

	Outcome								
	Sleep Insufficiency			Insomnia Symptoms			Act. WASO		
Predictor	*B*	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β
Step 1									
Constant	2.84	.04		2.69***	.04		45.17***		
Race	-.03	.07	-.02	.07	.07	.04	-7.56***	1.35	-.22
Gender	.14	.07	.08	.21	.06	.13	-.08	1.30	.00
Children	.08	.03	.10	-.03	.03	-.05	-1.48*	.59	-.10
Work Schedule	-.08	.08	-.04	-.12	.08	-.06	-.42	1.57	-.01
ΔR^2	.03			.04			.06		
ΔF	4.92**			5.70***			9.34***		
Step 2									
WTFC	.24***	.04	.26	.13***	.04	.16	.33	.77	.02
FTWC	.06	.06	.04	-.01	.05	-.01	-1.72	1.09	-.07
FSSB	-.05	.05	-.05	-.05	.04	-.05	-.10	.84	.00
ΔR^2	.08			.03			.00		
ΔF	19.22***			7.09***			.81		
Step 3									
WTFC X FSSB	.01	.05	-.05	.03	.04	.03	.46	.84	.02
FTWC X FSSB	-.10	.05	.01	.01	.06	.01	-.91	1.31	-.03
ΔR^2	.00			.00			.00		
ΔF	1.03			.28			.28		

Note. *B, SE B,* and β reported based on the full model. See note in Table 1 for coding. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2.3

Effect of Work-Family Conflict and FSSB on Sleep Quantity

	Outcome					
	Sleep Duration			Act. Total Sleep Time		
Predictor	*B*	*SE B*	β	*B*	*SE B*	β
Step 1						
Constant	7.19***	.04		426.16***	2.51	
Race	.12	.08	.06	22.18***	4.49	.19
Gender	.05	.08	.03	23.04***	4.31	.21
Children	-.10**	.04	-.12	-3.67	1.96	-.07
Work Schedule	.29**	.09	.13	7.96	5.23	.06
ΔR^2	.04			.09		
ΔF	6.87***			15.91***		
Step 2						
WTFC	-.11*	.05	-.11	-5.41*	2.54	-.09
FTWC	-.05	.06	-.03	.84	3.62	.01
FSSB	.07	.05	.06	-2.83	2.80	-.04
ΔR^2	.02			.01		
ΔF	5.35**			2.06		
Step 3						
WTFC X FSSB	-.01	.05	-.01	-3.72	2.80	-.06
FTWC X FSSB	-.01	.08	-.01	-.80	4.34	-.01
ΔR^2	.00			.00		
ΔF	.05			1.18		

Note. B, SE B, and β reported based on the full model. See note in Table 2.1 for coding.

* $p < .05$. ** $p < .01$. *** $p < .001$.

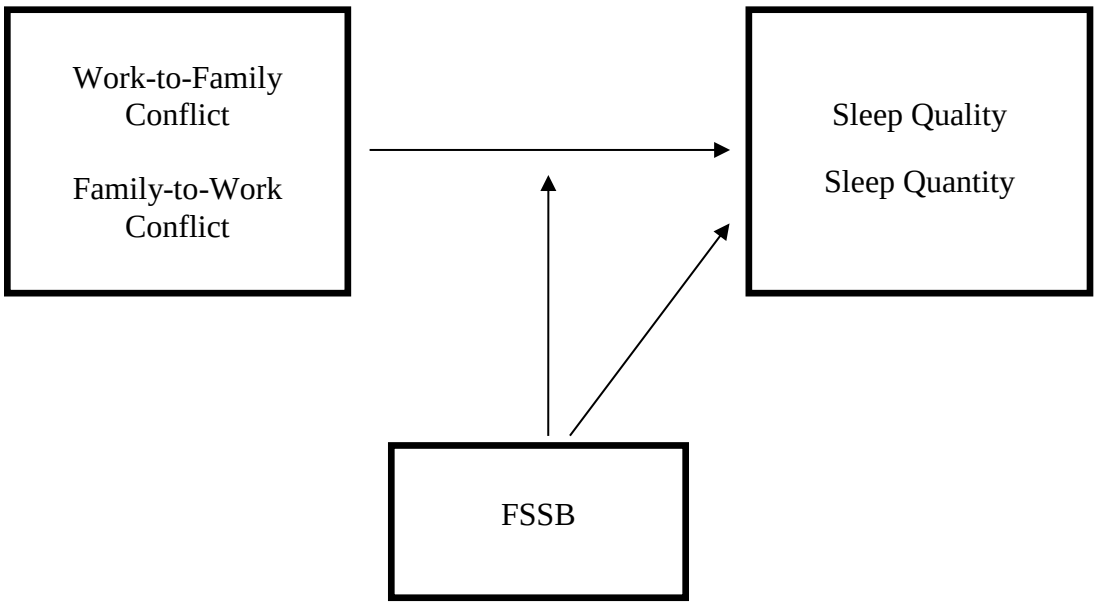

Figure 2.1. Theoretical model.

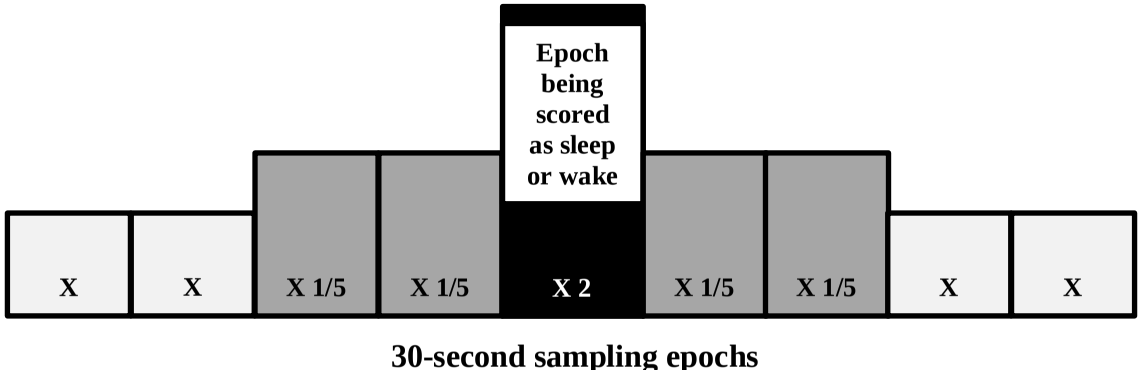

Figure 2.2. Calculation method for actigraphic scoring.

Chapter 3: Daily Work-Family Experiences and Sleep: The Moderating Role of Contextual Structural Resources

Author Note

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Abstract

Drawing on Conservation of Resources theory and the Work-Home Resources Model, we used a sample of 131 information technology workers to examine the associations between within-person work-to-family conflict (WTFC) and sleep quality and quantity, as work-family conflict represents a source of resource loss. In addition, we assessed daily reports of family-supportive supervisor behaviors (FSSB) as a contextual, yet transient resource and predictor of sleep quality and quantity. Control over work schedule and perceptions of work-family climate were classified as contextual, yet stable resources, and thus evaluated as between-person moderators of the within-person associations. Results demonstrated that it takes individuals longer to fall asleep on nights following high levels of WTFC. Perceptions of work-family climate and control over work schedule also played moderating roles in the WTFC- and FSSB-sleep quality associations. Our findings suggest that future interventions aiming to improve sleep should target WTFC and FSSB at both within- and between-person levels, while also taking into account the organizational setting within which the intervention is being conducted.

Keywords: work-family conflict, family supportive supervisor behaviors, sleep, conservation of resources theory, work-home resources model

Daily Work-Family Experiences and Sleep: The Moderating Role of Contextual Structural Resources

Sleep is becoming a topic of increasing interest to organizations, individuals, and scholars. As stated in their Sleep Disorders Research Plan, the National Institutes of Health (2011) have called for future research to examine environmental factors contributing to the risk of sleep deficiency, given that it has been associated with long-term obesity, diabetes (e.g., Buxton & Marcelli, 2010; Buxton et al., 2009), cardiovascular disease (e.g., Buxton & Marcelli, 2010; Mallon, Broman, & Hetta, 2002), and premature mortality (e.g., Grandner, Hale, Moore, & Patel, 2010). To this end, the current organizational literature has revealed that work-family conflict and the presence of family-supportive supervisors are generally related to sleep outcomes (e.g., Berkman et al., 2010; Crain et al., 2014), in line with the propositions of Conservation of Resources theory (COR; Hobfoll, 1989). These prior findings suggest that work-family factors may be important levers to target in order to minimize sleep deficiency and eventual disease. However, some critical research gaps concerning this topic remain unexplored.

First, previous studies have failed to capture the within-person processes that more closely approximate the day-to-day variation between work-family experiences and sleep. Prior research has typically relied on between-person estimates with participants reporting on their average experiences over the previous month (e.g., Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). However, an individual may sleep eight hours a night on average, but have a wide variation in how much sleep is attained day to day. Research designs should reflect that stress is a process that occurs within each individual, rather

than at a more general population level (Almeida & Davis, 2011). In line with this reasoning, scholars have suggested that short-term processes exist within the work-family interface, in addition to the more heavily researched long-term processes, and thus are deserving of future attention (e.g., ten Brummelhuis & Bakker, 2012).

Second, previous studies examining work-family stressors and resources in relation to sleep outcomes have rarely included both sleep quality and sleep quantity constructs (e.g., Berkman et al., 2010), let alone at the daily-level. *Sleep quantity* refers to the duration of time an individual remains in a sleeping state, whereas *sleep quality* refers to an overall evaluation of the sufficiency of sleep, in addition to difficulty initiating or maintaining sleep at night (Harvey et al., 2008). As suggested by Barnes (2012), an individual may have a long sleep duration, but that sleeping period may be marked by awakenings throughout the night. Alternatively, an individual may experience high quality sleep, but for an inadequate duration. By not including these distinguishable outcomes simultaneously within studies, scholars are failing to address sleep health holistically.

Third, there is a need to investigate moderators of the daily work-family conflict and sleep relationship. Of particular interest are those resources that can be strengthened through organizational interventions and sustained over time. In their Work-Home Resources framework, ten Brummelhuis and Bakker (2012) classify these resources as being both *contextual* (i.e., provided by the environment rather than originating within an individual) and *structural* (i.e., relatively stable rather than transient). More generally, there is a need to understand the role of such contextual structural resources when resource loss (e.g., work-family conflict) is also present at the daily-level, as a defining

feature of COR theory is the *primacy of resource loss*—which assumes resource loss is more salient than resource gain (Halbesleben, Neveu, Paustian-Underdahl, & Westman, 2014).

In addition, these same contextual structural resources can interact with other environmental, yet more transient resources, such as daily FSSB, which ten Brummelhuis and Bakker (2012) would classify as *contextual volatile* resources. COR theory proposes that individuals with greater resources are more likely to experience resource gain (Hobfoll & Shirom, 2000). This suggests individuals are better able to capitalize on contextual resources that are provided on a daily basis, under conditions of a favorable environment characterized by contextual, yet stable resources that can be drawn upon regularly.

The present study provides three critical contributions addressing these key limitations in the existing work-family and sleep literature. We first assess temporal dynamics of work-family experiences and sleep using daily diary methodology within the COR and Work-Home Resources frameworks. We also examine both sleep quality and quantity outcomes in relation to daily work-family experiences. Lastly, we investigate whether the contextual structural resources of control over work schedule and perceptions of work-family climate moderate the relation of daily work-family experiences to sleep in line with COR theory's propositions. By uncovering these associations, researchers will be better able to effectively design individual-level interventions that are adaptable to different contexts, in addition to organizational-level interventions targeting these specific aspects of the environment for improvement. Our theoretical model is presented in Figure 3.1.

Theoretical Frameworks

COR theory (Hobfoll, 1989) suggests individuals are primarily motivated to conserve and acquire resources. Strain results from a loss of resources, a threat of resource loss, or a lack of resource gain after the investment of resources. Resources were originally defined broadly within four categories including conditions (e.g., valued work role, tenure), objects (e.g., house), personal resources (e.g., self-esteem, mastery), and energies (e.g., time, money) that the individual values and strives to obtain, maintain, and protect (Hobfoll, 1989). Drawing on this work, ten Brummelhuis and Bakker (2012) have proposed a two-by-two taxonomy of resources within their Work-Home Resources Model. The first dimension represents source of the resource. *Contextual* resources exist external to an individual and are found within one's social contexts (e.g., house, social support). In contrast, *personal* resources include traits and energies (e.g., skills, mood). The second dimension along which resources can vary represents resource transiency. *Volatile* resources are temporary and can typically only be used once (e.g., social support, mood), whereas *structural* resources are enduring aspects of the environment or oneself that can be utilized more than once (e.g., house, skills). We examine daily work-to-family conflict as a source of resource loss and the contextual volatile resource of daily FSSB as predictors of nightly sleep. Furthermore, we assess the contextual structural resources of control over work schedule and perceptions of work-family climate as moderators of these daily associations.

Linking Daily Work-to-Family Conflict to Sleep

Greenhaus and Beutell (1985) have suggested that work-to-family conflict (WTFC) occurs when the demands of the work role are incompatible with the demands of

the family role. In this study, we focus on how this type of role conflict, a source of resource loss, is linked with nightly sleep. Some studies provide evidence for the negative relationship between WTFC/FTWC and self-reported sleep quality at the between-person level (Nylen, Melin, & Laflamme, 2007; Sekine et al., 2006). Similarly, Lallukka, Rahkonen, Lahelma, and Arber (2010) found that work-family conflict was positively related to self-report sleep complaints. Longitudinal studies revealed reduced individual-level and team-level WTFC positively predicted perceptions of adequate time for healthy sleep (Moen, Fan, & Kelly, 2013) and that reduced WTFC is associated with longer sleep duration (Moen, Kelly, Tranby & Huang, 2011). However, these studies fail to account for the day-to-day variation in work-family experiences and sleep.

To address this limitation, Barnes et al. (2012) did find interactive effects between work time and family time on self-report sleep time at the within-person level, suggesting that time is borrowed from sleep in order to accommodate high levels of work and family demands on certain days. The current study expands on this previous research by examining how actual reports of daily work-family conflict and supervisor support for family life influence nightly sleep. Some days are marked by particularly high levels of WTFC, given various work demands that arise and impede family performance, while others are marked by low levels of WTFC. For example, work deadlines, stressful conflicts with coworkers, or last-minute scheduling changes vary day to day, resulting in strain and a lack of time within the family domain that then impacts daily sleep quality and quantity.

Hypothesis 1: Sleep quality and sleep quantity will be poorer on nights following days with high levels of WTFC, compared to days with low levels of WTFC.

Linking Daily FSSB to Sleep

COR theory also suggests that individuals with greater resources are less vulnerable to resource loss and more likely to experience resource gain (Hobfoll & Shirom, 2000). This is because resources must be expended in order to gain new resources. While WTFC depletes resources, as suggested by Hobfoll and Shirom (2000), social support not only acts as a resource, but also results in access to additional resources (i.e., objects, conditions, personal characteristics, energy). Family-supportive supervisors empathize with an employee's efforts to seek balance between work and family domains and adequately fulfill both sets of roles (Thomas & Ganster, 1995). Hammer, Kossek, Yragui, Bodner, and Hanson (2009) define FSSB as a multidimensional superordinate construct consisting of emotional and instrumental support concerning family demands, in addition to role modeling behavior and creative work-family management. We examine FSSB as a contextual volatile resource that predicts better sleep quality and quantity.

Previous findings support the link between family-specific supervisor support and sleep at the between-person level. Past work by Berkman et al. (2010) used qualitative assessments of supervisors' supportive family practices and found that employees slept almost 30 minutes longer per night, as measured objectively by actigraphy, when their supervisor was more supportive. Crain et al. (2014) directly examined the association between the construct of FSSB and sleep outcomes, finding that a combination of predictors, including WTFC, FTWC, and FSSB, were significantly related to both objective and self-report measures of sleep quantity and quality within a cross-sectional design. Neither of these studies, however, utilized within-person designs and thus failed

to account for the day-to-day fluctuation in FSSB, which ten Brummelhuis and Bakker (2012) suggest is transient. Supervisors are more or less able to act in family-supportive ways, depending on the workday. For example, on days with frequent administrative meetings, a deadline, or travel, supervisors will not have many opportunities to interact with their employees and provide support. In addition, supervisors have fewer emotional and cognitive resources on certain days to provide employees with support, even if presented with the opportunity.

Hypothesis 2: Sleep quality and sleep quantity will be greater on nights following days with high levels of FSSB, compared to days with low levels of FSSB.

Contextual Structural Work Resources as Moderators

Control over work schedule. Consistent with Kelly and Moen (2007), our conceptualization of control emphasizes control over *when* and *where* work is conducted. COR theory proposes that if individuals perceive they have the resources to cope with a given stressor, the relationship between the stressor and strain outcomes will be attenuated (Hobfoll, 1989). For example, if an individual experiences work conflicting with family to a high extent on a given day, they are less likely to experience distress that impairs sleep quality if they have the understanding that tomorrow's work schedule can be adapted to better accommodate family demands that were compromised today. In addition, the individual can attain longer sleep durations (e.g., later wake-up times) despite experiencing high WTFC on a given day when they are able to choose when and where to work the following day.

Hypothesis 3a: Control over work schedule will moderate the negative association between within-person WTFC and sleep quality and quantity, such that the association is attenuated under conditions of high control over work schedule.

We also expect that individuals will be better able to capitalize on supervisors' family-specific supportive behaviors on a daily basis if they have high levels of discretion over when and where to work, given COR theory's proposition that individuals with resources are predisposed toward future resource gains (Hobfoll & Shirom, 2000). Better sleep quality will result after days when supervisors provide support for family, but this effect will be enhanced if employees also have the understanding that they can change their schedule, if needed. Adequate sleep durations will result if supervisors provide family-specific support, thereby allowing employees to manage both work and family demands, which lead to a lower probability of needing to borrow time from sleep. This association is enhanced when employees also generally have the ability to work from home or schedule work hours differently, better accommodating sleep.

Hypothesis 3b: Control over work schedule will moderate the positive association between within-person FSSB and sleep quality and quantity, such that the association is enhanced under conditions of high control over work schedule.

Work-family climate. We define work-family climate as the shared perceptions that family should not be sacrificed for work performance (Kossek, Colquitt, & Noe, 2001). Drawing on COR theory's primacy of resource loss principle, which suggests that resource loss is more salient than resource gain (Halbesleben et al., 2014), we assume that WTFC would detrimentally impact sleep, especially when an individual resides within what they perceive to be a *favorable* work-family climate. Although somewhat

counterintuitive, this proposition is line with COR theory. That is, experiences of WTFC are less expected within a positive, resource-rich work-family climate for employees, and thus, such experiences are likely to be more salient and distressing when they do occur. This distress will in turn be associated with nightly sleep quality. Sleep quantity will also be more affected in that an individual will borrow more time from sleep on days with high levels of WTFC and when they are not used to making family sacrifices for work.

> *Hypothesis 4a:* Perceptions of work-family climate will moderate the negative within-person association between WTFC and sleep quality and quantity, such that the association is enhanced under conditions of a positive work-family climate.

We also propose that perceptions of a positive work-family climate will moderate the association between daily FSSB and sleep quality and quantity. COR theory suggests that the acquisition of resources is easier for those individuals who already possess resources (Hobfoll & Shirom, 2000). As such, an employee is better able to capitalize on the family-specific support they are provided on a given day when they also reside within a work environment that is resource-rich. As a result, employees experience less distress that would impact sleep quality and are better able to manage both work and family time demands that would otherwise cut into sleep time.

> *Hypothesis 4b:* Perceptions of work-family climate will moderate the positive association between within-person FSSB and sleep quality and quantity, such that the association is enhanced under conditions of a positive work-family climate.

Method

The present investigation uses baseline data from the Work, Family, and Health Study (WFHS) to address the importance of workplace practices and policies for work, family, and health outcomes (see Bray et al., 2013; King et al., 2012).

Participants and Procedure

The current research used a sample of employees located in teams within the information technology division of a large Fortune 500 firm. Trained interviewers administered face-to-face computer-assisted personal interviews (CAPI) with employees. Employees completed a 60 minute interview at the worksite. A subset of these employees was eligible for daily diary data collection if they had a child who was between the ages of 9 to 17. If willing, these employees participated in a series of eight nightly telephone interviews. Trained personnel called participants on eight consecutive nights, with calls lasting around 25 minutes on average. Employees were provided with a pre-incentive of $25 for the worksite interview and an additional $100 for completing the eight days of diary surveys.

Within the larger study, 823 employees participated in the baseline CAPI survey data collection. Of these individuals, 148 were parents and were eligible for the current daily diary study. A total of 131 participants provided both 1014 days of diary data and CAPI data. For all analyses, we selected for work days, as work-to-family conflict was only collected on days the employee worked and we wanted to utilize the same sample across all analyses. This provided a final sample of 131 individuals with 803 days of data.

On average, participants (55% male) were 45 years old (*SD* = 6.30) with 2 children (*SD* = 1.07), and 87% were married or cohabitating. Approximately 80% of the

sample was White, 10% Asian Indian, 9% Hispanic, 6% other Asian, 2% Black or African American, and 2% Pacific Islander. Participants worked an average of 46 hours per week (*SD* = 5.84).

Measures

Daily WTFC. Daily work-to-family conflict was measured on the subsequent nights of the daily diary data collection using a five-item scale adapted from Netemeyer, Boles, and McMurrian (1996). Items were rated on a scale of 1 (*not at all*) to 4 (*a lot*). Higher scores indicated greater WTFC. A sample item from the scale reads, "(Since this time yesterday), how much did the demands of your work interfere with your family or personal time?" The person-level reliability estimate was .86, while the day-level reliability estimate was .75.

Daily FSSB. Daily family-supportive supervisor behavior was measured on the eight subsequent nights using the following item, "How supportive was your supervisor about work and family issues?" The item was rated on a scale of 1 (*not supportive at all*) to 7 (*very supportive*). Higher scores indicated greater FSSB.

Daily sleep quality. Daily sleep quality was assessed with two different measures adapted from Buysse et al. (1989). A specific *quality* item read, "How would you rate last night's sleep quality overall?" The item was rated on a scale of 1 (*very badly*) to 4 (*very well*). Higher scores indicated greater sleep quality. A second measure of quality, *sleep onset latency*, read, "How long (in minutes) did it take you to fall asleep?" Higher scores indicated greater sleep onset latencies, or difficulty initiating sleep.

Daily sleep quantity. Daily sleep quantity was assessed with a two-item measure adapted from Buysse et al. (1989). Participants were asked, "What time did you go to bed?" and "What time did you wake up (this morning)?" Sleep duration was then computed as the duration from bed to wake time in hours.

Control over work schedule. Control over work schedule was measured in the CAPI using an eight-item scale adapted from Thomas and Ganster (1995). A sample item was, "How much choice do you have over when you can take off a few hours?" Responses ranged from 1 (*very little*) to 5 (*very much*). Higher scores indicated greater control over work schedule. The reliability estimate for the scale was .82.

Organizational work-family climate. Perceptions of an organizational work-family climate was measured using a three-item scale from Kossek et al. (2001) in the CAPI. A sample item was, "In your workplace, employees are expected to take time away from their family or personal lives to get their work done?" Responses ranged from 1 (*strongly agree*) to 5 (*strongly disagree*), with higher scores indicating a more favorable climate for family. The reliability estimate was .87.

Analytical Strategy

All analyses were conducted using SAS Proc Mixed (Version 9.3). A series of multilevel models, selecting only for work days, were conducted to decompose variances at the between-person level and the within-person level. Individuals' average scores across the subsequent days in the study were centered at the grand mean and entered at Level 2 in order to estimate between-person effects. Within-person effects were estimated by entering daily scores centered at the person-mean at Level 1. Because respondents reported on their previous night's sleep and the current day's WTFC and

FSSB during their nightly interviews, all predictors were lagged by one day so that daily WTFC and FSSB predicted nightly sleep. An example equation (within-person WTFC predicting sleep quality) follows:

$$Sleep\ Quality_{di} = \beta_{0i} + \beta_{1i}(WP\ WTFC)_{di} + e_{di}$$

$$\beta_{0i} = \gamma_{00} + \gamma_{01}(BP\ WTFC)_i + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \mu_{1i}$$

Level 2 contextual structural resources were included in the analyses to estimate cross-level interactions. An example equation (moderating effect of BP control over work schedule on the relationship between within-person WTFC and sleep quality) follows:

$$Sleep\ Quality_{di} = \beta_{0i} + \beta_{1i}(WP\ WTFC)_{di} + e_{di}$$

$$\beta_{0i} = \gamma_{00} + \gamma_{01}(BP\ WTFC)_i + \gamma_{02}(BP\ Sched.Control)_i + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}(BP\ Schedule\ Control)_i + \mu_{1i}$$

All analyses were first conducted estimating both a random intercept and random slope. Due to convergence issues, the final analyses only estimated the intercepts as random. Analyses were also first conducted controlling for day of study. Because the model results did not change with and without this control variable, we report on the models without day of study for parsimony.

Results

Descriptive statistics and correlations can be found in Table 3.1. Intra-class correlations (ICCs) ranged between .25 and .68, indicating both between-person and within-person (across days) variations, thereby supporting the need for multilevel analyses. On average, participants slept 7.11 hours per night and reported a mean sleep

quality score of $M = 3.05$. Furthermore, it took participants 18 minutes to fall asleep on average.

WTFC and FSSB as Predictors of Sleep

We hypothesized that daily WTFC and FSSB would be related to aspects sleep. Our results indicate that WTFC is positively associated with sleep onset latency, an aspect of sleep quality, indicating that it takes an individual more minutes to fall asleep on days when more WTFC is experienced ($\beta = 1.98$, t (494) = 2.09, $p < .05$). However, no within-person effects were found with the other sleep outcomes (i.e., sleep quality, sleep duration). Thus, hypothesis 1 was partially confirmed. In addition, no within-person effects were found for FSSB predicting sleep quality and quantity. Thus, hypothesis 2 was not supported.

Moderating Effects of Contextual Structural Resources

WTFC by contextual structural resource interactions. We hypothesized that control over work schedule and perceptions of work-family climate would moderate the association between WTFC and sleep quality and quantity in hypotheses 3a and 4a. The results of these analyses can be found in Tables 3.2 and 3.3, respectively. No significant interactions were found between daily WTFC and general control over work schedule on any of the sleep quality and sleep quantity outcomes. As such, hypothesis 3a was not supported. As seen in Figure 3.2, however, a significant daily WTFC by perceptions of work-family climate interaction was found on the sleep onset latency outcome ($\beta = 2.85$, t (492) = 3.22, $p < .05$). Furthermore, tests of simple slopes confirmed that the link between WTFC and sleep onset latency was significant under conditions of perceptions of a positive work-family climate ($\beta = 5.91$, t (492) = 3.84, $p < .05$), but not under

conditions of perceptions of negative work-family climate (β = 0.15, t (492) = 0.14, p = 0.89). Thus, hypothesis 4a was partially confirmed.

FSSB by contextual structural resource interactions. We hypothesized that control over work schedule and perceptions of work-family climate would moderate the association between daily FSSB and sleep quality and quantity in hypotheses 3b and 4b. The results of these analyses can be found in Tables 3.4 and 3.5, respectively. As seen in Figure 3.3, a significant within-person FSSB by between-person control over work schedule interaction was found on sleep quality (β = 0.16, t (309) = 2.97, p < .05). Furthermore, tests of simple slopes confirmed that the link between FSSB and sleep duration was significant under conditions of high control over work schedule (β = 0.18, t (309) = 2.77, p < .05), but not under conditions of low control over work schedule (β = -0.06, t (309) = -1.32, p = 0.19). However, no other significant within-person FSSB by between-person control over work schedule interactions were found for the other sleep quality outcome or sleep quantity. Thus, hypothesis 3b was partially confirmed. In addition, no other significant within-person FSSB by between-person perceptions of work-family climate interactions were found for the other sleep quality or sleep quantity outcomes. Thus, hypothesis 4b was not confirmed.[3]

[3] Although it was not hypothesized, we did find a significant between-person FSSB by between-person perceptions of work-family climate interaction on the sleep quality outcome (β = 0.05, t (330) = 2.13, p < .05). Furthermore, tests of simple slopes confirmed that the link between FSSB and sleep quality was significant under conditions of perceptions of high work-family climate (β = 0.11, t (330) = 2.81, p < .05), but not under conditions of perceptions of low work-family climate (β = 0.00, t (330) = -0.02, p = .99).

Discussion

This study investigated whether daily variations in work-family experiences are related to variation in nightly sleep within individuals, across days. We found a significant within-person positive association between WTFC and sleep onset latency, which suggests a daily link between WTFC and sleep quality. Furthermore, the presence of significant workplace contextual structural resources as moderators suggests that work-family experiences influence sleep quality and quantity differentially depending on perceptions of the workplace's relatively stable control over work schedule and perceptions of work-family climate. This research builds on previous studies conducted by work-family scholars such as Berkman et al. (2010) and Crain et al. (2014) by examining whether sleep is a function of daily work-family stressors and daily contextual volatile family-supportive resources. In addition, we found that the more structural workplace environment plays a role in the associations between transient work stressors/resources and sleep.

Our findings indicate that it takes individuals longer to fall asleep on nights following high levels of work conflicting with family. We also found a within-person WTFC by between-person perceptions of work-family climate interaction, which suggests that aspects of sleep quality are impaired by high WTFC, especially when an individual resides in a positive work-family climate where such experiences are less expected. Thus, at the daily level, resource loss is salient and related to sleep despite the availability of resources. Under conditions of an unfavorable work-family climate, there is no such relationship between daily WTFC and sleep onset latency. It may be that employees who perceive unfavorable climates are used to relying on non-work sources of

support (e.g., spouse/partner, friends), resulting in the unfavorable climate being unrelated.

General levels of control over work schedule were found to enhance the positive association between daily FSSB and sleep quality. This interaction suggests that employees are better able to capitalize day to day on family-specific support from supervisors and protect against sleep impairment when they also have the ability to alter their work schedules. The non-significant effect of daily FSSB on sleep quality under conditions of low control over work schedule may reflect that a supervisor's efforts to encourage employees to alter schedules or work from home are not effective if workplace policies are not in place allowing for such flexibility.

In all, no significant relationships were found at the daily level between work-family experiences and sleep quantity. This may suggest that other contextual moderators may be present, besides control over work schedule and perceptions of work-family climate. For example, these relationships may differ depending on characteristics of the non-work domain rather than the workplace (e.g., family demands, commute time).

This pattern of results has several implications. First, because associations and interactions were found at the within-person level, it suggests that daily and average work-family and sleep processes differ. This means that sleep is not likely stable over the course of a week, and between-person studies on the work-family interface are informative, yet insufficient for understanding the temporal dynamics that play out day to day when employee sleep is in question. Second, the differential findings for daily sleep quality and quantity point to the importance of measuring distinct sleep constructs simultaneously in future studies. Third, FSSB is beneficial for sleep, but especially so

when employees reside within a work environment that allows them to capitalize on family-specific support from supervisors. Thus, both supervisor—employee relationships and the more general workplace climate and policies are critical for understanding how employee sleep is affected by work-family experiences.

Limitations and Future Directions

A few limitations relating to methodology must be noted. Although daily diaries were utilized to better understand the day-to-day fluctuations in work-family experiences and sleep, future diary studies would benefit from including both daily self-report and objective actigraphic measurements of sleep data. The organizational and occupational health psychology literature has emphasized the importance of increased utilization of objective measures of health (e.g., Greenhaus, Allen, & Spector, 2006; Hurrell, Nelson, & Simmons, 1998).

Power issues may have played a role in the overall lack of significant effects that were found at the within-person level. Although data were collected from 131 individuals over an eight day diary data collection, we selected only for workdays, given that some of the variables were not collected on non-work days, leaving an average of six days-worth of data. After lagging predictors so that associations between daily experiences and nightly sleep could be examined, our final analyses utilized an average of 5 days-worth of data for each individual. Future diary studies investigating similar relationships should attempt to survey individuals' work-family and sleep experiences over a longer duration (e.g., 30 days) of time and on both work and non-work days. In addition to addressing issues of power, this would also allow for a more thorough understanding of the temporal dynamics among work, family, and sleep.

Our moderation results suggest a few avenues for future research. Given our findings indicating that daily sleep can be negatively impacted while residing in a resource-rich environment, future studies should attempt to uncover additional instances in which resource loss is more salient than resource gain at the daily-level, by accounting for either different health outcomes or contextual work and non-work resources as moderators. Our other moderation finding suggests that resources within the work environment facilitate the beneficial relationship between FSSB and sleep quality and quantity. Future studies should examine how other resources similarly or differentially moderate this relationship. For example, personal resources, such as self-esteem, or conditions, such as status within the company, may play a role in how an individual responds to work-family stress and how sleep is subsequently affected.

Future research could also evaluate the relationships of interest in finer detail. For example, this study did not investigate potential mechanisms explaining the association between WTFC or FSSB and sleep. A closer look into the different dimensions of FSSB and their effects on sleep quality and quantity outcomes is also an avenue for future research. Lastly, because of respondent burden constraints, we were not able to collect data on the family-to-work conflict direction. Future studies should also utilize both directions of the construct in order to better understand differential effects depending on the direction.

Lastly, the extent to which these results would generalize to other samples is a question for future research. All participants from the present study were professional-level employees working in the information technology industry, who also had children in the home. It remains to be known whether the resources examined here, FSSB, control

over work schedule, and perceptions of work-family climate, would play a similar role for employees with other familial responsibilities or single, childless employees. Moreover, the work-family resources examined may be more valued by employees working in low-wage, hourly settings, who may not have access to the same financial resources that these professional-level workers presumably do.

In summary, our findings advocate for the importance of examining work stressors and resources, both structural and volatile, in relation to employees' sleep. Identification of such predictors and moderators is a first step in contributing to sleep promotion and protection, in addition to the more distal prevention of chronic illness. Our study also demonstrates that within-person variation exists among WTFC, FSSB, and sleep, and thus future work-family interventions should include both within- and between-person methodologies. Moreover, such change initiatives should target both individuals' work-family experiences, in addition to aspects of the contextual environment, when aiming to address employee health and well-being. We propose that future studies must adapt this multifaceted, but targeted, intervention approach to employee health and well-being to create sustained change.

Table 3.1

Correlations Among Within-Person and Between-Person Study Variables (N = 131 employees, 803 days)

Variable	*M (SD)*	1	2	3	4	5	6	7	8	9	10
1. Gender	0.45 (0.50)	—									
2. Number of Children	2.11 (1.07)	-0.16***	—								
3. Partner	0.87 (0.34)	-0.25***	0.04	—							
4. WTFC	1.75 (0.85)	0.06	0.02	-0.05	**0.60**	-0.20***			-0.04	-0.03	0.07
5. FSSB	5.82 (1.66)	0.12***	-0.18***	0.00	-0.27***	**0.68**			-0.04	0.02	-0.07
6. Control over work schedule	3.56 (0.75)	-0.09*	0.01	0.01	-0.31***	0.32***	—				
7. Work-Family Climate	2.80 (1.01)	-0.02	0.00	0.07*	-0.44***	0.15***	0.52***	—			
8. Sleep Duration	7.11 (1.27)	0.14***	-0.10**	0.05	-0.12***	0.19***	0.07*	0.10**	**0.41**	0.21***	0.13***
9. Sleep Quality	3.05 (0.66)	0.08*	-0.08*	0.00	-0.09*	0.12**	0.05	0.05	0.21***	**0.25**	-0.23***
10. Sleep Onset Latency	18.36 (16.87)	0.02	0.03	-0.16***	0.07	-0.08*	-0.07*	0.01	0.13***	-0.23***	**0.46**

*Note. * p < .05, ** p < .01, *** p < .001.* Descriptive statistics reported for work days only. Diagonals (bold) show intra-class correlations (ICC = between-person level variance/total variance) of the variable. Within-person correlations are reported above the diagonal and between-person correlations are reported below the diagonal. Gender (0 = Male, 1 = Female); Partner (0 = Single, 1 = Married/Cohabitating). WTFC = Work-to-Family Conflict; FSSB = Family-Supportive Supervisor Behavior.

Table 3.2

Moderating Effect of Control over work schedule on the Association between Work-Family Conflict and Sleep

	Outcome		
	Sleep Quality	Sleep Onset Latency	Sleep Duration
Predictor	Estimate (*SE*)	Estimate (*SE*)	Estimate (*SE*)
Fixed Effects			
Constant	3.04 (0.04)***	17.99 (1.11)***	7.14 (0.09)***
BP WTFC	-0.06 (0.06)	1.49 (1.76)	-0.22 (0.14)
WP WTFC	-0.04 (0.05)	2.34 (1.00)*	-0.13 (0.09)
BP Control over work schedule	-0.00 (0.05)	-0.81 (1.50)	0.04 (0.12)
BP WTFC*BP Control over work schedule	0.08 (0.07)	0.24 (2.16)	-0.08 (0.17)
WP WTFC*BP Control over work schedule	0.01 (0.07)	1.52 (1.32)	-0.02 (0.11)
Random Effects			
Intercept	0.11 (0.02)***	118.97 (18.45)***	0.69 (0.11)***
Residual	0.33 (0.02)***	131.24 (8.33)***	0.96 (0.06)***

Note. Estimate and *SE* reported based on the full model. See note in Table 3.1 for coding.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3.3

Moderating Effect of Perceptions of Work-Family Climate on the Association between Work-Family Conflict and Sleep

	Outcome		
	Sleep Quality	Sleep Onset Latency	Sleep Duration
Predictor	Estimate (*SE*)	Estimate (*SE*)	Estimate (*SE*)
Fixed Effects			
Constant	3.03 (0.04)***	18.67 (1.16)***	7.19 (0.09)***
BP WTFC	-0.08 (0.07)	3.55 (1.88)	-0.12 (0.15)
WP WTFC	-0.03 (0.05)	3.03 (0.99)**	-0.15 (0.09)
BP WF Climate	-0.00 (0.04)	1.25 (1.18)	0.05 (0.09)
BP WTFC*BP WF Climate	0.01 (0.06)	2.50 (1.66)	0.14 (0.13)
WP WTFC*BP WF Climate	0.01 (0.04)	2.85 (0.89)**	-0.05 (0.08)
Random Effects			
Intercept	0.11 (0.02)***	116.74 (18.09)***	0.68 (0.11)***
Residual	0.33 (0.02)***	128.79 (8.18)***	0.96 (0.06)***

Note. Estimate and *SE* reported based on the full model. See note in Table 3.1 for coding.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3.4

Moderating Effect of Control over work schedule on the Association between FSSB and Sleep

	Outcome		
	Sleep Quality	Sleep Onset Latency	Sleep Duration
Predictor	Estimate (*SE*)	Estimate (*SE*)	Estimate (*SE*)
Fixed Effects			
Constant	3.03 (0.04)***	16.40 (1.10)***	7.11 (0.09)***
BP FSSB	0.05 (0.03)	-0.79 (0.79)	0.10 (0.07)
WP FSSB	0.06 (0.04)	-0.68 (0.67)	-0.02 (0.06)
BP Control over work schedule	0.00 (0.06)	-0.19 (1.52)	0.05 (0.12)
BP FSSB*Control over work schedule	0.01 (0.03)	0.71 (0.80)	0.03 (0.07)
WP FSSB*Control over work schedule	0.16 (0.05)**	0.11 (0.92)	0.14 (0.09)
Random Effects			
Intercept	0.08 (0.02)***	99.01 (17.13)***	0.59 (0.12)***
Residual	0.32 (0.03)***	92.28 (7.38)***	0.88 (0.07)***

Note. Estimate and *SE* reported based on the full model. See note in Table 1 for coding.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3.5

Moderating Effect of Perceptions of Work-Family Climate on the Association between FSSB and Sleep

	Outcome		
	Sleep Quality	Sleep Onset Latency	Sleep Duration
Predictor	Estimate (*SE*)	Estimate (*SE*)	Estimate (*SE*)
Fixed Effects			
Constant	3.02 (0.04)***	16.82 (1.06)***	7.11 (0.09)***
BP FSSB	0.05 (0.03)	-1.21 (0.72)	0.09 (0.06)
WP FSSB	0.03 (0.04)	-0.80 (0.63)	-0.06 (0.06)
BP WF Climate	0.01 (0.04)	1.19 (1.10)	0.12 (0.09)
BP FSSB*WF Climate	0.05 (0.03)*	-0.37 (0.67)	0.05 (0.06)
WP FSSB*WF Climate	0.03 (0.03)	-0.52 (0.54)	0.02 (0.05)
Random Effects			
Intercept	0.07 (0.02)***	96.84 (16.93)***	0.57 (0.12)***
Residual	0.32 (0.03)***	92.30 (7.40)***	0.88 (0.07)***

Note. Estimate and *SE* reported based on the full model. See note in Table 3.1 for coding.
* $p < .05$. ** $p < .01$. *** $p < .001$.

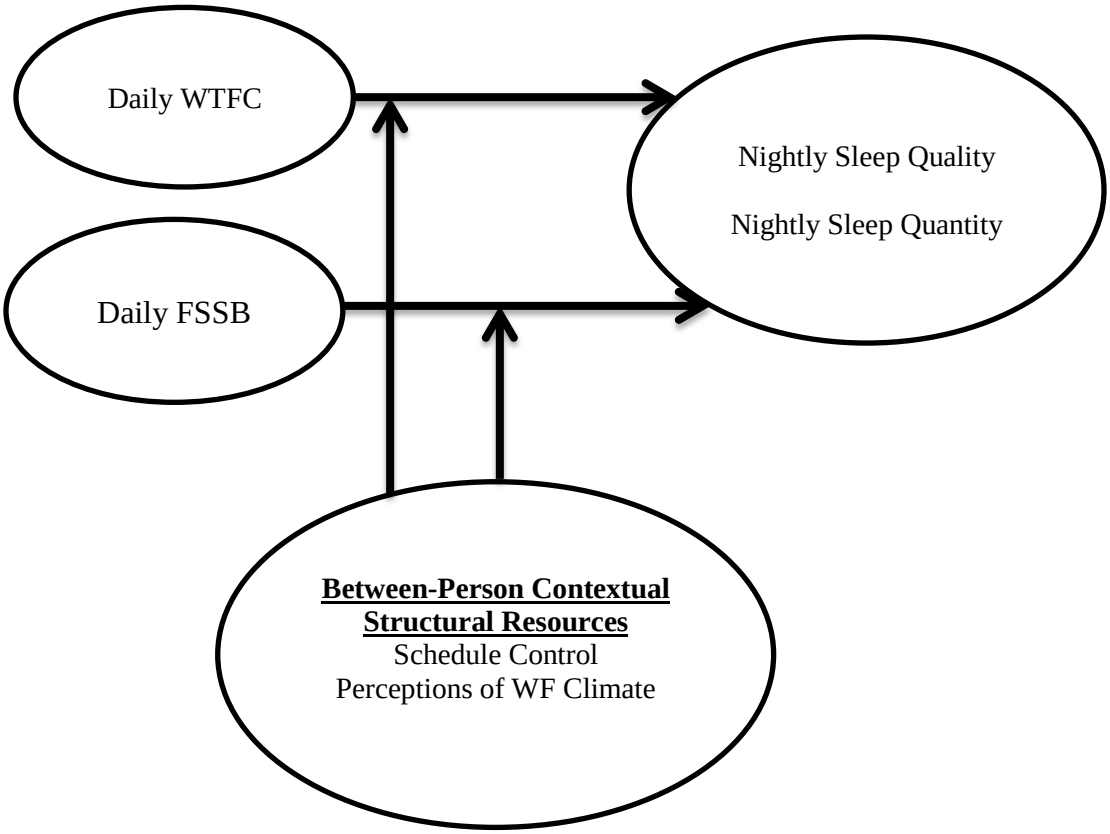

Figure 3.1. Theoretical model.

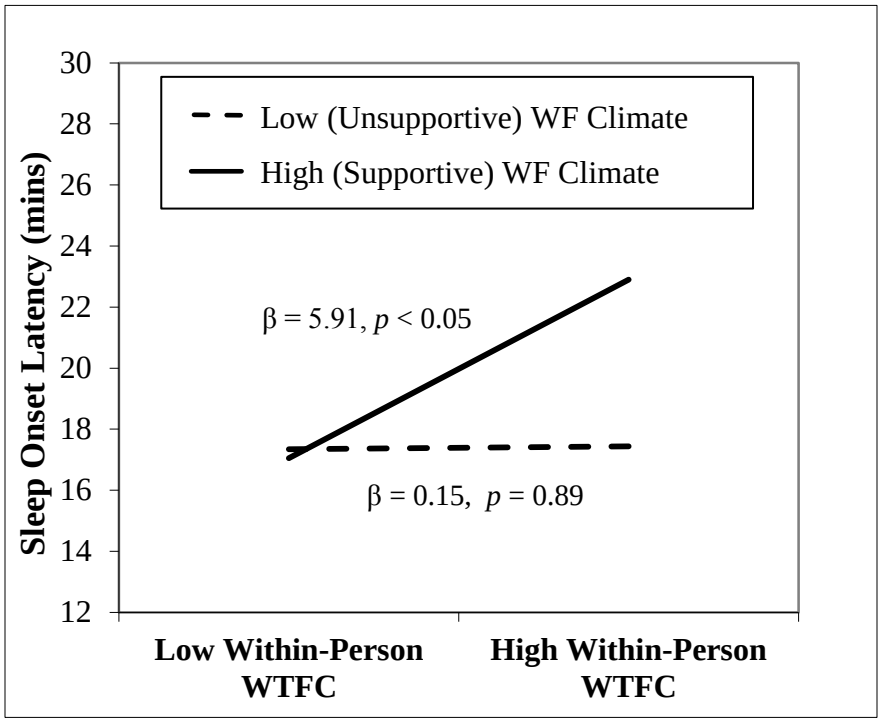

Figure 3.2. Moderating effect of between-person perceptions of work-family climate on the within-person WTFC—sleep onset latency relationship.

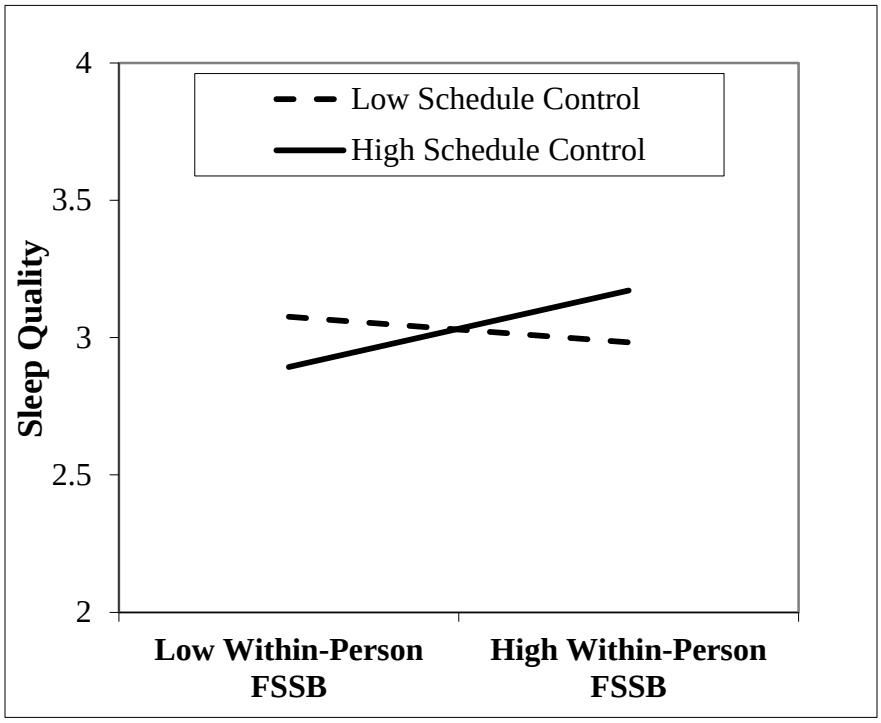

Figure 3.3. Moderating effect of between-person control over work schedule on the within-person FSSB—sleep quality relationship.

Chapter 4: Longitudinal Effects of a Work-Family Intervention on 18-month Sleep Outcomes: Results from the Randomized Controlled Work, Family and Health Study

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Abstract

Few studies have examined the effect of workplace initiatives on employee sleep outcomes. However, a recent exception includes Olson et al.'s (2015) evaluation of a work-family intervention on 12-month follow-up sleep outcomes. We extend Olson et al.'s work by examining whether these effects are maintained at the 18-month follow-up, while also investigating additional mechanisms of the intervention's effect. Thus, in the present study, a work-family intervention, designed to increase employee control over work schedule and family-supportive supervisor behaviors (FSSB), is hypothesized to increase both self-report and objective measures of sleep quality and sleep quantity at 18-months post-intervention in a sample of information technology workers. Additionally, 6-month control over work schedule and FSSB, in addition to 12-month work-family conflict and family time adequacy are proposed to mediate the intervention's effect on sleep outcomes. Results indicate that actigraphic total sleep time and self-reported sleep insufficiency were improved for individuals in the intervention group at the 18-month follow-up relative to individuals in the usual practice group. Furthermore, a significant indirect effect was found for the effect of the intervention on actigraphic total sleep time through 6-month control over work schedule and subsequent 12-month family time adequacy.

Keywords: intervention, sleep, conservation of resources theory, control over work schedule, family time adequacy

Longitudinal Effects of a Work-Family Intervention on 18-month Sleep Outcomes: Results from the Randomized Controlled Work, Family and Health Study

Although a vast biomedical sleep literature advocates for the importance of improving individuals' sleep quality and quantity (e.g., Luyster, Strollo, Zee, & Walsh, 2012), organizational scholars have only recently begun to draw on this literature and investigate how work-life factors may influence such outcomes. These efforts are critical, given that insufficient and inadequate sleep act as mechanisms in the development of disease and disability. Accordingly, in their 2011 National Sleep Disorders Research Plan, the National Institutes of Health has specifically called for future research to improve prevention of chronic sleep deficiency.

One way to prevent sleep deficiency is by decreasing work and family strain through organizational change interventions (Olson et al., 2015). Sleep scholars have identified work as the major waking activity that is exchanged for sleep time and have furthermore called for future interventions aimed at the organizational level that could influence sleep (e.g., Basner, Spaeth, & Dinges, 2014; Hale, 2014). However, few studies in general have targeted workplace characteristics in an attempt to improve sleep. A recent review of the literature identified only three quality intervention studies that aimed to benefit participant sleep, through the improvement of workplace characteristics, in addition to only 16 other studies that evaluated longitudinal relationships between workplace characteristics and sleep (Van Laethem, Beckers, Kompier, Dijksterhuis, & Geurts, 2013). Only one of the intervention studies mentioned here specifically targeted work-family strain as a key lever for improving sleep (Moen, Kelly, Tranby, & Huang, 2011), although multiple studies have found a relationship between work-family conflict

and sleep outcomes (e.g., Crain et al., 2014, Jacobsen et al., 2014; Lallukka, Rahkonen, Lahelma, & Arber, 2010).

Given that work-family interventions may hold promise in addressing sleep deficiency, the rigor of such programs is of interest. Notably, work-family scholars have argued that a lack of experimental designs have resulted in an inability to draw conclusions about the effectiveness of work-family policies and initiatives (e.g., Kelly et al., 2008). A review conducted by Hammer, Demsky, Kossek, and Bray (in press) indicates that very few work-family intervention studies are conducted as true experiments. These authors call for future longitudinal research on work-family initiatives, which utilize randomization and controls. Moreover, few studies have examined the processes by which interventions improve health (King et al., 2012). Understanding the mechanisms by which sleep is impacted as a result of work-family intervention targets is critical for the design and implementation of future interventions and the prevention of sleep deficiency that results in relation to work-life.

A few studies to date have rigorously tested work-family interventions, addressing the abovementioned concerns. Formative work conducted by Hammer, Kossek, Anger, Bodner, and Zimmerman (2011) involved a supervisor training and behavior tracking exercise to improve family-supportive supervisor behaviors (FSSB) within a sample of grocery store supervisors. Findings indicated that when employees experienced high levels of work-family conflict, the intervention had beneficial effects on employee job satisfaction, turnover intentions, and physical health, through employee perceptions of FSSB, at the 1 month follow-up. Another intervention utilized a quasi-experimental design to improve control over work schedule in a sample of professional

level workers (Moen, Kelly, Tranby, & Huang, 2011). Results indicated that the intervention improved health behaviors over a six month period, including sleep time and exercise, in addition to increasing the odds that an individual would not go to work when sick and would visit a doctor, if needed. Control over work schedule and negative work-home spillover were also found to be mediators of these effects. This same intervention focused on improving flexibility was found to increase the likelihood that an individual would quit smoking, smoke less often, and have more time for healthy meals (Moen, Fan, & Kelly, 2014). More recently, the Work, Family, & Health Study (WFHS; Bray et al., 2013; King et al., 2012) tested an intervention that builds off of the work conducted by Hammer et al. (2011) and Moen et al. (2011; 2013) by targeting both FSSB and control over work schedule within a randomized controlled trial design. This intervention has been shown to improve FSSB, control over work schedule, work-family conflict, and family time adequacy, at the 6-month post-intervention follow-up (Kelly et al., 2014). In combination, results from these initial studies suggest that interventions targeting FSSB and control over work schedule are likely to have a beneficial impact on a variety of work-family and health outcomes.

Although Moen et al. (2011; 2013) investigated intervention effects on aspects of sleep, their initiative did not target FSSB and only examined self-reported sleep outcomes at 6-months post-intervention. Of special relevance to the current work, a second study conducted by Olson et al. (2015) also utilized the WFHS's intervention, but examined effects on multiple aspects of both self-reported and objective sleep, more specifically, within a sample of information technology workers. They found that the intervention increased employee objectively-measured total sleep time and increased self-reported

sleep insufficiency at the 12-month post-intervention follow-up. Furthermore, the intervention affected sleep insufficiency at 12-months via reductions in 6-month control over work schedule and subsequently work-to-family conflict (WTFC). Although an important study for the work-family and sleep literatures, Olson et al.'s work is not without limitations. First, it remains to be known whether such intervention effects on sleep are maintained after the 12-month follow-up. Second, Olson et al. found evidence of partial mediation through control over work schedule and WTFC, suggesting that other constructs may act as mechanisms of the intervention effect on sleep outcomes. Lastly, their study conceptualized control over work schedule as a more proximal mediator to WTFC, but both variables were measured at the same time point, 6-months post-intervention.

The current study, therefore, builds on this previous work and evaluates the same WFHS's intervention effects on objective and self-reported sleep outcomes at 18-months post-intervention, in order to determine whether such effects are maintained over 6 additional months. Mediators besides 6-month control over work schedule and WTFC (i.e., 6-month FSSB, 12-month WTFC, and 12-month family time adequacy) are also evaluated in relation to these outcomes. In this way, we add to Olson et al.'s findings by evaluating sleep outcomes at a later time point, assessing FSSB and family time adequacy as additional mediators, and distinguishing between proximal mediators at 6-months (i.e., FSSB and control over work schedule) and distal mediators at 12-months (i.e., WTFC and family time adequacy) within a larger process model. The proposed theoretical model can be seen in Figure 4.1. We expect that this work-family intervention will impact 18-month sleep outcomes through employee perceptions of control over work

schedule and FSSB at 6-months, and subsequently WTFC and family time adequacy at 12-months.

Increasing Resources through STAR

The work-family intervention described in this study is referred to as STAR ("Support. Transform. Achieve. Results"; Kossek, Hammer, Kelly, & Moen, 2014). This initiative was focused on improving the resources of employee control over work schedule and supervisor support for family in order to decrease employee perceptions of work-family conflict. In turn, the intervention was hypothesized to lead to long-term benefits for organizations, employees, and their families. We examine sleep as one such employee outcome in relation to STAR.

The present study utilizes Conservation of Resources (COR; Hobfoll, 1989) Theory to provide a rationale for proposing that the intervention in question would influence workplace mediators and subsequent sleep outcomes. Hobfoll's (1989) COR framework posits that strain results from resource loss, the threat of resource loss, or a lack of resource replenishment after resource investment. As the focal construct of the theory, resources refer to those conditions (e.g., valued work role), objects (e.g., home), personal resources (e.g., self-esteem, mastery), and energies (e.g., time, money) which the individual values and strives to obtain, maintain, and protect. Hobfoll and Shirom (2000) have suggested that work-family stressors deplete resources, while resources act as protective factors within this process. Furthermore, those individuals with greater resources are less vulnerable to resource loss and more likely to experience resource gain. Individuals must use their available resources in order to offset resource loss, protect resources, and gain new resources. We focus specifically on the resources of control over

work schedule and FSSB. Within Hobfoll's framework, these can be classified as condition resources. For example, if an individual has more control over their work schedule, they are likely better able to adjust working times to accommodate family or other personal demands. This in turn should allow an individual to better maintain and acquire new resources, such as a valued family role, work role, financial resources, or even personal resources, like self-esteem.

Sleep as a health outcome. Although various measures of sleep exist, sleep has generally been classified in the literature as two distinct constructs*: sleep quality* and *sleep quantity* (e.g., Barnes, 2012). Sleep quantity typically refers to the amount of time an individual maintains a sleeping state, while sleep quality refers to a general evaluation of the sufficiency of sleep, in addition to difficulty initiating or maintaining sleep after onset (e.g., Harvey, Stinson, Whitaker, Moskovitz, & Virk, 2008). Van Dongen and Dinges (2005) have noted that both of these constructs are distinct from fatigue, an outcome of insufficient or inadequate sleep, and sleepiness, a subjective report of one's desire to sleep.

Thus far, sleep quality and quantity have been incorporated into organizational research as both antecedents and outcomes of workplace experiences. For example, sleep quality and quantity have been examined as predictors of unethical behavior in the workplace (e.g., Barnes, Schaubroeck, Huth, & Ghumman, 2011; Wagner, Barnes, Lim & Ferris, 2012), organizational citizenship behavior (Barnes, Ghumman, & Scott, 2013), sickness absence (e.g., Lallukka, Haaramo, Rahkonen, & Sivertsen, 2013), workplace accidents (e.g., Uehli et al., 2014), and performance (e.g., Philibert, 2005). Therefore, organizational and management scholars have noted the importance of evaluating sleep,

as it's a key factor for individual and organizational success and health and should be targeted by future interventions (e.g., Barnes, 2012).

As previously mentioned, few studies have examined how workplace interventions can positively impact sleep. The first of these intervention studies found that by increasing employees' control over their working time, employees attained almost an hour extra of self-reported sleep on nights before work (Moen, Kelly, Tranby, & Huang, 2011). In contrast, Bourbonnais (2006) implemented an intervention targeting unfavorable psychosocial work factors (i.e., psychological demands, decision latitude, social support, and effort-reward imbalance), but did not find significant effects on self-report sleep outcomes at the 12-month follow-up. Wahlstedt and Edling (1997) attempted to increase decision latitude, social support, contacts between management and staff, improve the shift system, and potentially obtain meals on-site in their workplace intervention. The authors found that a significant increase in skill discretion and authority over decisions negatively correlated with perceived sleep difficulties, while increased reported contact with teammates and supervisors also negatively correlated with sleep difficulties.

We argue that by focusing specifically on FSSB and control over work schedule, the present intervention is likely to improve both sleep quality and sleep quantity. The resources provided by STAR should decrease employee strain that impacts sleep quality, in addition to providing employees with addition time resources that are needed to obtain adequate sleep durations. Because Olson et al. (2015) have shown that STAR influences sleep at the 12-month post-intervention follow-up, we propose similar effects at 18-months. By understanding whether the intervention is effective at both post-training time

points, we provide a comprehensive evaluation of the efficacy of the intervention's effect on sleep outcomes. Such information is important in understanding the sustainability of intervention effects on this particular health outcome. Thus, the following is hypothesized:

Hypothesis 1: STAR will increase sleep quality and sleep quantity at the 18-month follow-up data collection.

Mediators of STAR effects on sleep outcomes. King et al. (2012) proposed a theoretical model for the WFHS based on results from pilot studies and an interdisciplinary literature review. Their model suggests that the intervention in question seeks to provide employees with the additional resources of control over work schedule and FSSB, which in turn are proposed to decrease work-family stress and ultimately improve sleep. Because Olson et al. (2015) have found evidence for 6-month control over work schedule and WTFC mediating the effect of the intervention on sleep outcomes, we investigate other potential mediators while also evaluating both proximal and distal mediators at separate time points. Thus, we introduce and discuss control over work schedule and FSSB as proximal mediators and WTFC and family time adequacy as distal mediators below. Proximal mediators are those workplace experiences that were directly targeted by the intervention and proposed to influence later outcomes within the nonwork domain, such as experiences of work conflicting with family and experiences of family time adequacy.

Control over work schedule as a resource and proximal mediator. Ganster and Fusilier (1989) have defined control over work schedule as an individual's belief that they have ability to exert influence over the environment through direct or indirect

means, thereby leading to the perception that the environment is less threatening. In line with Kelly and Moen (2007), our conceptualization of control is specifically concerning one's control over *when* and *where* they conduct their work. Kelly and Moen put forward a conceptual model of control over work schedule, work-family conflict, and health outcomes, and suggest that perceived control over work schedule influences enacted control over work schedule, which in turn results in work-family conflict and subsequent work, health, and well-being outcomes. Thomas and Ganster (1995) determined that inflexible work hours would lead to work-family conflict, as well. Their study found that control was negatively related to work-family conflict, which in turn influenced health outcomes such as depression and cholesterol levels.

Control over work schedule is likely to act as a resource that subsequently improves sleep by providing employees with more flexibility to determine when and where they work. With greater control over how one spends their day, employees will perceive the environment to be less threatening, experience less strain, and consequently experience better sleep quality. Additionally, with increased control over work schedule, employees are more likely to find enough time to attend to family demands, thereby leaving more time for sleep and less motivation to borrow time from sleep in order to meet family demands.

FSSB as a resource and proximal mediator. Thomas and Ganster (1995) have suggested that family-supportive supervisors empathize with an employee's efforts to seek balance between work and family domains and similarly understand their desire to adequately fulfill both sets of roles. Hammer, Kossek, Yragui, Bodner, and Hanson (2009) propose that FSSB is a multidimensional superordinate construct, which consists

of family-specific emotional support, instrumental support, role modeling behavior, and attempts at creative work-family management practices. Recent research shows that FSSB reduces work-family conflict, over and above general supervisor support (Kossek, Pichler, Hammer, & Bodner, 2011).

Previous research gives evidence for the direct effect of supportive supervisors on sleep (e.g., Berkman et al., 2010; Crain et al., 2014). Supervisors who are supportive provide resources necessary to manage both work and family demands. This in turn should allow for employees to experience better sleep quality because the environment is less threatening. In addition, employees who are able to manage work and family demands are more likely to find adequate amounts of time to obtain sufficient sleep durations. However, research to date has not examined these mechanisms of the FSSB-sleep link.

WTFC as a distal mediator. WFC has been defined as a form of inter-role tension where the demands of the work role are incompatible with the demands of the non-work role (Greenhaus & Beutell, 1985). While this conflict can occur bi-directionally, from work to family or from family to work, previous research suggests these directions are positively and reciprocally related (Frone, Russell, & Cooper, 1992). Other meta-analytic provides evidence for discriminant validity between these two constructs (Mesmer-Magnus & Viswesvaran, 2005). We focus on the work-to-family direction of this construct, given our theoretical model examines how resources in the workplace can positively influence family experiences, which are typically situated within the non-work domain alongside sleep.

Previous studies have found a cross-sectional relationship between work-family conflict and sleep-related constructs, including aspects of sleep quality (Crain et al., 2014; Lallukka et al. (2010); Nylen, Melin, & Laflamme, 2007; Sekine et al., 2006) and quantity (Crain et al., 2014). Other longitudinal studies indicate that decreases in WTFC are associated with increases in perceptions of adequate time for healthy sleep (Moen, Fan, & Kelly, 2013). Moreover, reductions in WTFC have resulted in longer sleep durations for individuals within intervention contexts (Moen et al., 2011). Drawing on COR theory, we suggest that experiences of resource gain in the workplace related to both control over work schedule and FSSB, should in turn decrease experiences of WTFC. In turn, less strain and more time to accommodate family should consequently improve aspects of sleep quality and quantity, respectively.

Family time adequacy as a distal mediator. According to Van Horn, Bellis, and Snyder (2001), time adequacy refers to an individual's evaluation of their available time resources that can be allotted to family members, including children, parents, and spouses. Previous research has found a positive association between FSSB and family time adequacy (Hammer, Kossek, Bodner, & Crain, 2013). To our knowledge, there are no studies that have linked family time adequacy with sleep outcomes. However, Barnes, Wagner, and Ghumman (2012) have found that time is borrowed from sleep in order to manage work and family responsibilities. We propose that with greater perceived time resources for family, employees are less likely to experience strain that could ultimately impact sleep quality. Additionally, with increased family time adequacy, employees are less likely to need to borrow time from sleep in order care for family members.

Given COR's propositions and this previous research, we hypothesize that the intervention is likely to lead to increased resources at 6-months-post intervention in the form of control over work schedule and FSSB. In turn, this is likely to promote sleep quality and quantity at the 18-month follow-up by decreasing experiences of 12-month WTFC and increasing perceptions of family time adequacy.

Hypothesis 2: The intervention will improve 18-month sleep quality and quantity through 6-month control over work schedule and FSSB and subsequently 12-month WTFC and family time adequacy.

Methods

Participants and Procedures

The present investigation uses baseline, 6-month, 12-month, and 18-month data from the WFHS, as previously mentioned. The current research made use of a sample of employees located in teams within the information technology division of a large Fortune 500 telecommunications firm. The WFHS refers to this organization by the pseudonym TOMO. To be eligible for the study, individuals had to be non-contract employees and be located in one of the two cities where data collection took place. Table 4.1 shows the means and standard deviations of key participant characteristics across both conditions.

Following baseline data collection, the intervention was implemented and was communicated to be a company-sponsored pilot program. In collaboration with company representatives, the researchers identified 56 study groups, each comprised either of individuals who reported to the same manager or multiple teams of individuals who worked collaboratively on common projects. An adaptive random assignment approach (Frane, 1998) was then used to assign study groups to either the usual practice or

intervention condition (see Bray et al., 2013 for a detailed description of this methodology). The usual practice and intervention conditions were balanced on job function, vice president, and number of employees in each of the two geographic regions home to the worksites.

Overview of the STAR Intervention

The particular intervention that was employed in the context of this study, STAR (Kossek, Hammer, Kelly, & Moen, 2014), was comprised of two components: 1) supervisor training and behavior tracking aimed at increasing supervisor support for employees' family and non-work lives, which was adapted from Hammer et al. (2011), and 2) training sessions with supervisors and employees that were participatory in nature and were aimed at identifying new work practices and processes that would increase employees' control over work schedule, thereby shifting the performance focus to results rather than face time, adapted from Moen et al. (2011; 2013). These two intervention components were adapted and customized for the information technology industry and the WFHS with a standardized formative data collection, taking place over the course of a year, from September 2008 to May of 2009. Data was collected using job shadowing, interviews with managers, and focus groups with employees. Researchers involved also used notes from meetings with community partners to inform the customization. Data collection was conducted with individuals from the participating organization, but primarily with individuals located outside of the locations used for the larger study.

Based on the formative data collection, the final integrated STAR intervention was conducted in two industries. For the purposes of this paper, we focus solely on the TOMO sample across the four waves of data. Managers within the intervention condition

attended a facilitated training session, which introduced them to STAR, and was followed by a self-guided, hour-long computer-based training. The training provided managers with information on the importance of decreasing employees' work-family conflict and increasing supervisor support for non-work life, in addition to explanations of why such efforts would be beneficial for employees and the organization alike. Specific examples of how managers could engage in such support were also included in the training. Managers were then asked to set goals for exhibiting support to employees and were asked to carry an iPod Touch device over the coming week, which was equipped with an alarm reminding the manager to log their supportive behaviors. Managers were provided with personalized feedback on their behaviors and an account of whether or not they had met their goals. A second self-monitoring task took place a month after the first. Lastly, managers participated in a facilitated training session at the end of the STAR initiative that allowed them to share their successes and to ask questions of the facilitators and other managers.

In addition to the manager training sessions and behavior tracking, employees and managers were also invited to attend participatory training sessions. Two different types of sessions were held: those for supervisors only and those for supervisors and employees jointly. In both sets of sessions, facilitators from CultureRx, an organizational development company, delivered face-to-face sessions. In the supervisor only sessions, the facilitators introduced participants to the intervention and provided instruction on support for employees' family demands and employees having control over their work. Within the supervisor and employee sessions, facilitators provided background on the intervention, led discussions around current workplace practices and policies, in addition

to discussions around novel ways of working that could increase employee control over work schedule and support for others' personal lives. Additional information on the STAR intervention and all downloadable intervention materials can be found online (www.WorkFamilyHealthNetwork.org).

Data Collection

Data collections took place within the workplace on paid company time. At each of the four waves of data collection, trained field interviewers administered face-to-face computer-assisted personal interviews (CAPI) with employees, obtaining demographic, workplace, family, and health information, including self-report sleep data. These interviews lasted 60 minutes at the worksite and all employees were compensated with a $20 incentive per wave.

Immediately following the CAPI, interviewers introduced the actigraphy data collection process in order to collect objective sleep data. Participation resulted in an additional $20 incentive per wave. If the participant agreed, the interviewer instructed them to wear a sleep monitor (Spectrum, Respironics/Philips, Murrysville, PA) on their non-dominant wrist at all times for the next week except in situations where the watch could be damaged (e.g., excessive impact, extreme temperatures).

Measures

In the following sections, we describe the organizational, family, and sleep measures used in the current study. Mean imputation was utilized for all scales with four or more items, when at least 75% of the data were present. Otherwise, listwise deletion was employed to construct scale scores. There was very little missing data across the items within a scale for the sample, ranging from 1-8%.

Control over work schedule. Control over work schedule assessed the degree to which employees perceive they have control over their work time using an eight-item scale based on Thomas and Ganster's (1995) measure. A sample question is "How much choice do you have over when you begin and end each workday?" with responses ranging from 1 (*Very little*) to 5 (*Very much*) (Baseline $\alpha = .79$, 6-month $\alpha = .82$).

Family-supportive supervisor behavior. Family supportive supervisor behavior (FSSB) was assessed as employee perceptions of supervisors' behavioral support for family and personal life. We used Hammer and colleagues' four-item short form measure (Hammer et al., 2013). Responses range from 1 (*Strongly disagree*) to 5 (*Strongly agree*), and a sample item is "Your supervisor works effectively with employees to creatively solve conflicts between work and non-work" (Baseline $\alpha = .88$, 6-month $\alpha = .88$).

Work-family conflict. Work-to-family conflict, reflecting the degree to which work role responsibilities are incompatible with family role responsibilities, was assessed using a five item scale developed and validated by Netemeyer, Boles, and McMurrian (1996). A sample item is "Due to your work-related duties, you have to make changes to your plans for family or personal activities." Item responses ranged from 1 (*Strongly disagree*) to 5 (*Strongly agree*) (Baseline $\alpha = .91$, 12-month $\alpha = .91$).

Family time adequacy. Family time adequacy assessed employees' perceptions of available time resources for family members, including children, spouses, and parents (Van Horn et al., 2001). A sample item is "To what extent is there enough time to be with your children?" and response options ranged from 1 (*Never*) to 5 (*All of the Time*), with higher values representing more time resources for family.

Objective sleep quality and quantity. Actigraphy represents a reliable and valid objective measure of sleep not used for the diagnosis of sleep disorders (Ancoli-Israel et al., 2003; Marino et al., 2013). Sleep monitor actigraphs are wrist-watch size devices that contain an accelerometer, continuously measuring movement as a proxy for waking activity (Ancoli-Israel et al., 2003; Barnes, 2012). In line with Crain et al. (2014) and Olson et al. (2015), a recording was scored as invalid if there was a device malfunction and constant false activity was seen in the recording or if the actigraphy data could not be retrieved from the device. Specific days within the recording could also be labeled as invalid if a watch error occurred, such as a failing battery, or if the participant did not comply with the study's actigraphic procedures (i.e., greater than 4 hr of actiwatch off-wrist time throughout the day, or an off-wrist period greater than 60 min within 10 min of the determined beginning or end of the main time in bed period for that day). Participants' actigraphy records were only included in the analysis if they had three or more valid days of actigraphy data, suggested by Olson et al. (2015) to be a reliable number of days.

Actigraphic WASO. Actigraphic *WASO* refers to the average amount of time spent awake per sleeping period, as evidenced by actigraphically-measured wrist movement patterns. Previous research validating actigraphy against polysomnography, the gold standard of sleep measurement involving surface electrodes, indicates that actigraphy estimates have high accuracy (Marino et al., 2013). However, although WASO estimates are unbiased when wake is less than 30 minutes during the night, this same validation study also showed that actigraphy tends to overestimate WASO if true

wake during the night is greater than 30 minutes. We note this limitation of actigraphy here, as it is specific to the measurement of WASO.

In this study, the initial WASO measurement was the total number of epochs determined to be wake multiplied by the set epoch length. The initial value for WASO was further modified to account for the total number of valid days, in order to obtain a more accurate WASO value. Thus, WASO was computed as the average amount of time spent waking during nightly sleep in minutes, with the total amount of time scored as wake being divided by the total number of valid days. For more detailed accounts of our validated actigraphy scoring procedure, please see Marino et al. (2013).

Actigraphic total sleep time. Actigraphic total sleep time, or objectively-measured quantity, can be derived from actigraphic periods of less frequent movement, indicating sleep, throughout a 24 hour period. As previously mentioned, actigraphy has been validated against polysomnography. Marino et al. (2013) found that a particular strength of actigraphy is that it has high sensitivity, or an ability to correctly assign epochs of sleep time.

In the current study, the initial total sleep time measurement was the total number of epochs determined to be sleep multiplied by the set epoch length. These initial values for total sleep time were further modified to account for the total number of valid days. Actigraphic total sleep time was computed as the average amount of sleep attained per day in minutes (including naps). Thus, the total amount of time scored as sleep over the course of the study was divided by the total number of valid days. As previously mentioned, for a more thorough description of our validated actigraphy scoring procedure, please see Marino et al. (2013).

Self-reported sleep quality and quantity. In addition to objective measures of sleep, two measures of sleep quality were assessed: sleep insufficiency and insomnia symptoms.

Self-reported sleep insufficiency. Sleep insufficiency, a measure of sleep quality, was measured using one item (Buxton et al., 2009; Buxton et al., 2012; Centers for Disease Control, 2011). As a measure of sleep insufficiency, participants were asked, "How often during the past four weeks did you get enough sleep to feel rested upon waking up?" Items were rated on a scale from 1 (*never*) to 5 (*very often*). After reverse scoring, higher scores indicated greater sleep insufficiency.

Self-reported insomnia symptoms. Insomnia symptoms, a measure of sleep quality, were measured using two items from the PSQI (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). As a measure of insomnia symptoms, participants were asked, "During the past four weeks, how often could you not get to sleep within 30 minutes?" and "During the past four weeks, how often did you wake up in the middle of the night or early morning?" Items were rated on a scale from 1 (*never*) to 4 (*three or more times a week*), with higher scores indicating more frequent insomnia symptoms. The two scores were then averaged for an overall insomnia symptoms score.

Analytic Strategy

Intervention effect analyses with sleep outcomes were conducted in SAS Proc Mixed (Version 9.3) with restricted maximum likelihood estimation, using a three-level general linear mixed model approach for cluster-randomized designs (Donner & Klar, 2004; Murray, Varnell, & Blitstein, 2004; Varnell, Murray, Janega, & Blitstein, 2004). All analyses were conducted within an intent-to-treat framework. Within these three-

level models, time waves (Baseline, 12-month follow-up, 18-month follow-up) were nested within participants and participants nested within the workgroups. ICCs at the workgroup level ranged from 0 to .05, while ICCs at the individual level ranged from .54-.67, depending on the outcome. The statistical model used (as seen in Table 4.4) is analogous to a general linear mixed model parameterization of a 2 by 3 ANOVA with workgroup-level random effects. In this conceptualization, condition (i.e., intervention versus usual practice) is crossed with time (i.e., baseline, 12-months, 18-months). Thus, the six condition by time means can be derived from the fixed effect model parameters that are shown in Table 4.2. The model's parameterization included treating time wave as a categorical variable, such that the 12-month follow-up was contrasted with baseline and the 18-month follow-up was contrasted with baseline. The outcomes (sleep insufficiency, insomnia symptoms, WASO, and total sleep time) were regressed on the treatment indicator, the follow-up wave indicators, and the treatment-by-wave interaction terms. In these models, the primary parameters of interest are the interactions between follow-up time waves and the treatment indicator, which represent the differential mean change in an outcome across time and intervention conditions (i.e., the treatment effect). A significant treatment by wave interaction for each of the four sleep outcomes would confirm hypothesis 1, or that sleep quality and quantity would be improved at the 18-month time point.

To test hypothesis 2, or that the intervention would improve 18-month sleep quality and quantity through 6-month control over work schedule and FSSB and subsequently 12-month work-to-family conflict and family time adequacy, difference scores were first computed for 6- and 12-month mediators (i.e., 6-month minus baseline

scores, 12-month minus baseline scores). Next, multilevel structural equation modeling techniques were then employed using Mplus (Version 6.0) in order to evaluate the intervention's effect on 18-month outcome difference scores through 6 and 12-month mediator difference scores. A fully-saturated model was specified with all study variables included. Hypothesis 2 would be confirmed if significant conditional indirect effects were found for the pathway from intervention to sleep outcomes through the 6- and 12-month mediators.

All analyses conducted for testing both intervention effects and mediation controlled for the number of employees used for randomization and the core function, a variable identifying groups where most individuals were involved with software development versus groups dominated by other information technology jobs. Additionally, the organization experienced a merger during the course of the study. Whether the merger was announced before or after data collection was also controlled for.

Results

Self-report data were collected at baseline (n = 823), 6-months (n = 701), 12-months (n = 701), and 18-months (n = 651). At baseline, 618 of these individuals provided a minimum of three valid days of actigraphy data (intervention = 313, usual practice = 305), while 474 individuals provided three or more days of valid actigraphy data (intervention = 234, usual practice = 240). At 18-months, 397 individuals provided three or more valid days of actigraphy data (intervention = 193, usual practice = 204). Analyses excluded 16 individuals who were part of a workgroup that was randomized to the intervention, but never invited to STAR activities, by error. Additionally, eight

individuals were excluded from the analyses because they did not have valid randomization variables, including the number of employees used for randomization and the core function. In order to ensure that both objective and self-report samples are equivalent, we restrict our self-report analyses to the same sample of individuals who also provide valid actigraphy data. The final functional sample size used in the analyses was 791.

The model-based means for each time point across intervention and usual practice conditions can be found in Table 4.2. Descriptive statistics and bivariate correlations for all study variables are presented in Table 4.3.

Intervention Effects

Hypothesis 1 stated that sleep quality and quantity at 18-months would improve as a result of the intervention. Olson et al. (2015) previously found significant intervention effects on actigraphic total sleep time and self-reported sleep insufficiency at the 12-month follow-up. We include these 12-month data in our models for comparison. As seen in Table 4.3, we extend Olson et al.'s findings and show that such effects are maintained at the 18-month follow-up.

Specifically, a significant intervention by wave interaction is found for 18-month actigraphic total sleep time ($\gamma = 14.69$, $t = 3.59$, $p < .001$). The magnitude of this effect is considered small ($d = .29$; Cohen, 1988).[4] Figure 4.2 depicts this differential change across the treatment arms from baseline to 12-months and baseline to 18-months. Actigraphic total sleep time increased in the usual practice group over the three waves,

[4] From Table 4.4, the effect size *d* equals the estimated difference in mean change over time from baseline to that time point across intervention conditions divided by the square root of the sum of the random effects for that model.

while total sleep time in the usual practice group remained somewhat steady over the three time points.

In addition, a significant intervention effect was found on sleep insufficiency at 18-months (γ = -.20, t = -2.44, p = .02). The magnitude of this effect is also considered small (d = .29; Cohen, 1988). As seen in figure 4.3, differential change across the treatment arms over time is evidenced by the intervention group experiencing decreased sleep insufficiency at both the 12 and 18-month follow-ups. In contrast, sleep insufficiency is maintained at the 12-month follow-up and decreases somewhat by the 18-month follow-up. No significant intervention effects were found at 18-months for either actigraphic WASO (γ = 1.69, t = 1.38, p = .17, d = .33) or self-report insomnia symptoms (γ = .06, t = .91, p = .42, d = .05).

The results from these change-on-change models partially confirm hypothesis 1. Specifically, significant intervention effects are found for 18-month actigraphic total sleep time and sleep insufficiency. This indicates that there was differential change from baseline to 18-months on these two sleep outcomes, depending on whether a participant resided in the control or treatment group. Although these effects are small, the findings indicate that total sleep time was lengthened over time as a result of the intervention, while sleep insufficiency decreased over time as a result of the intervention.

Indirect Effects

Using path modeling, we next tested hypothesis 2 and determined whether intervention effects were mediated by control over work schedule and FSSB at 6-months and subsequently WTFC and family time adequacy at 12-months. See figure 4.4 for the model that was tested. Results indicate a significant conditional indirect effect,

controlling for all other variables in the model, of the intervention on 18-month total sleep time through 6-month control over work schedule and 12-month family time adequacy (indirect effect = .73, p = .03). A significant direct effect of the intervention on total sleep time was also found with the path model, indicating partial mediation. This finding suggests that participation in the intervention group led to increases in employees' control over work schedules. This in turn resulted in employees experiencing more adequate time with family and more distally, a greater ability to obtain longer sleep durations over time. However, evidence of partial mediation suggests that the intervention may have influenced other mediators that had an impact on total sleep time, as well. Thus, hypothesis 2 was partially confirmed.

Discussion

We find that a work-family intervention's effect on sleep is not only maintained at 18-months, but also occurs through a longitudinal mediation with intended intervention targets at both 6- and 12-months. Specifically, both aspects of sleep quality (i.e., sleep insufficiency) and quantity (i.e., actigraphic total sleep time) are improved a year and half after the intervention's implementation. In this way, our findings demonstrate the robustness of a work-family intervention's effect on distal, longitudinal sleep outcomes. Furthermore, we find that 6-month control over work schedule and 12-month family time adequacy act as mediators of the intervention's effect on 18-month actigraphic total sleep time. Individuals not only appear to have had more control over their schedules six months after the intervention, but this flexibility allowed for more adequate time with family members six months after that. Our findings suggest that these individuals did not have the same need to borrow time from sleep in order to accommodate family demands,

and thus, were able to allocate more hours to sleep on average, even when sleep was measured at a distal time point 18 months after the intervention.

As such, we expand upon previous work by Olson et al. (2015) who found a significant intervention effect on 12-month sleep outcomes and a significant mediation with control over work schedule and work-to-family conflict, both measured at 6-months. Our results suggest that these intervention effects last 6-months longer than previously hypothesized by Olson et al. Furthermore, we find evidence of temporally distinct mediators at both 6- and 12-months, rather than just at one time point. This suggests that the work-family intervention in question operates, as proposed, according to King et al.'s (2012) theoretical model for the WFHS, which was based on results from pilot studies and an interdisciplinary literature review. In line with our results, their model suggests that the intervention in question seeks to provide employees with the additional resources of control over work schedule and FSSB, which in turn are proposed to decrease work-family stress and ultimately improve health outcomes, such as sleep.

We do not find support for the intervention's effect on either actigraphic WASO or insomnia symptoms. Although some research has found a relationship between work-family stress and difficulty initiating or maintaining self-report sleep (e.g., Crain et al., 2014; Lallukka et al., 2010), we are unaware of any work-family intervention studies that have included such variables. It may be that these are aspects of sleep quality that are less likely to be improved through the provision of organizational resources, such as control over work schedule and FSSB. When an individual is clinically diagnosed with insomnia, behavioral treatments are often administered (e.g., Drake, Roehrs, & Roth, 2003). Although we do not address insomnia as a disorder in this study, we do evaluate

the lower-grade manifestations of insomnia symptoms and WASO. Given the focus on behavioral treatments for insomnia disorder in both literature and practice, it's likely that individual behavior change is necessary for insomnia symptom and WASO improvement, as well. For example, Bootzin & Epstein (2013) explain that poor sleep habits, such as irregular sleep-wake schedules, dysfunctional cognitions, such as worry, and physiological, emotional, and cognitive arousal are the primary factors targeted within insomnia treatments. While the STAR intervention attempted to decrease work-family stressors, it did not address individuals' sleep habits, ability to control unwanted cognitions during the day or before bed, or ability to engage in de-arousal strategies. As we explain in more detail below, future organizational interventions may be more efficacious in improving insomnia symptoms and WASO if combined with individual training targeting these behaviors.

The indirect effect of the intervention on 18-month total sleep time through 6-month control over work schedule and 12-month family time adequacy is in contrast to findings from Olson et al.'s (2015) analysis. Instead, they found a significant indirect effect of the intervention on 12-month sleep insufficiency through 6-month control over work schedule and 6-month WTFC. Interestingly, while we both see intervention effects on the proximal mediator of control over work schedule, we find differential effects with distal mediators and sleep outcomes. Perhaps Olson et al.'s mediation results reflect a strain-based pathway, given their results with WTFC and sleep insufficiency, an aspect of sleep quality. Their findings may suggest that control over work schedule decreases work-family strain that leads to more restful sleep, while our findings may suggest that control over work schedule also plays a time-based function by increasing the availability

of time that can be allotted towards both family and sleep. Alternatively, these differential mediation findings may be the result of investigating distal mediators and sleep outcomes at two different time points within the two respective process models. This also builds on previous intervention research by Moen and colleagues (2011), which showed that a workplace intervention increased control over work schedule at the 6-month follow-up and subsequently self-reported sleep duration, also at the 6-month follow-up.

Our results concerning this indirect effect are also in line with COR theory and give evidence for the importance of organizations providing their employees with resources. Our findings specifically address time, what Hobfoll (1989) classifies as an energy resource. The theory proposes that individuals must use their available resources in order to offset resource loss, protect resources, and gain new resources. Mediation results from the current study indicate that an individual with more time resources will be better able to obtain sufficient amounts of time with family, one way to build additional resources (e.g., social support, valued family role, self-esteem), and subsequently attain longer sleep durations, another way to build resources (e.g., next day energy, self-regulatory behavior). Thus, the intervention appears to have instigated a resource gain spiral for individuals who were provided with more control over their schedules.

Future Directions and Limitations

Findings from the current study provide a foundation for future intervention research targeting sleep as a health outcome. Such studies should continue to use longitudinal designs, with follow-up data collections extending past the 18-month mark. Given intervention effects were found on sleep at both the 12 and 18-month follow-up,

it's likely that such effects were sustained after this time. Unfortunately, we were unable to collect data past the 18-month follow-up. In addition, we did not investigate whether there were seasonal effects across the course of the study on sleep. Although all participants in the intervention and usual practice groups were from a similar geographic region, other seasonal differences may have played a role for some individuals. For example, parents may have experienced differing abilities to obtain adequate and sufficient sleep depending on whether their children were in school or on summer vacation.

A limitation of this study concerns our inability to speak to which aspects of control over work schedule were utilized by employees, which in turn resulted in more adequate time with family and consequently longer sleep durations. To this end, other sleep researchers (e.g., Basner et al., 2014) have proposed commute time as a target for future interventions, as commute time is reciprocally related to sleep. Thus, employees in this study may have been teleworking more and commuting less, allowing for more sufficient time with family. Alternatively, employees may have been choosing different times during the day to work, allowing them to be available for family during more critical periods of the day (e.g., family member doctor visits, dinner time), as opposed to being available for just more time during the day.

In addition, alternative proximal and distal mediators should be examined, given our results indicating a partial mediation through control over work schedule and family time adequacy. For example, other time-based measures may be incorporated, such as commute time or work-related technology use in the home domain. Alternatively, strain-based measures may also play mediator roles, such as rumination or worry.

This study was conducted with a sample of information technology workers and it remains to be known whether such intervention effects on sleep would be uncovered with a lower-wage, hourly workforce. Given we found that the intervention primarily affected sleep through the mechanism of control over work schedule with the current sample, this intervention may have an effect through other mediators in contexts where it may be less feasible to provide employees with as much control over their working time. Indeed, there is a need for future research to address the sleep of shiftworkers (e.g., Smith, Folkard, Tucker, & Evans, 2011).

The intervention utilized in the current work was aimed primarily at improving the organizational factors of control over work schedule and FSSB. However, effects on sleep may have been stronger and more numerous had this intervention also incorporated training aimed at individual behaviors. As such, Hammer and Sauter (2013) suggest that these integrated Total Worker Health™ interventions, with both health protection and health promotion aspects, are ideal for affecting work-family outcomes and subsequently health. As described in further detail below, potential health promotion aspects could include sleep education and sleep hygiene training, mindfulness training, cognitive-behavioral training, and/or strategies for de-arousal both during the day and prior to bed.

The first of these suggested components, sleep education and sleep hygiene training, may be particularly useful in changing behaviors that are related to the timing and duration of sleep, in addition to the consistency of sleep schedules. Such schedules may involve providing individuals with information around the function of sleep, sleep needs, circadian rhythms, and developmental changes in sleep over the lifespan. Furthermore, sleep hygiene training could provide participants with information on those

behaviors that will lead to improved sleep, such as the avoidance of caffeine, nicotine, alcohol, the reduction of bedroom noise, techniques for stress management, and the importance of engaging in regular exercise (Irish, Kline, Gunn, Buysse, & Hall, in press).

Evidence also suggests that mind-body interventions targeting mindfulness or yoga practices hold promise for improving employee sleep. For example, Allen and Kiburz (2012) have found a relationship between trait mindfulness and sleep quality. Howell, Digdon, and Buro (2010), have also found that mindfulness is related to self-regulation of sleep. Mindfulness training could potentially sensitize an individual to their bodily cues, such as the need for sleep, thereby prompting healthy sleep-promoting behavior. Moreover in a randomized controlled trial, Wolever, McCabe, Fekete, Bobinet, Mackenzie, and Kusnick (2012) tested both a mindfulness and yoga intervention. Their results suggest that both types of programs were effective in promoting sleep quality compared to the control group. Thus, mind-body intervention components could also be used in conjunction with organization-level approaches.

In addition, future interventions may make use of cognitive behavioral training and/or training focused on strategies for de-arousal. Although we suggest some specific individual-level intervention strategies above that represent a viable avenue for future research, we also acknowledge that these tactics may be less effective for individuals who are older or who have other comorbid medical psychiatric, sleep, or substance use disorders, given that these are risk factors for clinical insomnia disorder (Schutte-Rodin, Broch, Buysse, Dorsey, & Sateia, 2008). Recommended psychological and behavioral therapies for insomnia disorder include cognitive behavioral therapy and/or relaxation therapy, while insufficient evidence exists suggesting that sleep hygiene is an effective

treatment in and of itself (Schutte-Rodin et al., 2008). Thus, elements of cognitive behavioral and relaxation training should be utilized by organizational scholars when designing future interventions that are intended to be efficacious for a variety of individuals.

Lastly, there is a need for future intervention research to incorporate the recovery and work-nonwork boundary management literature in order to better understand how interventions are affecting individuals' behavior related to sleep. Recent work suggests that sleep is protected when individuals create boundaries around work-related technology use in the home (Barber & Jenkins, 2013), however, work-related technology use is likely more prevalent with a flexible schedule. Thus, work-family and sleep scholars should aim to design interventions that balance improvements to work, family, individuals' own ability to recover, and sleep in combination.

Practical Implications

Results from this study suggest that a work-family intervention aimed at increasing employee control over work schedule and FSSB had significant and lasting effects on work-family strain and consequently sleep outcomes. Given the well-established literature indicating that tired workers are more likely to experience accidents (e.g., Uehli et al., 2014), lowered performance (e.g., Philibert, 2005), and eventual chronic illness (e.g., Buxton & Marcelli, 2010), organizations should consider the efficacy of work-family interventions for targeting employee sleep. The implementation of such programs would serve to mutually benefit workers, their families, and organizations.

Our mediation findings suggest that employee control over work schedule is a key factor for employees' time with family and time for sleep. As a result, organizations who may not have the resources available to undergo a large-scale intervention, such as the one described in the present study, may choose to focus on improving employees' ability to determine when they work. Formal flexible working arrangements, or even employees' ability to informally change their schedules when necessary, are likely to help employees better manage family demands, thereby leaving more sufficient time for sleep.

Conclusion

In summary, this study extended Olson et al.'s (2015) findings. Specifically, longitudinal intervention effects were found to be maintained at the 18-month follow-up and both proximal and distal mediators were identified, indicating the accumulation of time-based resources. Moreover, this research utilized both objective and self-report measurements of sleep quality and quantity in a rigorous randomized control trial. These results provide a foundation for future intervention research that targets work-family variables in an effort to improve sleep over time, a critical factor for long term health and well-being.

Table 4.1

Mean (SD) and Percentage of Demographic Characteristics by Condition

	Usual Practice	Intervention
Female	37.9%	42.3%
Age	46.6 (8.4)	46.9 (8.8)
Race/Ethnicity		
White, Non-Hispanic	72.1%	70.7%
Black or African American, Non-Hispanic	1.3%	2.4%
Asian Indian	13.8%	11.8%
Other Asian	4.2%	4.9%
Other Pacific Islander	0.8%	1.2%
Hispanic	6.7%	8.1%
More Than One Race	1.3%	0.1%
Married or Living with Partner	79.2%	80.1%
Number of children	1.0 (1.2)	1.0 (.95)
Elder Care	25.8%	24.4%
Education		
High School Graduate	2.5%	2.8%
Some College or Technical School	17.9%	22.4%
College Graduate	79.6%	78.4%
Hours worked per week	45.5 (6.0)	45.6 (5.4)
Shift		
Variable Schedule	21.3%	21.1%
Regular Daytime	77.9%	78.0%
Rotating	0.4%	0.8%
Split Shift	0.4%	0.0%

Table 4.2

Means by Condition Over Time

Outcome	Condition	Baseline	12-months	18-months
Actigraphic Total Sleep Time	Usual Practice	439.70	435.79	440.13
	Intervention	429.46	434.97	444.58
Actigraphic WASO	Usual Practice	43.73	41.23	45.51
	Intervention	44.12	43.06	47.60
Sleep Insufficiency	Usual Practice	2.80	2.81	2.70
	Intervention	2.86	2.61	2.56
Insomnia Symptoms	Usual Practice	2.71	2.70	2.65
	Intervention	2.69	2.63	2.70

Notes: Adjusted means for intervention and usual practice groups over time for each outcome derived from general linear mixed model analysis results.

Table 4.3

Descriptives and Correlations of Study Variables

	M	*SD*	1	2	3	4	5	6	7	8
1. Treatment	0.51	0.50	—							
2. 6m Control over work schedule	3.76	0.67	0.09*	—						
3. 6m Family-Supportive Supervisor Behaviors	3.86	0.77	0.06	0.40*	—					
4. 12m Work-to-Family Conflict	2.93	0.91	-0.04	-0.43*	-0.28*	—				
5. 12m Family Time Adequacy	3.43	0.68	0.00	0.31*	0.19*	-0.46*	—			
6. Baseline Actigraphic Total Sleep Time	435.10	53.39	-0.08*	0.01	0.00	-0.04	0.02	—		
7. 12m Actigraphic Total Sleep Time	437.89	52.13	0.02	0.00	-0.04	-0.03	0.06	0.66*	—	
8. 18m Actigraphic Total Sleep Time	443.97	55.32	0.03	0.05	0.03	-0.15*	0.11*	0.64*	0.74*	—
9. Baseline Actigraphic WASO	43.93	16.26	0.01	-0.01	-0.07	0.01	0.04	0.11*	0.01	-0.01
10. 12m Actigraphic WASO	41.45	14.75	0.07	0.00	-0.09	0.00	0.02	-0.02	0.13*	-0.03
11. 18m Actigraphic WASO	46.08	16.18	0.06	0.05	-0.07	-0.06	0.03	-0.02	0.04	0.14*
12. Baseline Insufficiency	2.85	0.87	0.06	-0.15*	-0.13*	0.24*	-0.18*	-0.09*	-0.01	-0.05
13. 12m Insufficiency	2.72	0.92	-0.10*	-0.16*	-0.12*	0.30*	-0.23*	0.05	0.04	-0.08
14. 18m Insufficiency	2.65	0.92	-0.07	-0.21*	-0.25*	0.28*	-0.20*	0.01	-0.03	-0.11*
15. Baseline Insomnia	2.70	0.78	0.02	-0.05	-0.11*	0.08	-0.06	0.13*	0.15*	0.09
16. 12m Insomnia	2.68	0.76	-0.04	-0.06	-0.11*	0.09	-0.04	0.15*	0.17*	0.15*
17. 18m Insomnia	2.70	0.72	0.06	-0.01	-0.15*	0.10	-0.09	0.16*	0.10	0.12*

Note. N = 396-618. 6m = 6-months; 12m = 12-months; 18m = 18-months; WASO = wake after sleep onset.
Treatment: 1 = intervention, 0 = usual practice.
* $p < .05$.

Table 4.3, cont.

Descriptives and Correlations of Study Variables

	9	10	11	12	13	14	15	16	17
1. Treatment									
2. 6m Control over work schedule									
3. 6m Family-Supportive Supervisor Behaviors									
4. 12m Work-to-Family Conflict									
5. 12m Family Time Adequacy									
6. Baseline Actigraphic Total Sleep Time									
7. 12m Actigraphic Total Sleep Time									
8. 18m Actigraphic Total Sleep Time									
9. Baseline Actigraphic WASO	—								
10. 12m Actigraphic WASO	0.70*	—							
11. 18m Actigraphic WASO	0.61*	0.66*	—						
12. Baseline Insufficiency	-0.01	-0.03	0.02	—					
13. 12m Insufficiency	-0.01	-0.02	0.00	0.53*	—				
14. 18m Insufficiency	0.02	0.00	0.02	0.56*	0.59*	—			
15. Baseline Insomnia	0.12*	0.14*	0.13*	0.25*	0.24*	0.22*	—		
16. 12m Insomnia	0.06	0.06	0.06	0.16*	0.32*	0.28*	0.55*	—	
17. 18m Insomnia	0.08	0.04	0.07	0.17*	0.23*	0.30*	0.48*	0.61*	—

Note. N = 396-618. 6m = 6-months; 12m = 12-months; 18m = 18-months; WASO = wake after sleep onset.
Treatment: 1 = intervention, 0 = usual practice.
* $p < .05$.

Table 4.4

Effect of Intervention on 12 and 18-month Sleep Outcomes

	Sleep Outcomes							
	Act. Total Sleep Time		Act. WASO		Insufficiency		Insomnia	
Predictor	β	(95% CI)	β	(95% CI)	β	(95% CI)	β	(95% CI)
Fixed Effects								
Intercept	434.81*	(422.99, 446.63)	46.48*	(42.87, 50.08)	2.57*	(2.38, 2.76)	2.55*	(2.39, 2.71)
Core Function[a]	-3.52	(-12.09, 5.05)	-1.38	(-4.02, 1.25)	-0.05	(-0.18, 0.09)	-0.09	(-0.20, 0.02)
# of Emps for Rmz	0.13	(-0.20, 0.46)	-0.08	(-0.18, 0.02)	0.01*	(0.00, 0.01)	0.01*	(0.00, 0.01)
Merger	6.18	(-3.22, 15.58)	0.19	(-2.68, 3.06)	0.15*	(0.01, 0.30)	0.04	(-0.09, 0.16)
Intervention	-10.25*	(-19.28, -1.21)	0.39	(-2.38, 3.16)	0.06	(-0.09, 0.21)	-0.02	(-0.14, 0.11)
12 m. Wave	-3.91	(-9.22, 1.40)	-2.50*	(-4.09, -0.91)	0.00	(-0.10, 0.11)	-0.01	(-0.10, 0.08)
18 m. Wave	0.43	(-5.21, 6.07)	1.78*	(0.09, 3.47)	-0.10	(-0.21, 0.01)	-0.05	(-0.15, 0.04)
Intervention*12 m. Wave	9.43*	(1.88, 16.98)	1.44	(-0.82, 3.70)	-0.26*	(-0.41, -0.11)	-0.05	(-0.18, 0.07)
Intervention*18 m. Wave	14.69*	(6.62, 22.76)	1.69	(-0.72, 4.11)	-0.20*	(-0.36, -0.04)	0.06	(-0.07, 0.20)
Random Effects								
CS Diagonal Offset	7.46		2.86		0.00		N/A	
CS Covariance	1975.39*		170.94*		0.43*		0.32	
Intercept	904.45*		81.16*		0.36*		0.26	

Note. CI, confidence interval. # of Emps for Rmz, number of employees for randomization. [a]The core function identifies groups where most individuals were involved in software development; groups dominated by other IT jobs are the reference group. N/A, not available because covariance parameter is redundant and thus the confidence interval could not be computed.
* $p < .05$.

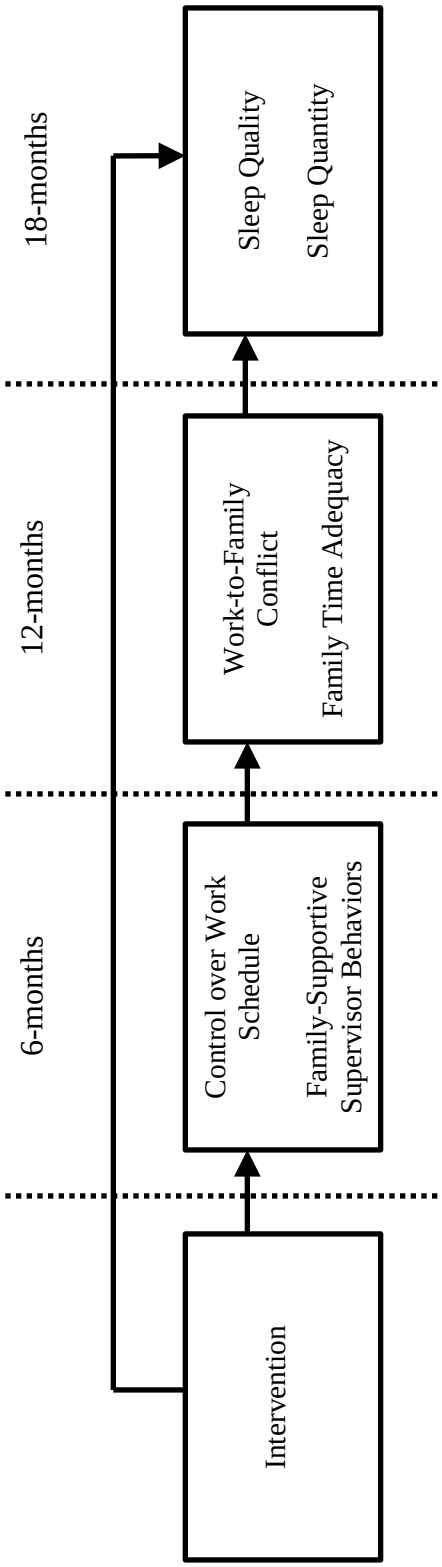

Figure 4.1. Theoretical model.

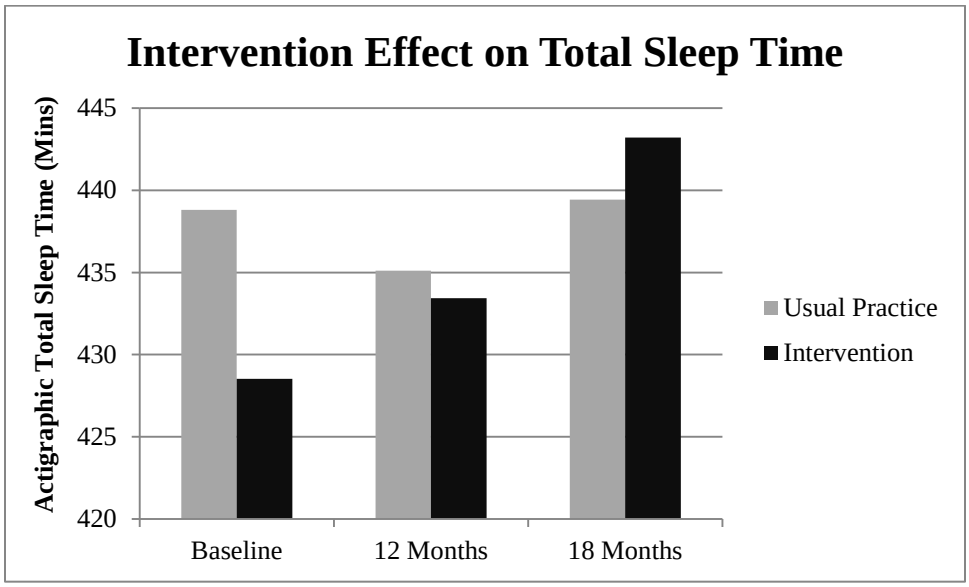

Figure 4.2. Graph of intervention effect on total sleep time.

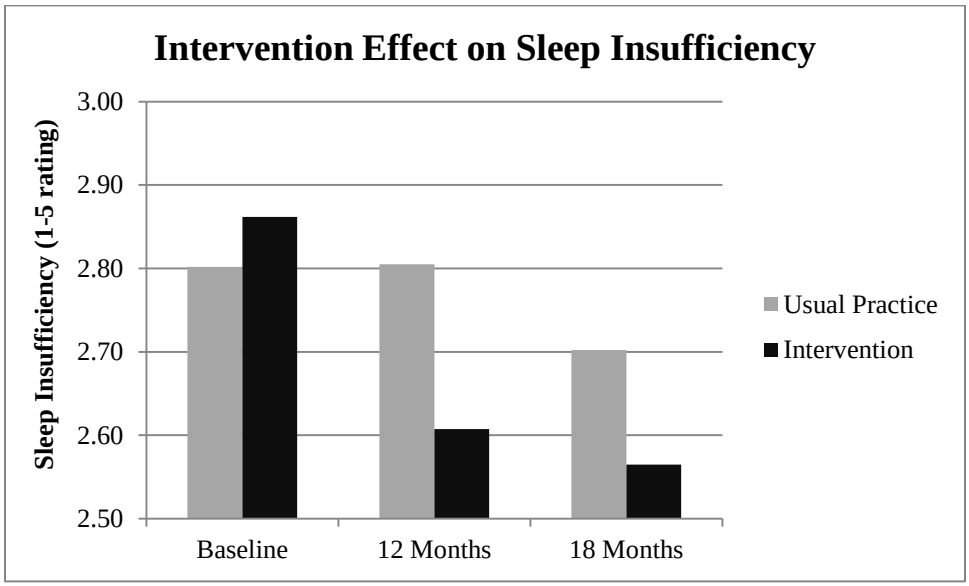

Figure 4.3. Graph of intervention effect on sleep insufficiency.

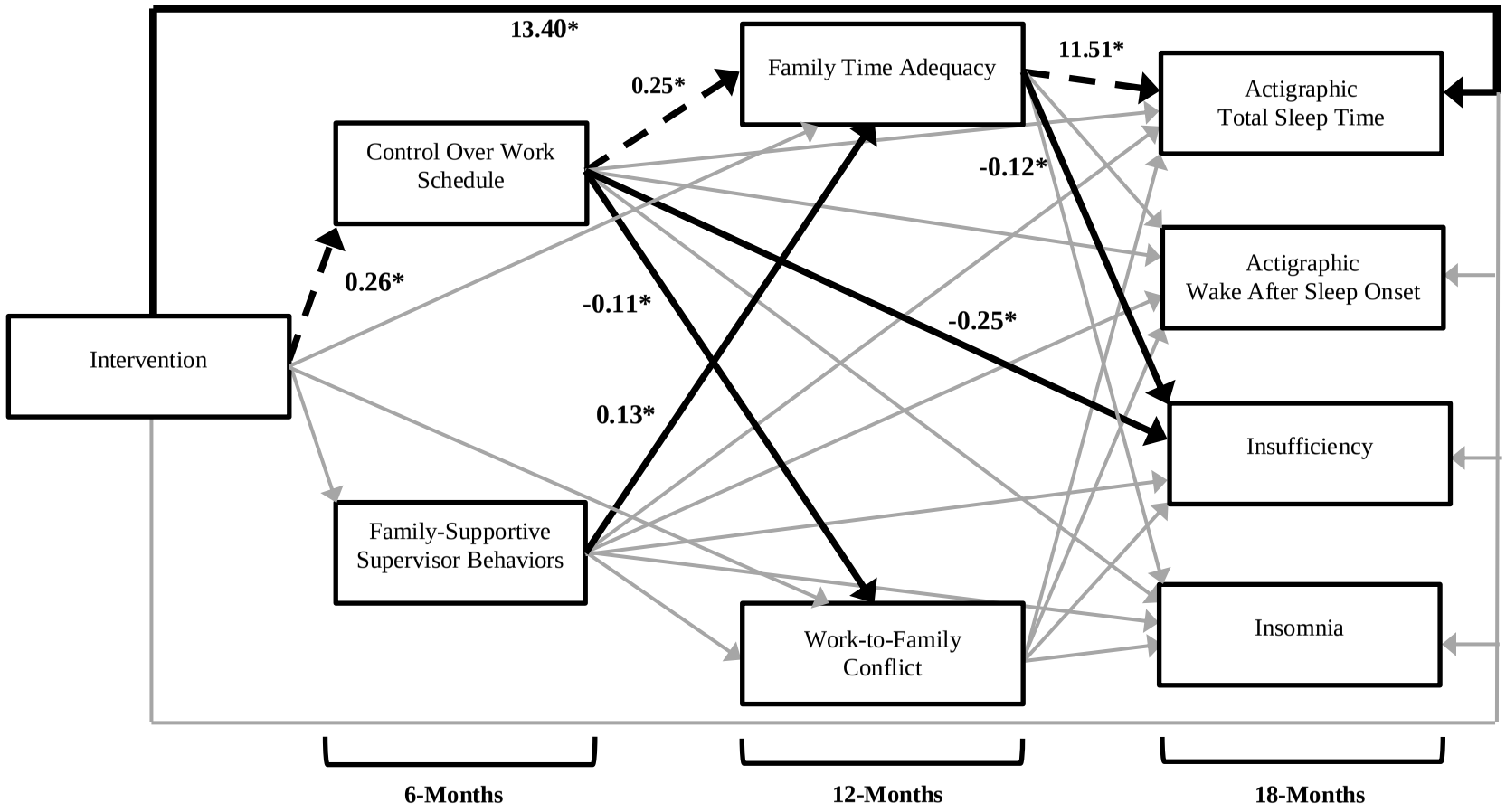

Figure 4.4. Empirical results of the intervention on 18-month sleep outcomes process model. Control variables (i.e., core function, number of employees for randomization, merger announcement) and covariances (i.e., between control over work schedule and family-supportive supervisor behaviors, family time adequacy and work-to-family conflict, and among sleep outcomes) not shown for parsimony. Bold arrows depict significant direct effects, bold dashed arrows depict significant indirect effects, and grey arrows depict non-significant direct effects. * $p < .05$.

Chapter 5: Conclusion

This body of work making up my dissertation sought to evaluate sleep as an outcome in relation to work-family experiences. Through a series of three studies, the current research motivates future interventions targeting sleep as a mechanism of more distal chronic illness outcomes. Findings from the three studies in question suggest that work-family experiences are critical targets for future organizational change initiatives aiming to improve this particular health outcome.

Major contributions of this research include that it is one of the first systematic bodies of work to examine the relationship among work-family experiences and sleep outcomes, including sleep quality and quantity, at both the between- and within-person levels, that it evaluates sleep using both objective, actigraphic and self-report measures, and that it assesses the effect of a rigorous work-family intervention on longitudinal sleep outcomes. Moreover, findings from all three studies, each using different methodologies, indicate that work-family experiences are associated with both sleep quality and sleep quantity, as predicted.

Findings from these three studies confirm previous research that has been conducted on the interplay among work, family, and sleep, while also expanding upon previous literature from both the organizational and sleep fields. Specifically, the use of objective actigraphic methods, in addition to self-report sleep surveys, to measure both sleep quality and quantity, has rarely been seen within the organizational field, especially with respect to work-family studies. Differential effects are found across sleep constructs and methodologies. As they were borrowed from the sleep literature, procedures for the objective measurement of sleep and the conceptual distinction between sleep quality and

quantity provides for a novel contribution that organizational scholars can adopt in future work.

Additionally, sleep is measured across the three studies at both the between- and within-person levels. Thus, findings from the current work add to the previous organizational and sleep literatures by confirming already established associations among work-family experiences and sleep at the between-person level. However, these associations are also measured at the within-person level and consequently it is found that sleep on a given night is a product of work and family experiences that took place earlier that day. Prior studies have only addressed whether typical work-family experiences are associated with sleep on average.

A third contribution of this work reflects that a rigorous randomized controlled trial was implemented and significant effects were found, such that the intervention improved employee control over work schedules, family time adequacy, and sleep quality and quantity over time. As a result, the current work addresses calls in both the organizational (e.g., Hammer et al., in press) and sleep literatures (e.g., Jacobsen et al., 2014) for such interventions. Moreover, this particular intervention targeted, tested, and found results for hypothesized organizational levers (i.e., control over work schedule, family-supportive supervisor behaviors (FSSB), family time adequacy, work-to-family conflict) that have remained relatively absent from the sleep literature.

The Work, Family, & Health Study

The studies contained in this dissertation utilized data from the Work, Family, & Health Study (WFHS), funded by the National Institutes of Health and the Centers for Disease Control (see Bray et al., 2013; King et al., 2012). This larger project involved a

randomized controlled trial within two different industries, information technology and long-term healthcare, testing an intervention targeting employee control over work schedule and FSSB. These primary levers were hypothesized to improve work-family conflict and subsequently the health and well-being of workers and their families (Kossek, Hammer, Kelly, & Moen, 2013). Data were collected from organizations, supervisors, employees, and their families at baseline, and 6, 12, and 18-months post-intervention.

The present work addresses associations among work, family, and sleep within the information technology sample of the larger WFHS. Study 1 uses baseline survey and objective sleep data, while study 2 uses baseline daily diary and survey data from a subset of these employees. Lastly, study 3 evaluates the intervention's effect on organizational and work-family outcomes at 6 and 12-months post-intervention and sleep outcomes at 18-months post-intervention. Although the three studies in question were not the primary focus of the larger WFHS, they contribute to understanding around how work and family influence sleep and additionally how the WFHS intervention was effective at improving sleep over time.

Constructs Examined Throughout This Dissertation

Sleep as an outcome. These studies assessed sleep as the sole outcome of interest. A focus on deficient sleep is warranted, given prior research that has established its effects on detrimental short-term organizational outcomes like accidents and injuries (e.g., Uehli et al., 2014), in addition to more serious, long-term consequences like chronic illness (e.g., Buxton & Marcelli, 2010; Cappuccio, D'Elia, Strazzullo, & Miller, 2010). Throughout this body of work, both sleep quality and sleep quantity are considered as

separate constructs, in line with recommendations from Barnes (2012). According to Harvey, Stinson, Whitaker, Moskovitz, and Virk (2008), quantity refers to the duration of time an individual resides in a sleeping state, while quality refers to the sufficiency of sleep, in addition to difficulty initiating or maintaining sleep throughout the night.

Work-family experiences as predictors. Additionally, work-family experiences are examined as predictors of both sleep quality and quantity. Work-family conflict, or incompatibility between work and family roles (Greenhaus & Beutell, 1985), is assessed throughout the body of work as a predictor of sleep outcomes. FSSB are also evaluated in relation to sleep outcomes, both as a predictor and moderator. These are behaviors that are exhibited by supervisors, indicative of concern for employees' ability to manage family demands (Hammer, Kossek, Bodner, Yragui, & Hanson, 2009).

Statement of Purpose Revisited and Addressed

As detailed in chapter 1, three overarching questions guided this research and were motivated by the National Institutes of Health 2011 National Sleep Disorders Research Plan that called specifically for future research on the antecedents of sleep deficiency. These questions were evaluated through testing COR's theoretical propositions around resource loss and gain. These questions include:

1) Do work-family factors influence aspects of sleep?
2) What characteristics of the work environment facilitate favorable work-family effects on sleep and protect against unfavorable work-family effects on sleep?
3) Can organizational interventions targeting work-family stress improve sleep? By what mechanisms does this occur?

Below, I describe the answers to these questions that arose out of the three studies included in this dissertation.

The first objective of this research was to determine whether work, family, and sleep were interrelated. Previous research has examined this question to some degree (e.g., Barnes, Wagner, & Ghumman, 2011; Jacobsen et al., 2014; Nylen, Melin, & Laflamme, 2007; Sekine, Chandola, Martikainen, Marmot, & Kagamimori, 2006), and these studies evaluating work-family experiences and sleep have primarily conceptualized sleep as an outcome of work-family predictors, rather than work-family experiences as outcomes of sleep. However, the research has evaluated only sleep quality or quantity in isolation, has examined these relationships cross-sectionally, has not differentiated between directions of work-family conflict, and/or has assessed a purely time-based conceptualization of the interrelatedness among work, family, and sleep.

Thus, the current research utilized both objective and self-report measurements of sleep quality and quantity, in addition to work-to-family conflict (WTFC) and family-to-work conflict (FTWC) as variables and strain-based theoretical arguments surrounding work, family, and sleep associations. Furthermore, these relationships were assessed using both a cross-sectional and daily diary design. Results from Study 1 and Study 2 indicate that work-family conflict is negatively associated with self-report and objective aspects of sleep quality and quantity on average and within persons over time. Specifically, in Study 1, These findings act as confirmation of COR theory's (Hobfoll, 1989) proposition that the loss or threat of loss of resources is stressful for individuals.

The second objective of this research was to better understand moderators of the association between work-family experiences and sleep outcomes. To date, no studies have evaluated this question and the current work seeks to determine the answer using both study 1 and study 2. In a cross-sectional design (i.e., Study 1), FSSB were not found to moderate this link, although they were hypothesized to have a buffering effect. In study 2, however, perceptions of a positive work-family climate was found to facilitate the positive association between work-family conflict and sleep quality, suggesting that at the daily level, resource loss is salient and related to sleep despite the availability of resources. Moreover, control over work schedule was found to enhance the positive association between daily FSSB and sleep quality. This interaction suggests that employees are better able to capitalize day to day on family-specific support from supervisors and protect against sleep impairment when they also have the ability to alter their work schedules. These results are in line with COR theory, verifying that resource loss is more salient than resource gain, even at the daily level, and that control over work schedule acts as a buffer on these daily relationships.

The third objective of this work focused on organizational interventions and whether one targeting work-family stress would improve sleep. Using a rigorous randomized controlled trial, study 3 found that a work-family intervention, aimed at increasing control over work schedule and FSSB, did in fact improve both sleep quality and sleep quantity at the 18-month post-intervention follow-up data collection. In addition, control over work schedule was found to act as a proximal mediator, while family time adequacy was found to act as a distal mediator of the intervention's effect on sleep quantity. In effect, these results confirm COR theory in that the provision of time-

based resources allowed for individuals to better maintain, protect, and obtain new resources, which led to longer sleep durations.

Patterns of Significance across the Three Studies

Although this dissertation successfully evaluated the three research questions of interest, more specific patterns of results within the findings across the three studies should also be noted. First, study 1 found significant associations, as predicted, between a combination of work-family constructs (i.e., WTFC, FTWC, and FSSB) and both sleep insufficiency and insomnia symptoms, while a significant relationship was found between WTFC and actigraphic total sleep time. However, a relationship was not found between any of these predictors and actigraphic WASO. Interestingly, as hypothesized in study 3, significant relationships were also found between the intervention and actigraphic total sleep time and sleep insufficiency at the 18-month follow-up, but again, no relationships were found with actigraphic WASO. This suggests that actigraphic total sleep time and sleep insufficiency may be the sleep measures that are especially sensitive to changes in work-family experiences at the between-person level and longitudinally over time. Furthermore, actigraphic WASO may be less affected by such changes, as I discuss in more detail later in this chapter.

Second, both study 1 and study 2 hypothesized resources (i.e., FSSB, perceptions of work-family climate, and control over work schedule) to be moderators of the WTFC and sleep quality and quantity relationships. While in study 1, no moderation effects were found, results from study 2 indicated that perceptions of a positive work-family climate actually strengthened the relationship between WTFC and the time it takes to fall asleep, within persons over time. Interestingly, we find that at the daily-level, resource

loss is more salient in the presence of this resource gain. These results are in contrast to the alternatively hypothesized moderation effects and lack of moderation effects that are seen in study 1.

Theoretical Implications

Conservation of Resources theory. The link between work-family experiences and sleep outcomes is motivated throughout this document with Conservation of Resources theory (COR; Hobfoll, 1989). COR theory proposes that because individuals strive to obtain and maintain resources, such as a valued family role, time, or self-esteem, strain can result when resources are either threatened or lost. In this way, work-family conflict is conceptualized as a loss or threatening of resources, resulting in strain and subsequently leading to undesirable sleep outcomes. However, the provision of resources, such as support from a supervisor, can positively impact sleep and may also alleviate associations between work-family strain and sleep outcomes.

In sum, the findings from the three studies included in this dissertation confirm COR theory's (Hobfoll, 1989) propositions. First, it is evident that the loss or threat of resource loss (e.g., valued work or family roles, time) that occurs as a result of work-family strain is distressing for individuals and affects sleep in detrimental ways. Second, results from study 2 and 3 indicate that control over work schedule is a condition resource that can help protect against an individuals' need to borrow from sleep in order to attend to family demands. Furthermore, study 2 confirms COR theory's principle of the saliency of resource loss, such that even in the presence of a condition resource (i.e., perceptions of work-family climate) work-family strain is likely to detrimentally affect sleep. Study 3 finds that when condition resources (i.e., control over work schedule and

FSSB) are provided to employees within their working environments, beneficial effects on work-family outcomes and sleep are seen. Because increases in sleep time were found as a result of the intervention leading to improvements in control over work schedule and family time adequacy, we can conclude that time, what Hobfoll calls an energy resource, is especially valuable for sleep. The results mentioned here serve to confirm COR theory as an appropriate framework motivating relationships among work, family, and sleep.

Although only a handful of studies have examined the link between work-family experiences and sleep outcomes, the current dissertation suggests that this relationship is worthy of attention and future investigation. This is case when one is examining associations between these variables both over time and at the daily-level. Results from these three studies suggest that average levels of work-family stress affect average experiences of sleep. In addition, it can be reasonably concluded that an individual's experiences with work and family on any given day can affect their sleep that night. Thus, future research on this topic should further investigate the link between work-family stressors and sleep both between- and within-persons over time.

To date, relatively few studies in the organizational literature have evaluated sleep as an outcome variable. However, this dissertation provides three pieces of evidence suggesting that work-family experiences act as predictors of sleep quality and quantity outcomes. Given the complementarity of findings across this series of studies, there is a need for investigation into the mechanisms behind such relationships. In order to better uncover these mediators, organizational scholars should turn to the sleep literature, which has thoroughly examined predictors of sleep, or what could be mediators between work-family experiences and sleep. For example, much research to date has evaluated

emotions (e.g., Baglioni, Spiegelhalder, Lombardo, & Riemann, 2010), worry, rumination (e.g., Takano, Iijima, & Tanno, 2012), and time use (e.g., Basner, Spaeth, & Dinges, 2014).

Practical Implications at the National, Organizational, and Individual Levels

Recent increased attention to work-family issues by both the media and policymakers has resulted in a national debate about the importance of supporting employees' ability to accommodate both work and family demands. Although discussions around beneficial outcomes of such initiatives are present, these discussions are often restricted to those outcomes that pertain to employee productivity and family life. While these are important and viable topics to consider, the findings from this dissertation would also suggest that positive sleep outcomes reflect another advantage of supporting working families. As previous literature has established the link between sleep deficiency and accidents (e.g., Uehli et al., 2014), in addition to mental health (e.g., Baglioni et al., 2011), and even chronic illness (e.g., Buxton & Marcelli, 2010), the importance of work-family policies to positive sleep outcomes at a national level should be highlighted. Work-family initiatives are also important for long-term national health.

At the organizational level, work-family programs should also be implemented in order to improve employee sleep. Results from the current research reflect the importance of organizations making attempts to implement family-friendly supports, even if not required by national policy. For example, the current research suggests that control over one's work schedule allows for adequate time for family, and subsequently, more time for sleep. Formal flexible scheduling practices, such as flextime, telework, or compressed workweeks, (see Kossek & Michel, 2011 for a review) can serve to benefit

not only employees' family life, but also their ability to obtain sufficient amounts of sleep over time. Findings from this research also indicate that daily work-family experiences affect sleep that following night. This suggests that organizations should also consider approaches for addressing employee work-family stressors that take effect on a daily basis. For example, daily rather than average amounts of support from supervisors and employees is likely necessary for employees to address family demands that interfere with work and work that interferes with family day-to-day. Organizational initiatives to bolster such daily sources of support are necessary, in addition to those that promote a more general positive work-family climate.

Lastly, this research also has implications for individuals. Given that this body of work finds associations between work-family stressors and sleep outcomes, employees, to the extent possible, should take individual action to manage their work-family boundaries. For example, sleep is protected when individuals create boundaries around work-related technology use in the home (Barber & Jenkins, 2013). Additionally, employees may more actively select jobs that provide them with work-family supports, such as flexible schedules or on-site childcare. Furthermore, given previous research indicating the reciprocal relationship between commute time and sleep (e.g., Basner et al., 2014), employees can choose to work in close proximity to one's home to avoid both work-family conflicts and decrements in sleep time. However, when these are not feasible options, employees should also engage in good sleep hygiene practices (e.g., consistent sleep schedules, avoidance of alcohol and caffeine before bed, regular exercise).

Limitations and Suggestions for Future Research

In summary, findings from this series of studies suggests that work-family stress is worthy of future investigation both as a predictor of sleep and as a viable intervention target for improving sleep. However, in combination, the results from these studies motivate larger avenues for future research, as well. Such investigation is necessary in order to fully understand the role of sleep within the larger nomological network of organizational and nonwork constructs, in addition to motivating interventions that are effective at preventing long-term chronic illness, beyond sleep deficiency.

Limitations and future research concerning study 1. Given the limitations of study 1, I describe next steps for understanding these phenomena of interest. Particularly, I address the need to examine all FSSB dimensions in relation to sleep, the potential construct of supervisor support for sleep, and establishing sleep as a mechanism of the relationship between work-family stressors and long-term health outcomes.

Study 1 assessed the role of FSSB using Hammer, Kossek, Bodner, and Crain's (2013) short-form measure. While this is a practical and valid tool for assessing the superordinate FSSB construct, future research should examine whether differential relationships are found between the dimensions of emotional support, instrumental support, role modeling, and creative work-family management and sleep quality and quantity outcomes. For example, it may be that instrumental support (e.g., scheduling changes) and role modeling (e.g., work-home boundary management) are more important for employee sleep quantity than quality. It may also be the case that different dimensions have more or less practical utility with regards to sleep, depending on the industry and type of occupation. Perhaps in a highly-regulated industry where workers are required to work non-standard shifts (e.g., transportation, healthcare), emotional

support is the most feasible form of support a supervisor can provide, as opposed to instrumental support or creative work-family management.

Relatedly, there is a need to better understand how supervisors support their employees' sleep needs. While the FSSB construct addresses supervisor support for non-work life generally, in addition to family, it is not clear whether any provided support is specific to sleep. Given that sleep occurs in the non-work domain, components focusing on supervisor support for employee sleep could be feasibly incorporated into FSSB training initiatives within the workplace. Alternatively, supervisor support for sleep could be examined, aside from the FSSB construct, and predictor of sleep quality and quantity, in addition to subsequent safety and performance outcomes in the workplace.

In study 1, and more broadly throughout this dissertation, it has been claimed that sleep is an important organizational intervention target because it is a precursor to long-term health and well-being. However, study 1 and other research to date, which have considered sleep as an outcome, have failed to assess the subsequent health outcomes that may result from not obtaining adequate and sufficient sleep, although organizational and management scholars have proposed such investigation (e.g., Ganster & Rosen, 2013). Therefore, there is a need to understand how changes within organizational contexts, especially those relating to work and family issues, can affect long-term health outcomes, through the mechanism of sleep, separate from other strain reactions (e.g., elevated blood pressure, lowered immunity). Given the complexity of these research questions, such investigation necessitates collaboration between biomedical sleep researchers and organizational scholars.

Limitations and future research concerning study 2. Although study 2 represents one of the first daily diary studies on work-family stress and sleep, I describe below critical next steps for understanding these relationships at the within-person level. Here, I address the need to examine reciprocal causality and daily-level mechanisms.

In study 2, in addition to both study 1 and study 3, an assumption was made that deficient sleep results from work and family stressors, based on the propositions of Hobfoll's (1989) COR theory. Although this notion was confirmed with within-person data, reciprocal relationships may also exist. An alternative theoretical framework, feelings-as-information (FAI) theory, suggests that nightly sleep quality and quantity may actually influence experience of next day stressors. The theory proposes that individuals rely on subjective mood when developing evaluative judgments about their surroundings (Schwarz & Clore, 2003). Taking into account previous literature that finds a link between deficient sleep and negative mood (e.g., Sonnentag et al., 2008; Vandekerckhove & Cluydts, 2010), FAI would suggest that individuals will have stronger perceptions of work-family conflict and inadequate time for family following deficient sleep.

More generally, the majority of research on sleep in the organizational literature has conceptualized sleep as a predictor rather than an outcome. Scholars, such as Barnes (2012) and Barber (2013), have primarily focused on the self-regulatory function that sleep serves for individuals. Specifically, adequate and sufficient sleep allows individuals to better control their thoughts, feelings, and behaviors, affording for better performance in both work and nonwork roles. In this way, sleep should be evaluated as both a predictor and outcome in a follow-up study.

An additional study on this topic should attempt to uncover mechanisms linking work-family experiences and sleep within-persons over the course of a day. Such research questions necessitate the use of an experience sampling design, whereby work-family experiences during the day can be proposed to predict experiences before bed and subsequent sleep quality and quantity outcomes. Constructs that are particularly ripe for investigation as mediators include positive and negative affect, worry or rumination, or even physiological arousal as measured by cortisol. Additional behaviors may also be examined as mediators of this relationship. These include evening work-related technology use, mindfulness or relaxation exercises, and sleep hygiene practices.

Limitations and future research concerning study 3. Study 3 represents one of the most methodologically rigorous studies to date examining work-family and sleep constructs. However, the intervention implemented is not without limitations. Below I describe follow-up intervention studies that have the potential to expand upon study 3's findings. Future interventions may involve health protection components related to sleep hygiene and mindfulness interventions.

Findings from study 3 suggests that future interventions aimed at decreasing work-family strain are particularly promising avenues for improving sleep outcomes. However, no intervention effects were found on either insomnia symptoms or actigraphic WASO. It is likely that these aspects of sleep quality are more influenced by changes in individual behaviors, as opposed to changes within the organizational environment, such as through increased control over one's schedule or increases in FSSB. In order to design the most effective and comprehensive work-family intervention, there is a need to consider more complex intervention study designs. Efforts targeting organizational

factors should be coupled with individual-level approaches that address employees' own behaviors affecting sleep. Hammer and Sauter (2013) have called for such integrated work-family Total Worker Health™ interventions that include both health protection and promotion aspects. Poor sleep habits, such as irregular sleep-wake schedules, dysfunctional cognitions, such as worry, and physiological, emotional, and cognitive arousal are the primary factors targeted within clinical insomnia treatments (Bootzin & Epstein, 2013). Thus, these are the types of targets that future health promotion intervention components should seek to address. One potential approach to these individual-level intervention components would be to assess at baseline where improvement is needed (e.g., sleep schedule consistency, length of sleep durations, initiating sleep at night), and then design the sleep promotion component with these needs in mind. Below I describe two potential approaches that could be combined or utilized in isolation.

The sleep hygiene literature may inform future individual-level training components targeting sleep schedules and sleep preparation. Irish, Kline, Gunn, Buysse, and Hall (in press) have noted that research is needed to determine whether sleep hygiene training is effective within non-clinical populations of individuals. These trainings often provide individuals with information around the function of sleep, sleep needs, circadian rhythms, and developmental changes in sleep over the lifespan, that are likely to motivate healthy sleep-related behavior. Furthermore, sleep hygiene training could provide participants with information on those daily behaviors that will lead to improved sleep, such as the avoidance of caffeine, nicotine, alcohol, the reduction of bedroom noise,

techniques for stress management, and the importance of engaging in regular exercise (e.g., Irish, Kline, Gunn, Buysse, & Hall, in press).

Additional individual-level intervention components may target daily and pre-sleep physiological, cognitive, and affective arousal through the use of mindfulness-based stress reduction (MBSR) strategies. Mindfulness has been defined as "a dispassionate, nonevaluative and sustained moment-to-moment awareness of perceptible mental states and processes" (Grossman, Niemann, Schmidt, & Walach, 2004, pp. 36). Mindfulness training can include such components as emotion skills instruction, meditation, stress-reduction practices, and body scans (Roeser, Skinner, Beers, & Jennings, 2012). It has been suggested that mindfulness practices are conducive to attaining adequate and sufficient sleep. Howell, Digdon, and Buro (2010), for example, have found that mindfulness is related to self-regulation of sleep. It may be that mindfulness training sensitizes individuals to bodily cues, which in turn, results in their being able to better engage in self-regulation around meeting physiological needs. Individuals engaging in mindfulness practices may be more likely to respond to their body's need for sleep by creating opportunities for adequate sleep duration. Moreover, mindfulness skills can address rumination, which has been shown to detrimentally impact sleep (Cropley, Dijk, & Stanley, 2006).

General limitations and directions for future work regarding alternative samples and measurement. In addition to those areas for future research noted above relating to each specific study, the larger body of research within this dissertation motivates two additional areas for investigation. These include examination of relationships investigated with hourly, low-wage workers and measurement issues.

These three studies drew on a sample of information technology workers who can be largely classified as professional level employees. Thus, a significant limitation of this research is that it is restricted to a specific sample of workers and questions remain as to whether the results found here would replicate in other occupations and industries. Although deficient sleep is an issue of interest for the population in its entirety, experiences of deficient sleep have been found to be more prevalent for minorities and individuals of low socioeconomic status (e.g., Ertel, Berkman, & Buxton, 2011). Not surprisingly, other research finds that individuals with multiple jobs are less likely to obtain sufficient sleep (e.g., Basner et al., 2014) and the sleep literature has well-established the link between shiftwork and sleep deficiency and disorders (e.g., Smith, Folkard, Tucker, & Evans, 2011). Thus, sleep scholars have pointed to this disparate patterning of sleep between those with socioeconomic advantages and those without as a larger social justice issue (e.g., Hale, 2014).

As a result, future research must address how work, family, and sleep are associated for both professional level and low-wage, hourly workers. For example, individuals who are working multiple jobs or night shifts are not only less likely to obtain sufficient and adequate sleep, but they are also less likely to have adequate time with family. In addition to lack of time, low-wage, hourly workers also face heightened and additional stressors compared to individuals with higher-paying, more secure jobs. The literature on economic stressors may be highly relevant and should be considered within this line of research. For example, individuals providing for their families, but who have low job security or income inadequacy, are likely to experience nighttime worry, which has been associated with deficient sleep (e.g., Harvey, 2000). To this end, there is a need

for future work to examine barriers to being a healthy sleeper for both professional level and low-wage, hourly employees.

The studies involved in this dissertation also point to the need for future focus on measurement issues, not only with regard to sleep, but also concerning longitudinal intervention effects. In both study 1 and study 3, self-report sleep measures asked participants to report on the previous four weeks of sleep while objective measures of sleep were taken the week after the self-report scales were completed. These time frames should be taken into account in future studies. Moreover, actigraphy data collection lasted for one week. It is likely that more reliable estimates of actigraphy could have been obtained, had the measurement window been longer. Another limitation of the current research is that intervention effects on sleep could not be estimated past the 18-month time point. Future research should consider whether such effects are maintained and even investigate potential non-linear trajectories of these effects.

Conclusion

In summary, this research assessed associations among work, family, and sleep using three successive and complementary studies. The work in totality confirms and extends Hobfoll's (1989) COR theory. This research provides a foundation for future work aiming to further understand sleep as both an outcome and predictor, work-family experiences and sleep in samples of low-wage, hourly workers, and organizational interventions targeting sleep as a proximal mediator of more distal long-term health outcomes. Such exploration would serve to benefit organizations, workers, and their families alike.

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