

Organizational and work correlates of sleep

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Abstract

Sleep has been associated with various work and health outcomes. Despite this, only a narrow range of its correlates have been studied in the IO/OB literature. Meanwhile, approximately one-third of adults in the United States have been found to be sleep-deprived, underscoring the importance of investigating potential correlates from multiple perspectives, one of which is the work context. To begin to address this issue, the current series of studies investigated a greater range of characteristics of the work context associated with sleep than has previously been studied, as well as develop a construct that pertains to the attitudes toward, and practices regarding, sleep. In Study 1, the construct of *sleep climate* was introduced to represent characteristics of the workplace regarding communication about sleep as well as practices, expectations, and attitudes that directly target sleep (e.g., education about proper sleep). In a sample of online participants, sleep climate along with other selected work context variables (e.g., climate, job characteristics) were found to correlate with sleep behavior. In Study 2, the malleability of sleep climate was investigated. Among a sample of medical school students, it was found that a workshop designed to teach the negative consequences of poor sleep as well as sleep tips positively altered sleep climate perceptions of participants. Furthermore, this change was accompanied by positive changes in sleep quality and quantity. In Study 3, agreement of sleep climate perceptions within workplaces was investigated. Among medical residents, membership in residency programs and learning sites was a significant source of variance in sleep climate perception. Agreement indices also suggested that the level of agreement on sleep climate perception of individuals at a given workplace is comparable to level of agreement on other work context variables such as general climate

and job characteristics. In addition, relationships between these work context variables and sleep that were found in Study 1 were largely replicated. Implications of these findings are discussed, along with practical recommendations.

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Introduction

The current series of studies seeks to investigate work context characteristics that impact sleep, primarily focusing on developing the construct of *sleep climate* and its characteristics. Despite known health and national-scale financial consequences linked to sleep deprivation, over one-third of adults in the United States fail to follow the seven-hours-per-day sleep recommendation by the American Academy of Sleep Medicine and Sleep Research Society (Consensus Conference Panel et al., 2015; Liu et al., 2016). Understanding the antecedents of sleep is critical in improving this state of large-scale sleep deprivation. Unfortunately, IO/OB research on sleep has focused largely on the workplace consequences of sleep, with much less attention devoted to the determinants of workers sleep quality and quantity. Moreover, studies on antecedents of sleep thus far have largely focused on individual-level characteristics of people that have been known to be relatively difficult to modify (e.g., personality), or a narrow range of work characteristics. Thus, the current series of studies will attempt to uncover a broader range of characteristics of work and organizations associated with sleep as well as develop the construct of sleep climate, which may be useful in improving sleep habits of working adults in the long term.

The contribution of the current studies are as follows. First, I will develop a construct that represents an organization or its subunit's attitude toward and practices regarding sleep, as well as develop and validate a measure of this construct. Second, I will elucidate a range of organizational and workplace properties that are associated with sleep behaviors of organizational members. Together, these will serve as a starting point for developing workplace interventions to create an environment that helps improve sleep

behaviors of individuals, and in the long run alleviate the problem of sleep deprivation that is prevalent in the US workforce.

In the current manuscript, I will first review the studies on sleep – how it has been operationalized in the organizational sciences, relationships with work outcomes, and major correlates that have been found in areas outside of IO/OB. Second, I will present a model of how the work context can impact sleep. Third, I will review two major areas of research of work context variables—organizational climate and job characteristics—to provide support for the aforementioned model. Here, I will also discuss the construct of sleep climate. Fourth, I will discuss some methodological and conceptual issues associated with work construct variables that are important to consider when examining their relationships with sleep. Fifth, I will describe the methods of the series of studies to be conducted to investigate the construct space of sleep climate as well as examine the relationship between various work context characteristics and sleep, then report the findings of the preliminary studies. Finally, I will discuss the limitations and implications of the studies.

Sleep

Sleep in the workplace

There is no doubt that sleep is an important activity. In addition to it consuming a substantial portion of our lives, it has implications for a multitude of human health and functioning issues. Studies have found links between sleep deprivation and: obesity (Beccuti & Pannain, 2011), diabete, immunity (Irwin, 2002), hypertension (Wang et al., 2012), sexual activity (Kalmbach et al., 2015), and mental health (Alvaro et al., 2013). Of more interest to organizational researchers, meta-analyses have shown relationships

between sleep deprivation and cognition (Lim & Dinges, 2010) as well as motor performance (Pilcher & Huffcutt, 1996). Meanwhile, more than one-third of adults in the United States have been found to sleep less than seven hours per night regularly (Liu et al., 2016), which is the recommended sleep duration for optimal health and well-being (Consensus Conference Panel et al., 2015). Additionally, it has been reported that individuals who sleep less than six hours per night experience a 2.4 percent productivity loss on average; it has been estimated that this translates to a \$411 billion economic loss annually for the United States (Hafner et al., 2016). These numbers underscore the importance of studying sleep in the context of organizational science.

Sleep has been operationalized in two major ways in organizational research. The first is sleep *quantity*, or how *long* an individual has slept. The second is sleep *quality*, which is a summary term used to describe how *well* an individual has slept, indicated by difficulty of sleep onset, number of awakenings during the night, not feeling recovered upon waking, and lacking alertness the next day (Barnes, 2012; Harvey et al., 2008). A definite answer has not been given to the question of why we sleep, although some hypotheses have been provided, such as repairing free-radical damage that has occurred during waking, and maintaining neurotransmitter receptor sensitivity (Siegel, 2003). Therefore, it can be reasoned that sleep quantity is important in that there must be sufficient time for these processes to take place. Meanwhile, after sleep onset, individuals cycle through REM and non-REM sleep stages, with the REM sleep cycle length being 90 minutes for humans (McCarley, 2007). Lack of sleep quality (e.g., frequent waking throughout the night) is thought to have an effect on health outcomes because this sleep cycle is disrupted (Barnes, 2012). Meta-analytic correlation between the two measures of

sleep are fairly small ($\rho = .16$; Litwiller, Snyder, Taylor, & Steele, 2017), suggesting the need to include both variables in sleep studies.

Although sleep has not been widely studied as a dependent variable in organizational sciences, a recent meta-analysis provides an array of correlates in the context of work. (Litwiller et al., 2017) found sleep quality to be associated with job engagement ($\rho = .22$), job satisfaction ($\rho = .20$), work–family conflict ($\rho = -.28$), task performance ($\rho = .17$), and contextual performance ($\rho = .05$). To a lesser extent, sleep quantity was also associated with job engagement ($\rho = .03$), job satisfaction ($\rho = .16$), and work–family conflict ($\rho = -.15$). These findings provide additional support for the notion that sleep plays an important role in the workplace, and that studying its antecedents would be instrumental in the development of ways to improve sleep of individuals in organizations, which in the long run may lead to improvements in associated work outcomes.

Correlates of sleep

Studies have examined several groups of individual-level correlates of sleep. The first group is personality traits. Meta-analytic evidence suggests trait negative affectivity as a major correlate ($\rho = -.30$ for sleep quality and $-.17$ for sleep quantity; (Litwiller et al., 2017). This relationship may be due to the format of the measures of sleep quality; subjective measures of sleep quality are prevalent, and the level of positive or negative affectivity of individuals could color the way they perceive their sleep quality, regardless of objective levels of sleep quality. Sleep quality does indeed encompass *perceptions* of fatigue and restfulness upon waking and throughout the day in addition to number of awakenings during the night (Harvey et al., 2008), so the overlap between sleep quality

and negative affectivity is to be expected. Aside from negative affectivity, primary studies have found the higher domain trait of neuroticism, as well as conscientiousness, to be associated with sleep quality and sleep hygiene (Duggan et al., 2014; Gray & Watson, 2002).

The second group of correlates is stress and negative affect. Stress encompasses emotionally challenging experiences and strain, and negative affect has often been conceptualized as one of the responses to stress (McEwen, 2007; Scheck et al., 1997); thus, these correlates are grouped together here. A review of affect and sleep suggests that they have a bidirectional relationship; specifically, negative affect such as sadness and anger have been associated with poor sleep (Kahn et al., 2013). Additionally, a recent study suggested daily negative affect as a stronger predictor of sleep quality relative to neuroticism (Slavish et al., 2018). Although the effect of positive affect on sleep has not been studied extensively, a recent study suggests that positive affect is a positive predictor of sleep quality (Cellini et al., 2017). A couple of reviews support the notion that stress is also negatively related to sleep (Åkerstedt, 2006; Kim & Dimsdale, 2007). Notably, studies on work context correlates of sleep seem to focus on stress as a mediator, as will be discussed later.

The third correlate that has been studied is circadian rhythm. Circadian rhythm is the 24-hour periodic cycle at which many common biological variables, such as body temperature and heart rate, ebb and flow (Smith et al., 1989). Studies have suggested that individual differences in circadian rhythm, such as morning vs. evening preference and stability of cycles, are associated with sleep (Di Milia et al., 2005; Önder et al., 2014; Taillard et al., 2002).

The fourth group of correlates is sleep hygiene behaviors — a variety of practices that optimize sleep (National Sleep Foundation, n.d.). Examples include avoiding caffeine and alcohol consumption shortly before bedtime, exercising, and having a consistent sleep schedule. Although consistent support is available for the positive effect of exercise on sleep for healthy and insomniac individuals (Hargens et al., 2013), empirical support for the effectiveness of other behaviors on sleep is mixed, with sample characteristics such as the presence of insomnia or dependence on substances (e.g., caffeine, alcohol, nicotine) complicating the issue (Irish et al., 2015).

Finally, a few studies have investigated psychological variables pertaining to the motivation to sleep. Loft and Cameron (2014) found that prioritization of sleep over other activities and perceived importance of sleep were associated with both sleep quality and quantity. Additionally, Tagler, Stanko, and Forbey (2017) investigated whether the reasoned action model (RAM; Fishbein & Ajzen, 2010) applies to sleep. The reasoned action model posits that the intention to engage in behavior is predicted by three things: attitude toward engaging in the behavior, perceived normative pressure, and perceived behavioral control (Fishbein, 2008). Tagler et al., (2017) found that all three components of the RAM positively predicted intention to sleep for a given amount of time, which in turn predicted sleep quantity. Taken together, these findings suggest that drivers of sleep motivation are important in exploring avenues to improve sleep behavior of individuals in the workplace.

With regards to work context characteristics, meta-analytic evidence shows that work load is negatively associated with both sleep quality ($\rho = -.16$) and quantity ($\rho = -.10$), hours worked per week is negatively associated with quantity ($\rho = -.31$), and

perceived control is positively associated with both quality ($\rho = .19$) and quantity ($\rho = .06$; Litwiller et al., 2017). More recent studies also suggest that job control and demands are associated with sleep (Parkes, 2017; Törnroos et al., 2017). Many of these studies conceptualize features of the work context within the Job Demands Control (JD-C) model (R. A. Karasek, 1979) or expansions of this model. Reflecting this, work context characteristics studied in relation to sleep are often classified as a) demands or stressors, that cause strain on workers, or b) control or resources, that help individuals deal with these demands. In addition, the range of specific work context characteristics that have been examined as correlates of sleep have been rather narrow, being limited to those included in popular measures of job demands and resources, such as those in the Job Content Questionnaire (decision latitude, psychological demands, social support, physical demands, job security; Karasek et al., 1998).

Why study work context correlates of sleep?

There are several reasons a more thorough investigation of work context correlates of sleep may be beneficial, particularly from the perspective of developing interventions to improve sleep behaviors of working adults. First, it remains unclear how malleable some of the individual correlates of sleep are. For example, a group of traits associated with bed and wake times is the big five personality traits (Gray & Watson, 2002). Although there is meta-analytic evidence that supports the malleability of personality traits through intervention (Roberts et al., 2017), feasibility and effect size of such interventions remain unclear. This meta-analysis suggests that interventions are capable of changing levels of big five personality traits, but does not provide a detailed breakdown of effect sizes by big five domains within non-clinical samples other than

emotional stability. Effect sizes were indeed substantial for emotional stability (overall $d = .35$ in nonclinical treatment samples). However, the extent to which interventions are effective for other traits in non-clinical settings remains unclear. Studies with student samples suggest that conscientiousness affects sleep behaviors just as much as emotional stability (Duggan et al., 2014; Gray & Watson, 2002), leaving further research on the effectiveness of interventions especially on this trait to be desired.

Regarding circadian rhythm, studies have suggested biological bases between individuals that lead to differences in sleep-wake cycles (Archer et al., 2003; Toh et al., 2001). This means that some people are naturally more prone than others to go to sleep and get up earlier or later than others. This is not to say that these rhythms and morning-preference cannot be altered; a comparison between university students and workers with a morning work schedule who were matched for age suggests that morning preference and sleep habits may be influenced by lifestyle (Mecacci & Zani, 1983). Thus, attempts could be made to modify individual sleep-wake cycles to fit work cycles. However, such interventions could induce problems associated with sleep deprivation due to the discrepancy between individuals' natural and the work-enforced sleep-wake cycle, at least initially (e.g., Eckel et al., 2015). In such cases, it is ideal that organizational characteristics that positively impact sleep are in place to alleviate the negative effects of externally forced sleep-wake cycle changes.

Second, individual-level correlates of sleep may be affected by the work context. That is, while it may be the case that individual-level variables such as sleep hygiene or sleep motivation are the most proximal determinant of sleep behavior, these variables may be affected by the work context. For example, high workload, tight deadlines, and

negative interactions with coworkers can cause high levels of stress that in turn lead to sleep disturbances, even for individuals who experience relatively little stress in other life domains. Conversely, aspects of the work context may motivate individuals to have better sleep habits. There has not been much research on work context characteristics that relate positively to sleep, aside from a study on sleep leadership (Gunia et al., 2015). If we were to make an assumption that the work context influences individuals-level antecedents of sleep, further research on such influences may contribute to the improvement of sleep of working adults.

Third, many work context correlates that have been studied thus far are not very amenable to changes. For example, two of the three major correlates identified in the Litwiller et al. (2017), workload and hours worked per week, cannot easily be altered by the organization because those variables largely depend on external factors such as demand for the organization's products and services. And if these factors were to be altered with increased personnel, it comes at a high cost for the organization. Furthermore, results of the 2008 Sleep in America Poll showed that 87% of the respondents' work schedule allowed time for enough sleep; despite this, the mean reported hours of sleep per night was 6 hours and 40 minutes against the 7 hours and 18 minutes that respondents reported were needed to function at their best (National Sleep Foundation, 2008). This suggests that reducing work time may have limited impact on the amount of sleep that workers get, and rather, workers may need a boost in *motivation* to sleep more. The definition and components of motivation will be discussed further in a later section, but here, I use motivation as a summary term encompassing the confidence, commitment, value, and intention placed on a specific behavior. Another major

characteristic found to impact sleep through a large-scale poll is shift work (National Sleep Foundation, 2008). Some businesses require 24-hour operation and therefore must incorporate various shifts to accommodate this. In contrast, the other major correlate found in Litwiller et al. (2017), perceived control, is a rather malleable job characteristic and could be altered through intervention; for example, Bond and Bunce (2001) showed that giving employees opportunities to ask for performance feedback increased perceptions of job control.

Fourth, research on work context correlates of sleep have largely ignored the broader range of organizational and job characteristics other than the ones often covered in the JD-C (R. A. Karasek, 1979) and related models. That is, past research on the work context correlates of sleep have focused on how these variables impact sleep through their effects on stress. However, as discussed before, there are other individual-level correlates of sleep, such as affect and motivators of sleep. These may serve as additional pathways through which the work context impacts sleep. The organizational sciences literature is rich with research on features of the work environment other than job demands and control, such as organizational climate (Carr et al., 2003) and various job and work characteristics in the job design literature (Humphrey et al., 2007). Because research has shown that these features of the organization or job have impact on individual work-related outcomes, they may affect sleep through the mediating pathways mentioned above.

In summary, research on work context characteristics that impact sleep is scarce, despite the large body of research on job and organizational variables that impact individual behavior. Uncovering a broader range of organizational characteristics

associated with sleep will help develop actionable steps to improve sleep of individuals from an organizational level, not only improving the health of organizational members, but also potentially leading to increased productivity and other economic benefits for the organization. In the current study, I would like to develop the construct of sleep climate, as well as explore what specific variables within the organizational climate and job characteristics literatures impact sleep behavior of organizational members.

How work context characteristics can influence sleep

For the work context to influence sleep of individual organizational members, it will likely first have to influence one or more of the individual correlates of sleep, because sleep is an individual-level phenomenon. Examination of the individual correlates of sleep suggests that there are two broad pathways between the work context and sleep: the affective/stress pathway and the cognitive pathway. This follows from the idea that the effects of personality, circadian rhythm and preference, and sleep hygiene on sleep will either precede or succeed the effects of affect/stress or motivation to sleep. For example, the personality trait of neuroticism is likely to affect sleep through negative affect, and circadian rhythm attuned to later times of day is likely to lead to lower motivation to go to bed at an early time. An exception to the mediating effect of individual characteristics is that the work context may directly place temporal constraints on the quantity of sleep, such as when a job has an early start time (e.g., 6 am) and a late end time (e.g., 11pm). In this scenario, workers are unlikely to get more than approximately 6 hours of sleep, regardless of stress level or motivation to get a lot of sleep. Therefore, in such cases the work context may influence sleep of individuals without affecting the individual correlates of sleep. To summarize, the work context can

influence sleep of organizational members through three pathways: temporal constraint, affective/stress, and cognitive (Figure 1). This affective/stress and cognitive classification of work context correlates of sleep is similar to the model presented by (Kopelman et al., 1990), which depicted how organizational climate influences productivity through affective and cognitive pathways. As such, the mechanisms discussed here can be thought of as an expansion to their model.

Temporal constraints

The mechanism of the first pathway, temporal constraint, is quite intuitive: people have more time to sleep under short work hours and low workload, and have less time to sleep under long work hours and high workload. Studies support this notion (Barnes et al., 2012; Basner et al., 2007). However, a large majority (87%) of respondents of a national sleep poll also responded that their work schedule allows time for enough sleep, despite their mean hours of sleep being lower than the ideal hours of sleep to function well during the day (National Sleep Foundation, 2008). This underscores the importance of considering other aspects of the work context that affect sleep.

Affective pathway

The mechanism of the affective pathway is also straightforward. Factors in the work environment cause negative affect or stress, and these in turn influence sleep. As stated before, many existing studies on the effects of work-related variables on sleep are based on the proposition of the JD-C (R. A. Karasek, 1979) model, or its derivations, such as the Job Demands-Resources (JD-R; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001). These models categorize features of the job into two: job demands—features of the job that trigger mental or physical effort and thus cause stress in workers, such as

workload and time pressure, and job resources—features of the job that aid the attainment of work goals, alleviate job demands and its negative consequences, or facilitate personal growth and development (Demerouti et al., 2001). Thus, one of the propositions of these models is that job demands can place workers under stress. Based on findings that negative affect and stress correlate with sleep (Åkerstedt, 2006; Kahn et al., 2013; Kim & Dimsdale, 2007), it can be hypothesized that work context characteristics that are categorized as job demands may affect sleep through its effects on stress and negative affect. In addition, the Affective Events Theory (AET; Weiss & Cropanzano, 1996) posits that individuals experience positive or negative events throughout the workday, which in turn induces affect consistent with the affective tone of these events. Thus, certain work environments can be thought to possess features that make it likely for certain affect-inducing events to happen more than others. Such differences may lead to differences in sleep between members in different work environments.

The affective pathway is expected to impact sleep quality more than quantity. Physiological stress responses such as abnormal hormone secretion, increased heart rate, and arousal (M. H. Bonnet & Arand, 1995), is likely to delay sleep onset, fragment sleep, and as a consequence, decrease sense of well-restedness upon waking, all of which are components of sleep quality (Barnes, 2012). Sleep quantity may also be affected to the extent that being unable to fall asleep immediately or waking up frequently during the night will slightly reduce the total duration of sleep.

Cognitive pathway

The cognitive pathway is more complicated than the affective pathway, because two mechanisms may be at play. The first pertains to motivation to engage in sleep

behaviors. Motivation has been defined as psychological drivers of direction, intensity, and persistence of behavior (Kanfer, 1990). Consistent with definition, I define sleep motivation as a sum of psychological forces that drive individuals to sleep. Theories of motivation suggest that there is a multitude of variables that could be considered components of such internal forces, such as valence and self-efficacy. Two of the most widely studied theories of motivation are the VIE theory (Vroom, 1964) and Social Cognitive Theory (Bandura, 1986). The VIE model posits that motivation to engage in behavior is a function of expectancy—the perceived likelihood that an action will lead to a given outcome, valence—the overall subjective attractiveness of the outcome, and instrumentality—the strength of association between the outcome and other outcomes (Vroom, 1964). The relationship between these motivational components and outcomes have been supported in a meta-analysis, with relationships being particularly strong for the outcome of behavioral intentions (Van Eerde & Thierry, 1996). Characteristics of the work environment that can affect these components with regards to sleep. For example, perception of norms regarding sleep may influence the valence of having certain sleep habits to fit in with others, the perception that individuals who have certain sleep habits perform very well on the job may increase the instrumentality of sleep, and appropriate workload may increase the expectancy of being able to obtain a sufficient amount of sleep.

Meanwhile, one of the tenets of Social Cognitive Theory is that self-efficacy is a major driver of behavior; higher the belief that one has in carrying out behaviors to attain desired outcomes, the more likely that this individual will engage in these behaviors (Bandura & Locke, 2003). Some of the proposed determinants of self-efficacy are

education, training, and observation of others; these have been found to relate to self-efficacy in the context of work (Saks, 1995; P. J. Taylor et al., 2005). Therefore, education and training on healthy sleep behaviors or the presence of individuals who engage in such behaviors can be thought to positively influence the self-efficacy of individuals in this work environment to have good sleep habits.

The second mechanism in the cognitive pathway pertains to preoccupation with work during non-work times. There are attributes of the organization or the job that make it difficult for individuals to distance themselves from thoughts about work, which in turn may interfere with sleep. Multiple studies have found that the (in)ability to psychologically detach from work is associated with sleep (Sonnentag et al., 2008; Syrek et al., 2017). Specifically, Sonnentag et al. (2008) found that there is a positive within-person relationship between psychological detachment from work, defined as being both physically away and not thinking about work, and sleep quality. On the other hand, Syrek et al. (2017) found a within-person positive relationship between affective rumination and sleep impairment. Affective rumination was described as the negative affective reaction to the inability to detach from work, and thus includes both cognitive and affective components (Cropley et al., 2012). Importantly, these findings suggest that not only the negative reaction to thoughts about work, but the mere thought of work, can negatively impact work. Thus, characteristics of work that make it difficult for individuals to stop thinking about work, such as uncertainty surrounding work conditions and coworkers, an upcoming important event, or a complex project may impact sleep through this mechanism of preoccupation.

The relative effect of work context characteristics on sleep quality and quantity is expected to differ depending on the mechanism involved. When the motivational mechanism is at play, the relative effects on sleep quality and quantity are not readily clear. On the one hand, high motivation as well as self-efficacy to sleep, along with the knowledge of the benefits of sleep (and the harm of sleep deprivation) may lead individuals to prioritize sleep over other activities, resulting in higher sleep quantity. On the other hand, the primary effect on sleep may be that individuals engage in good sleep hygiene behaviors, which improves their sleep quality, while slightly increasing sleep quantity as a secondary effect. When the preoccupation mechanism is at play, the effect on sleep quality is expected to be larger compared to the effect on sleep quantity. This is similar to effects through the affective pathway, in that the effects will be more indirect for quantity. That is, being preoccupied with thoughts about work is primarily expected to delay sleep onset or wake up individuals at night, decreasing sleep quality. Although accumulation of such sleep delays or fragmentations can lead to reduction in overall sleep quantity, this is more likely to be an indirect effect of decreased sleep quality.

Interplay among the three pathways

It is important to note that these pathways are likely not completely independent of one another. First, they can work sequentially. For example, a sleep education workshop at work may increase one's motivation to have better sleep hygiene (cognitive pathway), one of which is to engage in a relaxing ritual before bed. Engaging in this ritual, in turn, may alleviate negative affect and stress, leading to better or longer sleep (affective/stress pathway). Second, these pathways could function in tandem through an interaction effect. For example, there could be an interaction between the cognitive

pathway and temporal constraint such that having a high motivation to obtain longer sleep would only lead to longer sleep for those without temporal constraints. Another example is an interaction between temporal constraint and negative affect/stress, wherein the negative effect of workload on sleep quantity is stronger for those who are more strongly affected by stress and thus require a longer time to complete work tasks, placing a stronger constraint on time available for sleep. Finally, the preoccupation aspect of the cognitive pathway overlaps with the affective pathway. As described above, affective rumination regarding work has an affective component, since it pertains to a negative affective reaction to the thought of work (Cropley et al., 2012). This makes it difficult to place it exclusively in only one of the pathways, but here I have placed it in the cognitive pathway, because it is strongly related to psychological detachment, which is the other type of (lack of) preoccupation with work.

In summary, there are three major ways in which the work context can influence sleep of organizational members: by influencing the amount of time that can be allocated to sleep, by influencing affect and stress, and by influencing sleep motivation and cognitive preoccupation with work. Next, I turn to the two broad categories of work context characteristics, organizational climate and job characteristics, and review the research regarding the relationship between these constructs and individual outcomes as well as discuss more in depth how they may impact sleep.

Organizational Climate

What is climate?

One potential organizational characteristic that may impact sleep of members is organizational climate. Organizational climate has been defined in a number of ways in

the literature (Verbeke et al., 1998), but generally concerns the experience and perception of situations in the organizational context by organizational members (Ostroff et al., 2013). There has been much debate about what constitutes organizational climate; many reviews discuss issues regarding the construct space of climate and its measurement, with still no consensus having been made (e.g., James & Jones, 1974; Ostroff et al., 2013; Schneider, Ehrhart, & Macey, 2013; Zohar & Hofmann, 2012). For now, I will adopt Ostroff et al. (2013) definition of climate: “*Climate is an experientially-based description of what people ‘see’ and report happening to them in an organizational situation*” (p. 644). This definition does not specify the level of organization at which climate exists; it could be at the organization-wide, branch, department, work group, or even at the individual level. For the sake of simplicity, I will use the term “organization/organizational” to refer to all of these except the individual level for the following discussion. Lack of consensus about the definition aside, with the amount of evidence showing that various organizational characteristics subsumed under the term “climate” impact individual outcomes (e.g., Carr et al., 2003), it is worthwhile to investigate the influence these characteristics have on sleep behaviors of organizational members. To this end, I would like to discuss how climate could impact sleep behaviors and propose the construct of “sleep climate”.

How would climate impact sleep?

There is ample research that supports the effects of climate on work outcomes. To consider whether this effect of climate can be generalized to sleep behaviors, it is useful to examine the mechanism through which climate influences behavior, because the mechanism at play may differ depending on the type of climate and outcome. Types of

climate that have been studied can be largely divided into two categories: molar climate and strategic climate. Molar, or generic climate dimensions, are broad climate dimensions that represent aspects of the organization that are important for organizational members and also are relevant across organizations (Ostroff et al., 2013). On the other hand, strategic climate is a climate with a specific target dependent variable or referent, and is often conceptualized as “a climate for —” (Ostroff et al., 2013). With this distinction in mind, I will discuss how climate may impact sleep, reviewing research on the mediators of the climate – behavior relationship.

Of the three pathways between the work context and sleep behavior, the affective/stress and cognitive pathways are relevant to climate. The Kopelman et al. (1990) model is useful in explaining how climate affects sleep, as it explains climate’s influence on behaviors through individuals’ cognitive and affective states. Cognitive states in the model refer to sources of motivation that were discussed before: valence, instrumentality, expectancy, and self-efficacy, which are elements of the VIE model (Vroom, 1964) and Social Cognitive Theory (Bandura, 1986). Meanwhile, affective state refers to job satisfaction. Although job satisfaction is regarded as a summary evaluation of the job consisting of both cognitive and affective components (Dalal, 2012), considering the bidirectional relationship found between job satisfaction and affect (Judge & Ilies, 2004), it is reasonable to label job satisfaction as an affective state. Thus, the basic logic of this model is that climate influences behaviors through two pathways: motivational components and job satisfaction. The affective (job satisfaction) pathway is relevant for both types of climate (molar and strategic) and the cognitive (motivational) pathway is more relevant to strategic climate, as will be explained in further detail.

Additionally, it is important to note that the behaviors assumed to be affected by climate in this model are attachment, task performance, and citizenship behaviors, all of which are directly relevant to the work context. Furthermore, the climate dimensions included in the model are goal emphasis, means emphasis, reward orientation, task support, and socioemotional support, most of which pertain to task performance. In summary, this model depicts the influence of *work-related* climate dimensions on *work-related* behaviors. Because sleep is commonly considered a non-work behavior, it is not readily clear how this model may apply to sleep. Thus, further examination of the two mechanisms is required.

The affective pathway is relevant for both general and strategic climate targeting sleep, because organizational members can react to these climates in affect-laden ways. In this pathway, the link from climate to satisfaction is relatively straightforward, because it is understandable that people would like or dislike certain aspects of their work environment, which will collectively contribute to how much they are satisfied with their job. On the other hand, how job satisfaction leads to better sleep requires deeper thought. In the Kopelman et al. (1990) model, the authors appear to suggest a direct effect of satisfaction on performance. This is the Model 1 case discussed by Judge, Thoresen, Bono, and Patton (2001). Judge et al. (2001) explained the reasoning behind this case by citing (Eagly & Chaiken, 1993), which posited that people who have favorable attitudes toward a target tend to reciprocate by engaging in behaviors that benefit the target. In the context of work, this means that individuals who have high job satisfaction are more likely to engage in behaviors that contribute to organizational goals such as task performance and citizenship behaviors or are less likely to quit their job compared to

those with low satisfaction. Through this mechanism, it is *not* likely that climate will affect sleep behavior because sleep is often not considered behavior that benefits an organization. However, to the extent that organizational members understand that better sleep does in fact benefit the organization (e.g., through its effects on performance), climate emphasizing sleep could influence sleep behaviors of members through this affective pathway.

Affect can also mediate the climate-behavior relationship without involving reciprocation. As discussed before, negative affect and stress have been found to correlate negatively with sleep (Kahn et al., 2013; Kim & Dimsdale, 2007). Although the specific mechanism through which negative affect and stress affects sleep remains unclear, in the case of insomnia, physiological responses such as abnormal hormone secretion and increases in body and brain metabolic activation, heart rate, and sympathetic nervous system activation is thought to be involved (Michael H. Bonnet & Arand, 2010). These effects can co-occur under conditions that elicit low job satisfaction in individuals, or even independent of job satisfaction. For example, in a workplace characterized by climate dimensions of low supervisory support and high pressure to produce, a supervisor may assign his subordinate a large amount of work without sufficient advice or time, and also criticize the subordinate harshly for not completing the work in a given span of time. Such events could cause negative affect and stress for this subordinate, which in turn may cause poor sleep. However, this worker may also be highly satisfied in the job, because of interest in the tasks or positive relationships with other coworkers. Thus, it is possible that there is an affective pathway that does not involve the reciprocating effects of job satisfaction.

Two meta-analyses have provided support for the mediating effects of job satisfaction between climate and behavior. The first, Carr et al. (2003), explicitly tested the Kopelman et al. (1990) model. The effects of climate as categorized by Ostroff (1993) on job performance, psychological well-being, and withdrawal were examined, along with the mediating effects of job satisfaction and organizational commitment. Overall, the results supported this mediational hypothesis in which job satisfaction and organizational commitment mediate the climate–outcome relationships.

The other meta-analysis that examined the mediating effect of affect on the climate–work outcome relationships is Parker et al. (2003). The largest difference between this study and Carr et al. (2003) is the former’s focus on the general factor of psychological climate (PCg; L. A. James & James, 1989). PCg was defined by L. A. James and James (1989) as the general factor underlying various psychological climate dimensions. This general factor was posited to reflect the cognitive appraisal of how much certain aspects of the organization is beneficial or detrimental to the perceiver’s well-being. Simply put, this general factor reflects how positively or negatively the respondent thinks about the organization. Data showed good fit with a path model in which PCg influenced job satisfaction and work attitudes (which included job involvement and commitment), which in turn led to motivation and work performance, supporting the mediating effect of job satisfaction in the climate–performance relationship.

Hypotheses

The Carr et al. (2003) and Parker et al. (2003) studies provide preliminary support for the affective pathway between climate and behavior. Thus, I hypothesize that climate

dimensions that induce positive and negative affect will correlate positively and negatively with sleep quality, respectively. In developing more specific hypotheses, specific climate dimensions must be determined. The issue here is that researchers have developed countless dimensions that are not consistent across measures, without theoretically-derived inclusion criteria (Zohar & Hofmann, 2012). For the current manuscript, I will use the climate dimensions in the Organizational Climate Measure (OCM; Patterson et al., 2005), summarized in Table 1. The reason for choosing this measure is because it is based on the Competing Values Framework (Quinn & Rohrbaugh, 1983) which covers a wide range of organizational characteristics that contribute to productivity that are relevant across organizations, and has been validated on a relatively large sample size of 6,689 employees across 49 organizations (Patterson et al., 2005).

Of the 17 dimensions featured in the measure, I will focus on 12. These 12 dimensions are autonomy, supervisory support, welfare, formalization, tradition, innovation & flexibility, outward focus, reflexivity, efficiency, effort, pressure to produce, and quality. The remaining five dimensions were not selected because of similarity with other OCM dimensions or with job characteristics (e.g., involvement similar to decision-making autonomy) or lack of clear linkage with sleep (e.g., clarity of organizational goals). Brief descriptions of each are summarized in Table 1. As discussed before, effects on sleep through the affective/stress pathway is expected to be stronger for sleep quality compared to quantity. Autonomy, innovation & flexibility, reflexivity, and efficiency are expected to relate positively to sleep, because having higher control over your work-related decisions, and being able to alter aspects of the job to be more

productive or efficient, are likely to lead to lower frustration, leading to better sleep. For similar reasons, formalization and tradition are expected to relate negatively to sleep, because high levels of these dimensions place constraints on how work is carried out regardless of how (in)efficient established procedures are, potentially leading to high frustration. Supervisory support and welfare are expected to relate positively to sleep because the feeling of being valued by your supervisor and the organization should induce positive affect. In addition, organizations with high supervisory support and welfare are expected to have fewer negative human interactions, reducing the number of negative affective events, which may translate to better sleep. Pressure to produce is likely to relate negatively to sleep. Constant push to meet high targets, high workload, and fast pace of work is likely to place strain on organizational members, which in turn is likely to lead to poor sleep. In summary,

Hypothesis 1: Sleep quality and quantity will relate to the OCM dimensions (direction of relationship) (a) Autonomy (+), (b) Innovation & Flexibility (+), (c) Reflexivity (+), (d)Efficiency (+), (e) Formalization (-), (f) Tradition (-), (g) Supervisory support (+), (h) Welfare (+), and Pressure to produce (-). The relationship will be stronger for sleep quality than quantity.

The direction of the relationships between sleep and outward focus, effort, and quality is not readily clear. On the one hand, these dimensions can relate positively to

sleep because organizational members may get happiness out of serving customers well, working to the best of their abilities, and delivering high-quality service or products. On the other hand, emphasis on these outcomes and high effort may be accompanied with extra burden imposed on organizational members in the form of high workload or work pace, which may be stressful. Thus, I leave the relationship between these dimensions of climate and sleep open as research questions.

Research question 1: What is the direction of relationship between the OCM dimensions (a) Outward focus, (b) Effort, and (c) Quality and sleep quality and quantity?

Finally, the relationships between molar climate dimensions and sleep is expected to occur through the affective mechanism.

Hypothesis 1j: The relationship between molar climate dimensions (OCM) and sleep quality/quantity will be mediated by affect.

Strategic climate

Carr et al. (2003) and Parker et al. (2003) meta-analyses studied climate dimensions that are broad in scope, and the work outcomes examined were domain-general (performance, psychological well-being, and withdrawal), providing support for the effects of broad climate dimensions on general work outcomes. However, because sleep is a very specific category of behavior that is generally considered to be unrelated

to work, the degree to which the effects of climate extend to sleep remains unclear. Thus, it is useful to also review the research on climates targeted at specific outcomes.

Schneider (1975) argued that when the purpose of research is to investigate the effects of climate on specific outcomes, the dimensions of climate should reflect the outcomes that they try to predict; that is, he proposed that climate should have some target behavior as a “climate for–”. This thought has been echoed by Zohar and Hofmann (2012) which also proposed that climate research should set clear boundaries for what should and should not be included in a given climate perception, and that strategic climate is an approach consistent with this idea. Research on such *strategic*, or *focused*, climate has grown since Schneider (1975). To date, many climates with varying targets have been studied: climate for safety (Beus et al., 2010; Christian et al., 2009), violence (Kessler et al., 2008), procedural justice (Ehrhart, 2004), and customer service (Schneider et al., 1998).

Essentially, Schneider (1975) argued for the application of bandwidth matching to climate research. As Ajzen and Fishbein (1977) demonstrated, predictor-criterion relationships are strengthened when the two variables are matched for target, action, context, and time. This effect of bandwidth matching is to be expected in climate – behavior relationships as well. Strengthening of the climate – outcome relationships is expected to occur because of reduction in what Schneider (1975) labeled the “level of abstraction”. That is, individuals evaluating the climate is required to make less inference when asked about specific practices and procedures that pertain to a focal outcome variable, compared to when being asked about more abstract descriptions. This increases

the reliability of the climate measurement, strengthening its relationship with the target of the strategic climate.

The effect of bandwidth matching regarding strategic climate can also be explained by the cognitive mechanism, as alluded to earlier. One of the mechanisms of the cognitive pathway is that climate affects behavior through drivers of motivation (valence, instrumentality, expectancy, self-efficacy) to engage in that behavior. Strategic climate includes characteristics of the organization that are thought to influence these drivers of motivation to engage in target behaviors that also have relatively little impact on other behaviors. For example, aspects of safety behavior climate, such as praise for engaging in safety behavior or workshops on safety behavior, are likely to increase the perceived value or self-efficacy of engaging in safety behavior, but not other behaviors (e.g., citizenship behavior). Therefore, strategic climate regarding a very specific target (e.g., how much supervisors value and reward safety) should relate stronger to behaviors pertaining to that target (e.g., safety behaviors) compared to behaviors that are not (e.g., citizenship behavior).

Research supports the notion that relationships between strategic climate and its target behavior are stronger compared to those between molar climate dimensions and work behavior. Meta-analyses of molar climate found corrected correlations between climate and performance to be as high as .09 (between affective climate and performance; Carr et al., 2003) or .16 (between leader climate and performance; Parker et al., 2003). Meanwhile, studies of the relationship between strategic climate and target behavior have found stronger relationships. Safety climate has been the most widely studied strategic climate (Beus et al., 2010; Christian et al., 2009; Clarke, 2006). Christian et al. (2009)

found the relationship between safety climate and two indices of safety performance, compliance and participation, to be between .40 and .59, depending on the conceptual level of climate (individual or group) and type of safety behavior (compliance or participation). Beus et al. (2010) suggests that safety climate has far-reaching effects on important outcomes of safety behavior as well, with a finding of $\rho = -.24$ between organizational safety climate and injury.

Studies have also found stronger relationships between other strategic climates and behavior compared to molar climate – performance relationships. Service climate and customer-focused OCB has been found to correlate at .29 (Schneider et al., 2005); procedural justice climate and various forms of OCB correlated at between .25 (with manager-rated conscientiousness) and .59 (with employee-rated helping; Ehrhart, 2004); multiple dimensions of violence climate and CWB correlated between 0 (policies/procedures and physical violence) and -.25 (practices/response and physical violence; Kessler et al., 2008). These findings provide further support for the notion that climate dimensions related to sleep will relate to sleep behavior of organizational members.

Furthermore, Neal and Griffin (2006) demonstrated that the relationship between strategic climate and the climate target is mediated by motivational components regarding the climate target, providing support for the presence of the cognitive pathway. In this study, staff at a hospital were followed for a span of four years, and the changes in safety climate, safety motivation, safety compliance, and safety participation were examined. A lagged effect of group safety climate on subsequent safety motivation of individuals was found, as well as a lagged effect of safety motivation on subsequent

safety participation. Safety motivation was measured with three items: “I feel that it is worthwhile to put in effort to maintain or improve my personal safety”, “I feel that it is important to maintain safety at all times”, “I believe that it is important to reduce the risk of accidents and incidents in the workplace”. These items seem to measure the perceived valence of safety. Because valence is an important driver of motivation according to the VIE model (Vroom, 1964), the findings of this study support the effect of safety climate on safety behavior, mediated by safety motivation. Taken together, studies on strategic climate support the cognitive pathway between climate and very specific classes of behavior, and suggests that climate can influence sleep of organizational members.

A recent study on *health behavior climate* (HBC) provides further support for the notion that climate emphasizing non-work related behaviors may be associated with those behaviors of organizational members (Sonntag & Pundt, 2016). This study developed and validated a measure of health behavior climate — a construct that encompasses three dimensions regarding healthy eating and exercise: values and expectations, organizational practices, and communication. Results indicated that at the individual level of analysis, every dimension of HBC was related with their respective target identity (i.e., exercise identity or healthy eating identity) at between $r = .20$ and $r = .43$. Additionally, all dimensions of HBC regarding healthy eating correlated with the frequency of intake of fruit and vegetables at between $r = .14$ and $r = .22$. Furthermore, the rwg_j (.75 – .82) and ICC1 (.16 – .53) values of the HBC dimensions suggested that there is a fair degree of agreement within organizations and variability between organizations, providing support for HBC as an organizational construct. Because engaging in healthy eating and exercise are normally not considered work-related behaviors, overall, the results of this study

provide further support that the effects of climate are not limited to work-related outcomes.

Sleep Climate

Taken together, the above discussions suggest that the construct of *sleep climate* is conceivable; that is, features of the organization regarding sleep are perceived by individuals in the workplace, and such perceptions may relate to sleep-related outcomes. Barnes and Spreitzer (2015) recommended the cultivation of a similar construct, *sleep culture*, to manage sleep as a strategic resource in organizations. However, to my knowledge, such construct has not been studied empirically. The only study that has examined organizational characteristics that specifically target sleep comes from Gunia et al. (2015), which investigated the effects of *sleep leadership* — a set of behaviors that clarify the relationship between means and goals between sleep, and support healthy sleep behaviors of subordinates — on subordinate sleep in a military context. This study found that sleep leadership was associated with higher quality sleep in subordinates, after controlling for general leadership. I would like to expand on this idea and develop the construct of *sleep climate* to include a wider range of organizational characteristics that target sleep.

The reasons for choosing the construct of climate to achieve this end over culture or leadership are as follows. First, climate is a broad concept that subsumes various practices and behaviors; arguably, leadership is one aspect of climate, as will be discussed below. Therefore, climate is a more appropriate construct to use than leadership when considering a wide range of organizational characteristics regarding sleep. Second, the operational distinction between climate and culture is very muddy despite the

definitional differences. Organizational culture is defined as the “shared basic assumptions, values, and beliefs that characterize” organizations (Schneider et al., 2013, p. 362), and thus it differs from climate definitional perspective. However, in research, the measurement of culture and climate can be very similar. For example, a popular measure of culture, the Denison Organizational Culture Survey (DOCS; Denison & Neale, 1996), includes items that describe practices of an organization such as “Decisions are usually made at the level where the best information is available” and “Different parts of the organization often cooperate to create change”. It is difficult to distinguish the construct measured by these items from constructs measured by climate measures. Additionally, some measures of culture (e.g., O’Reilly, Chatman, & Caldwell, 1991; Wallach, 1983) focus on values, and values are sometimes included as a dimension in measures of climate (e.g., Dedobbeleer & Béland, 1991; Kessler et al., 2008; Sonnentag & Pundt, 2016). Although an argument could be made for the use of culture over climate, I prefer to use climate in this case because of the focus on more tangible aspects of the organization (i.e., practices, policies, procedures, and behaviors).

Content of sleep climate

As Zohar and Hofmann (2012) noted, climate researchers have historically included a very wide range of organizational characteristics, arguably to the point that the construct of climate lost its usefulness. Fortunately, it is possible to narrow down the contents of climate when a target behavior is specified. Looking back at the definition I adopted earlier in this manuscript (Ostroff et al., 2013), climate is conceptualized in terms of perceptions of situations in the organization. Another definition put forth by Schneider et al. (2013), “the shared perceptions of and the meaning attached to policies, practices,

and procedures employees experience and the behaviors they observe getting rewarded and that are supported and expected” (p. 362), also focuses on features that are experienced or observed. Taken together, it is clear that features of the organization to be included must be something that could be perceived or experienced by the organizational members that target sleep. I will review the organizational features (dimensions) included in past measures of strategic climate to identify commonalities among them, and use this as guidance to determine the contents of sleep climate.

Zohar (1980) created one of the first measures of strategic climate. His measure of safety climate had eight dimensions: importance of safety training programs, management attitudes toward safety, effects of safe conduct on promotion, level of risk at work place, effects of required work pace on safety, status of safety officer, effects of safe conduct on social status, and status of safety committee. One may notice that there are overlaps among some of these dimensions in that some focus on an individual’s standing within the organization, and others on organizational practices. These dimensions were not replicated in later studies. Brown and Holmes (1986) extracted two dimensions from the same measure as Zohar (1980): risk perception, management concerns for worker well-being, and management actions for safety. On the other hand, Dedobbeleer and Béland (1991) found two dimensions: management commitment to safety and workers’ involvement to safety. Safety climate measures developed later gravitated toward more parsimonious factor structures similar to these. Neal, Griffin, and Hart (2000) included four dimensions: management values of safety, communication, training on safety, and safety systems (sufficiency of safety equipment and safety procedures). Hofmann, Morgeson, and Gerras (2003) emphasized the rewarding aspect of

climate, including the dimensions of management attitude toward safety, effects of safe behavior on social standing, and safety reward. Zohar updated his measure of safety climate to have a simpler structure in Zohar and Luria (2005). The measure developed in this manuscript included three dimensions: active management practices — practices that pertain to monitoring and controlling safety behaviors, proactive practices — practices that promote learning and improvement of safety behaviors, and declarative action — the communication of the importance of safety. The most parsimonious measure of safety climate was developed and used by Neal and Griffin (2006), which merely measured management values toward safety.

A construct similar to safety climate, psychosocial safety climate, has been developed its own measure by Dollard and Bakker (2010). This measure included four items, each measuring the following: senior management support and commitment for psychosocial safety, management's priority of psychological safety and health over productivity goals, organizational communication, and organizational participation and involvement. Hall, Dollard, and Coward (2010) expanded this measure to twelve items and the data supported a four-factor structure, one for each of the four items in the original Dollard and Bakker (2010) measure.

Schneider et al. (1998) developed the first service climate measure. This measure encompassed four dimensions: global service climate (knowledge and skills of workers to deliver high customer service, level of effort to deliver customer service, recognition and rewards for giving high quality service, service quality, leadership support for service, communication, and resources provided to give high customer service), customer orientation (communication with customers, management commitment), managerial

practices (manager values and commitment), and customer feedback (seeking feedback from customers). This has been the most widely used measure of service climate to date (e.g., Liao & Chuang, 2004; Salvaggio et al., 2007; Walumbwa, Hartnell, & Oke, 2010). Although not used widely, (Dietz et al., 2004) developed their own measure of service climate with two underlying dimensions: branch-targeted and organization-targeted service climate. However, the items pertained to service effort, priority for service, recognizing service, and quick response to customer needs, many of which are included in the Schneider et al. (1998) measure.

The first measure of violence climate was developed by Spector, Coulter, Stockwell, and Matz (2007). Because they based the measure on the safety climate measure, the dimensions were similar to those of widely used safety climate measures: training on violence avoidance, prevention policies and procedures, reporting procedures, management encouragement, expectations, and values. Kessler et al. (2008) updated the measure to include three factors: policies and procedures, training and reporting, and pressure for unsafe practices.

The Organizational Tolerance of Sexual Harassment Scale (OTSHS) developed by Hulin, Fitzgerald, and Drasgow (1996) has been by far the most widely used measure of sexual harassment climate (e.g., Kath, Swody, Magley, Bunk, & Gallus, 2009; Munson, Miner, & Hulin, 2001; Ormerod, Collinsworth, & Perry, 2008). This measure included three dimensions: expected risk for retaliation (norms, expectations), likelihood that harassment allegations would be taken seriously (values, expectations), and likelihood that the harasser would receive meaningful sanctions (expectations, procedures). (Estrada et al., 2011) developed their own measure with two dimensions:

risk for reporting harassment (expectation and comfort of reporting) and seriousness/actions (how seriously the report will be received and the degree of penalty against the offender; expectations and practices).

The strategic climate mostly similar to sleep climate in concept, health behavior climate, has the dimensions of values and expectations (management values toward health behavior as well as norms and expectations within the organization regarding health behavior), organizational practices (training and information provision as well as other organizational practices and procedures that support health behavior), and communication (Sonnetag & Pundt, 2016). Sonnetag & Pundt (2016) replicated these dimensions in three separate samples.

Taken together, there are some common dimensions in these measures of strategic climate that may also apply to sleep. First, many measures include formal policies, practices, and procedures regarding the climate target. In addition to these organizational features being readily perceivable by organizational members, some definitions of climate explicitly limit climate to perception of these features (e.g., Schneider et al., 2013), making this group of organizational features an obvious candidate to include as a dimension of sleep climate. Specific forms of these features include training (e.g., Zohar & Luria, 2005), rewards and punishments (e.g., Hofmann et al., 2003), or other practices that promote or discourage target behavior (e.g., Sonnetag & Pundt, 2016). Applied to the target behavior of sleep, these practices may manifest as education on healthy sleep behaviors, rewarding systems for workers who sleep well (although this may be a rare case), or wellness programs that promote healthy sleep.

The second common dimension is the perception of norms and expectations. Whereas the first dimension was about formal or official features, this dimension pertains to unwritten rules and practices. This includes implicit expectations organizational members feel are placed upon them (e.g., Sonnentag & Pundt, 2016), expected outcomes of and organizational responses to incidents (e.g., Dedobbeleer & Béland, 1991; Hulin et al., 1996), and norms (e.g., Kessler et al., 2008; Schneider et al., 1998). Norms and expectations regarding sleep may be that workers in the organization typically stay up later at night than necessary, consume large amounts of caffeine during the day rather than get sufficient sleep, or that workers are expected to sacrifice sleep in order to get work done.

The third dimension that appeared in multiple measures of strategic climate is communication. This dimension pertains to how much open communication regarding the climate target exists within the organization. Climate measures used in Neal et al. (2000) and Sonnentag and Pundt (2016) had communication as its own dimension, using items such as “Here, you talk among colleagues when you have prepared healthy and delicious food” (Sonnentag & Pundt, 2016). Although sleep may not be talked about in formal settings within the work context, it is likely that organizational members talk about how they have not been sleeping well or that they have had to stay up late to complete a task.

The final two dimensions that are often included in measures of strategic climate are management values/beliefs and leader behaviors regarding the climate target. Not only do many measures include leadership or management values and beliefs as its own dimension (Dedobbeleer & Béland, 1991; Kessler et al., 2008; Sonnentag & Pundt,

2016), some climate measures have asked solely about management values or supervisor behaviors (Johnson, 2007; Zohar, 2000). Two questions arise regarding these dimensions. The first question is whether leadership behaviors regarding the climate target should be regarded as a component of climate or as an antecedent of strategic climate. Some studies have conceptualized leadership regarding the climate target as antecedents of said climate and supported this claim through structural equation modeling (Barling et al., 2002; Schneider et al., 2005). Interestingly, Schneider et al. (2005) used a subset of the Schneider et al. (1998) measure of service climate as a measure of service leadership, but did not provide a rationale as to why they decided to separate that subset as an antecedent of the rest of the dimensions. Given that leadership behavior can be observed by organizational members and thus does not conflict with the definition of climate, and that it is reasonable to think that leadership behavior and other climate dimensions such as practices and norms continuously affect each other, I will consider leadership a component of climate.

The second question is whether values and beliefs can directly be perceived or experienced, per the definition of climate. The short answer is, probably not; organizational members have to infer the extent to which their supervisors or higher management value the climate target through its manifestation through observable practices, policies, procedures, or behavior. To this end, meta-analytic comparison of the strength of relationship between target outcomes and climate measured purely by the perception of management values and beliefs (e.g., “Safety is given a high priority by management”; Neal & Griffin, 2006) versus climate measured purely by observable supervisor and management behavior or practices (e.g., “My supervisor says a good word

whenever he/she sees a job done according to the safety rules”); Zohar, 2000) would be useful. Theoretically, climate measured purely by perception of management values and beliefs should relate weaker with target outcomes compared to climate measured purely by observable features, because the former type of measure allows for wider interpretation, lowering the reliability of scores obtained from it. In addition, it could be argued, as Schneider et al. (2005) have, that management values and beliefs are antecedents to more visible features like practices and policies; thus, values and beliefs are a more distal determinant of behavior compared to practices and policies and should have a weaker relationship with target outcome compared to practices and policies. However, it is also possible that values/beliefs and practices/policies have a cyclical relationship in which practices and policies also have an impact on management values and beliefs toward that target outcome, making it difficult to discern which is the more proximal predictor of behavior. To date, no systematic analysis has been carried out to compare the relative strength of these relationships, nor establish the causality between management values/beliefs and practice and policies. Therefore, to keep in line with past research including values and beliefs as a component of climate, I choose to keep management values and beliefs as a component of strategic climate.

In summary, the expected five major dimensions of sleep climate are 1) formal policies, practices, and procedures, 2) norms and expectations, 3) communication, and 4) management values and beliefs, and 5) leadership. However, the dimensions that are obtained empirically may not be so clear cut. For example, unwritten expectations regarding sleep may be perceived as almost a formal requirement by organizational members, and communication of sleep by supervisors could be construed equally as

leadership behavior or formal practices. Thus, although sleep climate items will be written with these dimensions in mind, the data may reveal an underlying factor structure different from the one proposed here.

Malleability

In considering intervention for sleep at a workplace level, it is essential that sleep climate is a malleable feature of the workplace. Intervention studies on health and safety climate suggest that these climates can be altered (Basen-Engquist et al., 1998; Zohar & Polachek, 2014). These studies employed practices such as dissemination of posters, brochures, and videos emphasizing health and safety, self-assessment tools to help compare individual performance to organization standards, how-to guides on health behaviors, and feedback interventions targeting supervisors to increase communication emphasizing safety. Similarly, it is expected that sleep climate can change in response to interventions that target its content areas. For example, a formal training session that communicates the importance of sleep as well as teaching techniques to improve sleep behaviors is likely to improve sleep climate perceptions because of increases in the formal practices, communication, and management values and beliefs dimensions.

Additional note on the mechanism

As discussed previously, the effects of sleep climate on sleep are expected to occur through the cognitive (motivational) mechanism; practices, procedures, and policies as well as leadership and management values are likely to increase organizational members' motivation to sleep more and better. However, this is not to say that the affective mechanism cannot also be at play. When the sleep climate is such that it does not support, or rather, hinder sleep, this could cause negative emotional reactions in

organizational members, which could lead to strain and reduced sleep quality. As with the case with molar climate, this reduction in sleep quality can also indirectly affect sleep quantity.

Hypotheses

Considering the above discussions regarding sleep climate, hypotheses regarding the underlying factor structure of sleep climate as well as the relationships between the five dimensions of sleep climate and sleep outcomes are stated below.

Hypothesis 2: Sleep climate will have five underlying dimensions: 1) formal policies, practices, and procedures, 2) norms and expectations, 3) communication, 4) management values and beliefs, and 5) leadership.

Hypothesis 3: Sleep quality and quantity will correlate positively with dimensions of sleep climate (a) Formal policies, practices, and procedures, (b) Norms and expectations, (c) Communication, (d) Management values and beliefs, and (e) Leadership.

Hypothesis 3f: The relationship between sleep climate and sleep will be mediated by the cognitive (motivational) and the affective pathways.

Hypothesis 3g: Sleep climate perceptions can be improved through a training intervention.

Hypothesis 3h: Sleep climate will be a distinct construct from molar climate and health behavior climate.

Up until now, I have discussed how climate may have an impact on the sleep behavior of organizational members. In addition, I have proposed the construct of “sleep climate” and some considerations pertaining to this. In the next section, I will discuss how another group of work context characteristics, job characteristics, can impact sleep.

Job characteristics

What are job characteristics?

Systematic investigation of how work features influence how workers react to these features goes back as far as early twentieth century, when Taylor (1911) studied how simplification and specialization of job tasks influenced staffing difficulty and training requirements. Since then, the study of work design has come to take a much broader perspective to include a broader range of work features and affected outcomes, with one modern definition of work design encompassing the “study, creation, and modification of the composition, content, structure, and environment within which jobs and roles are enacted” (Morgeson & Humphrey, 2008). According to some review chapters on work design, *job characteristics* seem to be used as a term representing the individual elements of work design (Grant et al., 2011; Morgeson et al., 2013; S. K. Parker & Wall, 2001).

The modern conceptualization of job characteristics (Morgeson & Humphrey, 2008) is organized at the level of *roles*. This has implications for the construct’s overlap

with organizational climate. To the extent that job characteristics are limited to attributes of sets of job tasks, we can make a clear distinction between job characteristics and organizational climate in that job characteristics are attributes of the job tasks (i.e., a collection of tasks that are performed) while climate is an attribute of the organization or its subunit (i.e., the environment in which job tasks are performed, consisting of people, practices, procedures, and policies). However, when the concept of job characteristics is expanded to include features of roles and the environment surrounding the job, the boundaries between job characteristics and climate begin to blur. Morgeson and Humphrey (2008) adopted the definition of role put forth by Davis and Taylor (1979), which determined roles to be a set of rules and expectations placed on workers that guide *all* of their occupational behavior. Thus, when the realm of the job is extended to include roles people are responsible for as organizational members, job characteristics can become attributes of the organization rather than the job. In addition, features of the environment within which jobs and roles are enacted clearly include policies, processes, and practices regarding some idea or behavior, which is the very definition of climate.

As such, climate and job characteristics may be best thought of as being on a continuum. On one end, there is pure climate, which is an attribute of the organization or its subunit. Concern for employee welfare and product quality, for example, are attributes of the organization that are likely to be shared organization-wide across multiple jobs. These climates may influence how people perform their tasks, but are not attributes of the tasks themselves. On the other end are pure job characteristics, which are attributes of job tasks. For example, task significance or variety are unique to job tasks and are not attributes of the organization or its subunits. Then, there are attributes that fall

somewhere in between. For example, sexual harassment climate could be considered both a climate or job characteristic. On the one hand, it is climate because it consists of policies, practices, and procedures that are enacted across the organization. On the other hand, it could be considered a job characteristic if seen as a code of conduct that required to carry out some job role.

It is also plausible to think that climate and job characteristics influence each other. On the one hand, climate can influence job characteristics in a top-down fashion, in that practices, policies, or processes with some underlying value or attitude can shape or restrict specific job attributes. For example, an organization emphasizing autonomy is likely to have more jobs that are autonomous compared to one that does not. On the other hand, job characteristics can shape the climate, if some subgroup of an organization consists of multiple people with the same job. To reuse to the example of autonomy, a department in which every individual has a highly autonomous job can create a shared perception that the organization values high autonomy. The issue of the relationship between climate and job characteristics is highly complicated and deserves an in-depth manuscript of its own. However, because this is outside the scope of this paper, I will treat attributes traditionally studied in the field of job characteristics and climate as job characteristics and climate, respectively.

How would job characteristics impact sleep?

It is expected that job characteristics can impact sleep through all three mechanisms. Although there has been research on the mediating mechanisms between job characteristics and sleep, all of them studied job-related outcomes such as productivity (Grant, 2008), work motivation (Burr & Cordery, 2001), and OCB (Chen &

Chiu, 2009). Thus, these studies provide little insight on how job characteristics may affect sleep. Fortunately, there have been numerous studies investigating the relationship between job characteristics and sleep. Many of these studies point to the affective/stress pathway. As mentioned before, a great majority of past studies (Åkerstedt, 2006; Burgard & Ailshire, 2009; De Lange et al., 2009; Törnroos et al., 2017) were designed under the framework of the JD-C model (R. A. Karasek, 1979) or its expansions. One of the major principles of these models is that features of the job can be categorized into job demands — those that cause distress in workers and job control or resources — those that aid goal attainment of job goals or alleviate the negative effects of job demands (Demerouti et al., 2001). This supposed effect of job demands is consistent with the affective/stress pathway described earlier in the manuscript: high job demands or low lack of job control/resources are expected to be associated with negative affect or stress, which in turn is expected to lead to impaired sleep. Indeed, studies built on the JD-C and related models find that sleep is associated negatively and positively with job demands and control/resources, respectively (Åkerstedt et al., 2002, 2015; Burgard & Ailshire, 2009; De Lange et al., 2009; Gadinger et al., 2009; Parkes, 2017).

There are a couple of limitations with the past literature examining the relationship between job characteristics and sleep from the JD-C perspective. First, the Job Content Questionnaire (R. Karasek et al., 1998) or a revision of this instrument have been used widely to measure job demands and control/resources (Appendix A). This measure includes five broad dimensions of job characteristics: decision latitude, psychological job demands, social support, physical job demands, and job insecurity, with each of these encapsulating a number of subdimensions. Although this measure does

cover a substantial range of job characteristics, because it is based on the JD-C model, it leaves out other important characteristics that are major components in other models of job design. For example, task significance, task identity, and feedback, which are the central job characteristics in the Job Characteristics Theory (Hackman & Oldham, 1975), are left out. Considering the wider range of job characteristics that are included in more modern measures (e.g., Work Design Survey; Morgeson & Humphrey, 2006), the range of characteristics studied thus far is narrow.

The second limitation is that often, only the relationship between sleep and an aggregate of all job demand or control dimensions were examined. This also stems from the perspective that the JD-C model takes, that job characteristics are categorized into either a job demand or a job control. The result of this practice is that the relationships between specific characteristics and sleep remain unclear. While it is plausible that by definition, high job demands or lack of job control, support, or resources cause distress in workers, and this impacts their sleep negatively, it is also likely that the strengths of these relationships differ from one another. This is supported by Ribet and Derriennic (1999), one of the few studies that did not examine the job characteristics – sleep relationship from the JD-C perspective. This study found some job characteristics to be associated with the occurrence or disappearance of sleep disorders over time. Notably, it was found that not all characteristics that would be categorized as a job demand was associated with the occurrence of sleep disorders; specifically, having to perform multiple tasks simultaneously was not associated with the occurrence or disappearance of sleep disorders. This finding suggests, especially from the standpoint of developing work

design interventions to improve the sleep of workers, it would be useful to understand the degree of relationships between specific job characteristics and sleep.

The second way job characteristics could impact sleep is through the preoccupation mechanism in the cognitive pathway. There are various job characteristics that make it difficult for individuals to disengage themselves from their job while not being at work. For example, complex problems that come up at work may lead individuals to think about solutions even when they are not work. Workers that have continuous business relations with particular clients may be constantly worried about how the clients may respond to the next business proposal or negotiation. As mentioned before, studies support the negative association between off-time thoughts about work and sleep quality (Querstret & Cropley, 2012; Sonnentag et al., 2008; Syrek et al., 2017). Unfortunately, studies investigating job characteristic antecedents of such off-time work thoughts are scarce. Syrek & Antoni (2014) found that unfinished tasks at work positively predicted rumination about work and negatively predicted sleep quality, suggesting that jobs with features that leave individuals with unfinished work, such as complex tasks that are made up of multiple components, may affect sleep through rumination about work.

The third way job characteristics may impact sleep is through temporal constraints. Clearly, attributes of the job that consume time take away time that could otherwise be allocated to sleep. Early start times and late times together make it difficult for individuals to obtain adequate sleep quantity, as does long commute time. Studies support the notion that longer worker hours is associated with shorter sleep quantity (Barnes et al., 2012; Basner et al., 2007), and also the negative relationship between commute time and sleep quantity (Hurst, 2008; Walsleben et al., 1999).

Hypotheses

I choose to use the Work Design Questionnaire (WDQ; Morgeson & Humphrey, 2006) for the current study because it includes a broad range of job characteristics not covered by the Job Content Questionnaire (R. Karasek et al., 1998). Although the details of the questionnaire will be addressed in the methods section, a brief description of the job characteristics included in this instrument is presented in Table 2. Again, when job characteristics are expected to influence sleep through the affective pathway or through the preoccupation mechanism of the cognitive pathway, I expect that the effect will be larger on sleep quality compared to sleep quantity because of the supposed delayed sleep onset and mid-sleep awakenings. Meanwhile, when the job characteristics influence sleep through time constraints, I expect that the effect will be on sleep quantity instead of quality.

As I have hypothesized with the autonomy dimension of OCM, the autonomy characteristics in the WDQ are expected to correlate positively with sleep quality, because having higher control over ones' work is likely to lead to lower frustration and other negative affective and cognitive states that may interfere with sleep.

Hypothesis 4: WDQ dimensions (a) Work scheduling autonomy, (b) Decision-making autonomy, and (c) Work-methods autonomy will correlate positively with sleep quality and quantity; the relationship will be stronger for sleep quality than quantity.

Task variety, task significance, task identity, skill variety, and specialization are all expected to correlate positively with sleep, because these characteristics make the job seem more interesting, enjoyable, or meaningful. These perceptions can be expected to relate negatively with negative affect, having a positive impact on sleep.

Hypothesis 4: WDQ dimensions (d) Task variety, (e) Task significance, (f) Task identity, (g) Skill variety, and (h) Specialization will correlate positively with sleep quality and quantity; the relationship will be stronger for sleep quality than quantity.

Feedback from the job and feedback could impact sleep either positively or negatively. On the one hand, feedback reduces ambiguity regarding performance, negating the need to be consumed with worries about how well one is performing when not on the job, which is expected to contribute to higher sleep quality. On the other hand, individuals receiving negative feedback may ruminate on it after work, resulting in poor sleep quality. Therefore, I leave the relationships between feedback and sleep quality as research questions.

Research question 2: What is the relationship between WDQ dimensions (a) Feedback from the job, (b) Feedback from others and sleep quality and quantity?

Job complexity, information processing, and problem solving will likely correlate negatively with sleep. These characteristics represent the extent to which the job is cognitively challenging and requires dealing with difficult problems. Jobs high in these characteristics are expected to trigger off-time thoughts about job tasks compared to jobs low in these characteristics, leading to lower sleep quality.

Hypothesis 4: WDQ dimensions (i) Job complexity, (j) Information processing, and (k) Problem solving will correlate negatively with sleep quality and quantity; the relationship will be stronger for sleep quality than quantity.

Social support is expected to correlate positively with sleep because the feeling of being valued by your supervisor and coworkers should be negatively associated with negative affect which will impede sleep.

Hypothesis 4l: Social support (WDQ) will correlate positively with sleep quality and quantity; the relationship will be stronger for sleep quality than quantity.

I expect both types of task interdependence to be negatively correlated with sleep. Initiated interdependence is likely to induce strain because one may feel forced to complete tasks in a certain amount of time. Meanwhile, received interdependence is

likely to induce frustration when incumbents have completed their part of the task but others do not complete their part in a timely manner.

Hypothesis 4: WDQ dimensions (m) Initiated interdependence and (n) Received interdependence will correlate negatively with sleep quality and quantity; the relationship will be stronger for sleep quality than quantity.

The direction of the relationship between interaction outside the organization and sleep is expected to depend on the types of people one has to deal with. On the one hand, interacting with friendly people outside the organization may help alleviate strain that one feels on their job, which could contribute to better sleep. On the other hand, if the people outside the organization are demanding or are unfriendly, this could lead to poor sleep. However, the average direction of relationship is difficult to predict. Therefore, I pose this as a research question.

Research question 2c: What is the relationship between Interaction outside organization with sleep quality and quantity?

There are two ways the three work context characteristics (ergonomics, physical demands, work conditions) can impact sleep. First, these characteristics could lead to fatigue, which in turn may help individuals sleep deeper and longer. This is consistent with findings that exercise is associated with better sleep (Hargens et al., 2013; National

Sleep Foundation, 2013). Second, these characteristics could cause psychological distress which could lead to worse sleep. Thus, I pose the relationships between these characteristics and sleep as research questions.

Research question 2: What is the relationship between WDQ dimensions (d) Ergonomics, (e) Physical demands, (f) Work conditions and sleep quality and quantity?

It is not readily apparent whether equipment use will correlate positively or negatively with sleep outcomes. Although learning how to use equipment may be stressful at first and may slightly impair sleep, this effect is likely to wear off over time as one gets accustomed to using the equipment. Therefore, I pose this relationship as a research question.

Research question 2g: What is the relationship between Equipment use (WDQ) and sleep quality and quantity?

I would like to investigate the extent to which other characteristics not included in the WDQ relate to sleep. First is the uncertainty of workload. Some jobs require incumbents to respond to tasks that emerge unexpectedly, and as a result, may have to stay at work longer than planned. Such uncertainty in workload makes it difficult for individuals to establish a consistent sleep schedule, which is a recommended sleep

hygiene behavior (National Sleep Foundation, n.d.). Therefore, uncertainty of workload is expected to correlate negatively with sleep.

Hypothesis 4o: Uncertainty in workload will correlate negatively with sleep quality and quantity.

Second is the schedule consistency. Although similar to the concept of uncertain workload, this differs in that the individuals are aware that their schedule differs from day to day; it is expected. Therefore, individuals are able to plan their sleep schedule according to these constantly changing work schedules. Nevertheless, it can be expected that inconsistent sleep times make it difficult for individuals to establish a circadian rhythm, impairing their ability to sleep well.

Hypothesis 4p: Schedule consistency will correlate positively with sleep quality and quantity.

The third characteristic is the friendliness of clients. As alluded to in discussing the effect of interaction outside organization on sleep, the nature of people involved in these interactions can influence sleep in different ways. Naturally, interacting with clients and customers who are unfriendly and demanding should be stressful, leading to worse sleep.

Hypothesis 4q: Client friendliness will correlate positively with sleep quality and quantity.

The fourth characteristic is the pace of work. Work pace has often been defined in terms of the speed at which you have to work (e.g., R. Karasek et al., 1998), or having to work under time pressure (Lennon, 1994). However, for the current study, I have created items that assess these characteristics in further detail. Those are: the amount of time it takes for one's work to reach beneficiaries, amount of time it takes to complete primary task, amount of time required to obtain performance feedback from the job itself as well as from others, and amount of time involved in interdependence (i.e., amount of time it takes for one's job to hold up others' jobs, and the amount of time it takes for others' jobs to hold up one's job). These characteristics, collectively, are likely to provoke a sense of urgency, which may be stressful and lead to impaired sleep.

Hypothesis 4r: Work pace will correlate negatively with sleep quality and quantity.

The fifth and sixth are work duration and commute time. Because these characteristics take away time that could otherwise be potentially allocated for sleep, they are expected to be negatively correlated with sleep quantity.

Hypothesis 4: Job characteristics (s) Work duration and (t) Commute time will correlate negatively with sleep quantity.

Incumbents are expected to have some affective response to all the job characteristics measured by the WDQ as well as uncertainty in workload, schedule consistency, client friendliness, and work pace, which in turn will influence sleep. Therefore, job characteristics are expected to influence sleep through the affective pathway.

Hypothesis 4u: The relationship between job characteristics (WDQ, uncertainty in workload, schedule consistency, client friendliness, work pace) and sleep will be mediated by the affective pathway.

In addition, a few job characteristics that pertain to cognitive exertion (i.e., job complexity, information processing, and problem solving) are expected to relate to difficulty in cognitive disengagement from work during off-times. This in turn is expected to influence sleep. Thus, these job characteristics are hypothesized to influence sleep through the cognitive (preoccupation) pathway.

Hypothesis 4v: The relationship between the group of job characteristics that pertain to cognitive exertion (i.e., job complexity, information processing, and problem solving) and sleep will be mediated by the cognitive (preoccupation) pathway.

As is the case with molar climate and health behavior climate, job characteristics is a separate group of constructs from sleep climate in that it is not a perception of workplace or organizational features that target sleep.

Hypothesis 4w: Sleep climate will be a distinct construct from job characteristics.

Finally, although molar climate, health behavior climate, and job characteristics are characteristics of the work context, they are distinct from sleep climate in that they do not have sleep of organizational members as a direct target. Moreover, these various work context characteristics may vary in the mechanism through which they influence sleep. Therefore, sleep climate should explain additional variance in sleep behaviors over and above those explained by molar climate and job characteristics.

Hypothesis 5: Sleep climate will display incremental validity in prediction sleep behaviors above and beyond molar climate, health behavior climate, and job characteristics.

Methodological issues

The study of work context characteristics such as climate and job characteristics comes with a few common methodological issues. Although it may not be possible to fully remove the effects of these issues, it is important to acknowledge them beforehand.

Thus, the nature and findings of these issues, as well as how I plan handle them will be discussed here.

Subjectivity/objectivity of the work context

The first issue concerns the subjectivity/objectivity of the work context. That is, do work context characteristics assessed through self-report measures by incumbents reflect objective characteristics of the job, or are they primarily subjective perceptions of incumbents? Technically speaking, all measures of the work context are subjective measures based on perceptions of raters, because the ratings are affected by a multitude of personal factors (Spector et al., 2000). Especially in the climate literature, it seems that objectivity/subjectivity has become less of an issue lately, as recent reviews by various authors have adopted the conceptualization of climate as the perception- or experience-based description of organizational features (Ostroff et al., 2013; Schneider et al., 2013; Zohar & Hofmann, 2012). Nevertheless, it is important to ask if these ratings are anchored in the objective environment, and are not exclusively a product of individual perception. There have been two major ways this issue has been studied.

The first is through convergence between multiple sources of information, taken mainly in the domain of job characteristics. The idea here is that if the ratings made by an incumbent converge with ratings made by other individuals who are less subject to making biased ratings or with job analysis databases, we can be somewhat confident that self-report ratings are not exclusively a function of the incumbents' subjectivity. A review of the job characteristics model found that correlations between incumbents' and others' ratings were between .16 and .91, suggesting moderate to good convergence (Fried & Ferris, 1987). Furthermore, a more recent validation study of a climate measure

has found the measure to have high interrater reliability (ICC(2); range from .75 to .97) and interrater agreement ($r_{wg(j)}$; range from .69 to .85), based on a sample of 6869 employees across 55 organizations (Patterson et al., 2005), providing further support that there is convergence across raters. On the other hand, a validation study on a job characteristics measure has found lower interrater reliability (ICC(2); range from .01 to .58) and similar interrater agreement ($r_{wg(j)}$; range from .68 to .92), based on a sample of 540 employees across 243 jobs (Morgeson & Humphrey, 2006). The authors speculated the low interrater reliability may be due to lack of variance in ratings across jobs, or that these characteristics may not be stable. Nevertheless, the high interrater agreement provides some support for convergence across raters.

The second way of assessing the objectivity of work context ratings is through the manipulation of work context characteristics. If ratings are anchored in reality, manipulation of the objective work context should result in changes in ratings of the manipulated characteristics. Multiple studies, both on climate and job characteristics, have found that manipulating features of the work environment leads to changes in ratings of these features (e.g., Morgeson & Campion, 2002; Morgeson, Johnson, Campion, Medsker, & Mumford, 2006; Zohar & Polachek, 2014). Results of these studies provide evidence that perceptions of work context characteristics covary with the objective characteristics.

In summary, available evidence indicates that self-report measures of the work context reflect the objective environment to some degree. However, there is another prevalent methodological issue that may lead to misinterpretation of study findings, particularly with studies utilizing surveys.

Common method bias

The second issue, and one that has been known to lead researchers to misinterpret research findings, is the effect of common method variance (CMV) — variance attributed to the method rather than the construct being measured (Podsakoff et al., 2003). This has been known to influence the observed relationship between variables. Specifically, as Cote and Buckley (1988) demonstrated, the observed correlation between two measures will be inflated, the same, and attenuated, when the correlation between two measures with the method effect removed is smaller than, the same, and larger than, the correlation between the methods, respectively. The magnitude of the relationship between variables has implications for practice; for instance, an organization may base the decision whether to implement an organizational climate intervention to improve sleep of employees based on the strength of relationship between climate and sleep behavior relative to the cost of implementing such an intervention. Therefore, it is important to address this issue as best as possible and obtain an accurate estimate of relationships between variables.

Podsakoff et al. (2003) provides recommendations for controlling such biases produced by common method variance. In Study 1, data will be collected at a single time point using the same method (online survey); thus, it will be appropriate to use the single-common-method-factor approach to control for any common shared variance stemming from the use of self-report survey. In Study 2, data will be collected at two time points, separated by an intervention and a follow-up period. Nevertheless, when analyzing the relationship among variables within the same time point, it will make sense to use the single-common-method-factor approach for the same reason as Study 1. In Study 3, data will be collected also at two time points. In this study, the predictor and criterion

variables are separated temporally. However, because all data will be collected through an online self-report survey, again the single-common-method-factor approach should be used to control for CMV.

Level of conceptualization and analysis

The third issue pertains to the level of the construct. That is, are climate and job characteristics conceptualized at the individual- or some other level (e.g., organization, job)? The answer to this question is largely dependent on how the construct is defined by the researcher. Regarding climate, when it is simply defined as organizational members' perception of situations in the organizational context without specification of whether the perception is shared or not, the construct could either be at the individual or organization level. For the most part, climate defined as such has been conceptualized at the individual level and has been labeled "psychological climate" in the literature (L. R. James & Jones, 1974). On the other hand, when climate is defined as the *shared* perceptions of some organizational characteristic (e.g., Schneider et al., 2013), it is implied that climate is some attribute of the organization or its subunit. Climate conceptualized in this manner has been labeled "organizational climate" (L. R. James & Jones, 1974). For the time being, I will simply use the term "climate" to be agnostic to the level of conceptualization.

The definition of job characteristics stated earlier does not by itself specify the level of conceptualization. It can, however, be inferred that the conceptualization is at the job level and not the individual level, because two identical jobs should be nearly identical in terms of content and structure. Therefore, it follows that there should not be great variability in job characteristics ratings within a single job; however, this seems to

not be the case (Morgeson et al., 2013). This is understandable, because self-report ratings consist of both individual and job factors. In addition, individuals make real changes to their jobs (Demerouti et al., 2015), which may be why there is variability has been found within jobs. Thus, as with climate, the level of conceptualization would depend on the research study.

There are two major considerations regarding level of conceptualization. First, when the constructs are conceptualized as shared perception of work context characteristics, the research study by default should be designed in a way that allows for verification of such sharedness within organizations or jobs. That is, data must be collected from multiple organizations or from individuals across multiple jobs. Then, researchers must provide evidence that there is considerable agreement within organizations/jobs and/or that a substantial portion of the variance in climate scores is attributable to between-organizational/job variance. Within-group agreement indices (r_{wgj}) and intraclass correlations (ICC(1)) have often been used to achieve these objectives, and Bliese (2000) and L. R. James (1982) have presented values of these indices commonly found in studies. If such standards are met, the researcher has support for conceptualizing constructs at the organizational or job level. When the standards are not met, this does not necessarily mean that conceptualizing at the organizational/job level is wrong. Low agreement within organizations or jobs could reflect true disagreement between organizational members which suggests a weak climate or individuals modifying their jobs, or measurement error. Thus, researchers must be careful in interpreting results in such a case, paying close attention to other organizational characteristics and the psychometric properties of the measure.

Second, the referent for items must be considered. Chan (1998) described the implications of using different referents of organizational characteristic items. In doing so, he made the distinction between psychological climate and psychological *collective* climate. The latter is thought to be measured when items refer to non-self (e.g., “people in my organization”, “my job”, “my organization”), and represents individual perception of *other* organizational members’ perception of climate. Thus, when individual responses are aggregated, it will represent shared perception of others’ perceptions.

Furthermore, Wallace et al. (2016) discussed the impact different referents may have on criterion-related validity. Their argument was that evaluation of common outcome variables studied in organizational sciences involve varying degrees of affect or cognition. For example, evaluation of behavioral outcomes (e.g., task performance) involves more cognition than affect because one *thinks* about behaviors individuals have engaged in during a given period of time. On the other hand, evaluation of attitudinal outcomes (e.g., job satisfaction) can be thought to be more affect-laden because it prompts individuals to respond how they *feel* about a target. Similarly, the referent of items measuring work context characteristics influences the degree of cognition or affect in responding to such items. Items with the organization/job as the referent can be expected to be more cognitive-based compared to individual-referenced items because the assessment of how others think or behave elicits more thinking compared to assessment of one’s own evaluation of the work environment. Therefore, the authors hypothesized, that correlations between aggregated variables and outcomes should be maximized when there is match between the degree of cognitive- or affective- basis of the variables and the referent used. Their meta-analysis on climate supported this

hypothesis with regards to the climate for concern for employees. Stronger relationships were found between climate and attitudes when self-referent was used as opposed to other-referent; on the other hand, stronger relationships were found between climate and job performance when other-referent as opposed to self-referent was used. The results are inconclusive, as the hypothesis was not supported for the climate of concern for customers.

The measure of climate I plan to use in the current studies (OCM; Patterson et al., 2005) use other-referent. This is understandable, because climate is the perception of what goes on in the organization. Arguably, items written with other-referent is more likely to encourage respondents to think broadly about other organizational members' experiences as well as formal practices as opposed to purely personal experiences. Therefore, the measure of sleep climate will also be constructed with other-referent items. The measure of job characteristics (WDQ; Morgeson & Humphrey, 2006) also use other-referent items. This is consistent with the idea that characteristics within a single job should be similar. However, the WDQ recognizes that individuals may create modifications to their jobs by using phrases such as "The job allows me to" and "The job gives me a chance to".

Overview of Studies

To examine the hypotheses and research questions, three studies were conducted. Study 1 was conducted to develop and validate a measure of sleep climate as well as explore the relationships between sleep and molar climate and job characteristics. Study 2 focused on examining the malleability of sleep climate in response to an intervention. To achieve this, a measure of sleep climate was administered on a group of medical school

students at the University of Minnesota before and after a workshop on healthy sleep and the difference in sleep climate perceptions were examined. Study 3 sought to investigate the extent to which individuals at a single work site agree on sleep climate perceptions. This was achieved by administering the sleep climate measure on medical residents at the University of Minnesota that work at various clerkship sites around the Twin Cities area.

Study 1

Study 1 was conducted on an online sample on Amazon Mechanical Turk (MTurk) to 1) develop and validate a measure of sleep climate, 2) test the overarching hypothesis that molar climate, sleep climate, and job characteristics correlate with sleep, and 3) to narrow down the large number of dimensions within the work context characteristics for the later data collection. The third purpose was important because of the nature of the participants in Studies 2 and 3. During meetings with two individuals in charge of HR and student data at the medical school, it was revealed that medical school students and residents receive a large number of surveys and are unlikely to respond to ones that would take more than 10 minutes to complete. In addition, the professor in charge of delivering the sleep workshop in relation to Study 2 notified me that although distributing paper surveys to students at the start of the workshop will be the best option for obtaining the maximal number of participants, survey length should be kept to a minimum to ensure he can deliver the workshop in its entirety.

Study 1 Participants

An online sample from MTurk was recruited for this study. A total of 483 individuals completed the survey for a compensation of \$3.50, and 449 of them were

retained for the final data analysis. Of these participants, 340 (75.72%) identified as Caucasian, and 269 (59.91%) identified as male.

Study 1 Procedure

The description of the study was posted on the MTurk website as a Human Intelligence Task (HIT). Individuals registered as workers self-selected into the study by clicking on the study link, accessing the Qualtrics survey, and providing consent online. Data were collected in three batches. In the first batch, data from 55 individuals were collected to get input on the sleep climate items. To do this, I asked open-ended questions about features of work, people at work, and specific events at work that have made participants sleep better or worse in the past, as well as provided space to write down any feedback about the items in the survey. The second batch involved collecting data from 223 individuals to examine the factor structure of the sleep climate measure as well as perform preliminary analyses of the correlations among study variables. Based on the analyses, the sleep climate measure was revised. Details of the revision are explained in the Results section. Then, data were collected from 205 additional individuals for cross-validation of revisions made on the basis of results from the initial batches.

Study 1 Measures

Molar climate

I chose the Organizational Climate Measure (OCM; Patterson et al., 2005) as the measure of molar climate. As explained earlier, the reason for this was because of its basis on a theoretical framework that covers broadly organizational characteristics that contribute to productivity that are applicable across organizations (Quinn & Rohrbaugh, 1983). Furthermore, the measure has been validated on a relatively large sample size of

6,689 employees across 49 organizations (Patterson et al., 2005). Out of the 17 dimensions, 12 were chosen that did not overlap significantly in concept with dimensions of the Work Design Questionnaire (Morgeson & Humphrey, 2006) or with other dimensions within the OCM, to not over-extend the length of the survey. Each dimension was measured with 4 to 6 items. Participants responded to items on a five-point Likert scale ranging from “Strongly disagree” to “Strongly agree”. Sample items include “Management let people make their own decisions much of the time” (autonomy), “Ways of improving service to the customer are not given much thought” (outward focus), and “People here are under pressure to meet targets” (pressure to produce). All items are presented in Appendix B.

Sleep climate

A measure of sleep climate was constructed based loosely on the items from the Organisational Health Behavior Climate (OHBC) measure (Sonnentag & Pundt, 2016), as this was the closest strategic climate that most closely resembled the idea of sleep climate. This measure comprises three dimensions: values and expectations, organizational practices, and communication, with four items for each dimension and target behavior (exercise and healthy eating). Sample items include “I think that colleagues who stay physically fit are more respected than those who exercise less”, “In this organization, there are training and information events about upright posture”, “Here there are plenty of opportunities to talk about exercise and physical activities/healthy eating”, and “If you are interested in eating healthier, you will get support from this organization”. Items that seemed applicable to sleep were adapted appropriately to reference sleep. For example, the third example item was modified to “Here there are

many opportunities to talk about healthy sleep behaviors”. In addition to items adapted from the OHBC measure, items were created to cover the five dimensions discussed earlier (i.e., formal policies, practices, and procedures; norms and expectations; communication; management values and beliefs; leadership). For example, the item “In this organization, you are expected to perform well regardless of how well you have slept” was created to reflect a common expectation regarding sleep in the workplace. The consumption of caffeine in lieu of getting sleep is an example of a common sleep-related practice in the workplace; “If you’re tired, you’re expected to consume caffeine to fight it instead of getting some sleep” was created to reflect this. In total, 29 items were created for the measure. For the communication dimension, participants responded on a five-point Likert scale ranging from “Strongly disagree” to “Strongly agree”. For the other dimensions, the response option “I don’t know” was included. All items are presented in Table 3.

Job characteristics

The Work Design Questionnaire (WDQ; Morgeson & Humphrey, 2006) was the centerpiece in measuring job characteristics. All 21 dimensions were included in the online survey. Each dimension was measured with between 3 and 6 items. Participants responded to items on a five-point Likert scale ranging from “Strongly disagree” to “Strongly agree”. Sample include “The job involves a great deal of task variety” (task variety), “The job provides me the chance to completely finish the pieces of work I begin” (task identity), and “The job activities are greatly affected by the work of other people” (received interdependence). In addition to the WDQ, I developed and included items that assess workload uncertainty, schedule consistency, client friendliness, and

work pace. Workload uncertainty, schedule consistency, and client friendliness were on the same response scale as the WDQ. Sample items include “I am often tasked with unexpected work” (workload uncertainty), “My work schedule differs from day to day” (schedule consistency), “My clients and customers are friendly” (client friendliness), and “How long does it take to complete your primary task?” (work pace). Work pace was measured on an 11-point scale, with each point representing the span of time within which certain aspects of the job took effect (“A few minutes” ~ “Never”). Commute time was measured with one-item, “How long is the one-way commute to your workplace (in minutes)?”, and work duration was calculated based on work start times and end times. All items are presented in Appendix C.

Health behavior climate

Health behavior climate was measured with the instrument by Sonnentag and Pundt (2016). This instrument comprised three subscales (i.e., values and expectations, organizational practices, and communication) for each health behavior (i.e., healthy eating, exercise) for a total of six subscales. Each subscale contained three items. Items were measured on a five-point Likert scale from “Strongly disagree” to “Strongly agree”. Sample items include “Management in this organization shows an interest in healthy nutrition” (healthy eating, values and expectations) and “From time to time, teams from this organization participate in sport evenets and competitions (e.g., a local running event)” (exercise, organizational practices). All items are presented in Appendix D.

Sleep behavior

Sleep was measured in terms of quality and quantity. Sleep quality was measured using an adaptation of the Jenkins, Stanton, Niemcryk, and Rose (1988) measure of sleep

problems. This included a total of six items, asking about the frequency of sleep problems respondents have had in the past month on a six-point Likert scale (“Not at all” ~ “22-31 days”). Sample items include “Had trouble falling asleep” and “Woke up several times per night”. All items are presented in Appendix E. Sleep quantity was calculated based on the average bed- and wake- times in the past month.

Study 1 Analysis and Results

Examination of the responses to open-ended items asking about the work context that facilitate or interfere with sleep revealed that what the participants mentioned were already covered by either the sleep climate items or items in other measures included in the survey (e.g., the WDQ). Therefore, no revision was made to the items. After the second batch was collected, analysis of the factor structure of the sleep climate measure was performed. First, an EFA with oblimin rotation was performed to examine how the items clustered based on the data. The Scree plot suggested that there were three factors underlying the sleep climate measure. Perusal of the items with primary loadings on each factor suggested that the factors represented communication about sleep, features of the work context that facilitate good sleep (“positive features”), and features of the work context that impair good sleep (“negative features”). This was not consistent with the dimensions that were intended to be measured. The standardized factor loadings, means and SDs, and the intercorrelations of the factors are presented in Table 3. Furthermore, CFA revealed that the originally intended model with five factors had poor fit with data with $\chi^2 = 1298.46$, $df = 424$, $CFI = .76$, $TLI = .73$, $RMSEA = .10$, $SRMR = .13$.

Therefore, Hypothesis 2a was not supported.

The sleep climate measure was revised by dropping items with small loadings while also maintaining a fair coverage of what the factors were thought to represent. Finally, 10 items were retained in the measure, which showed good fit with the data with $\chi^2 = 94.44$, $df = 32$, $CFI = .94$, $TLI = .91$, $RMSEA = .09$, $SRMR = .05$. This measure was administered on the third batch for cross-validation. The factor structure held up well when analyzed with only participants from the second, cross-validation batch ($\chi^2 = 90.61$, $df = 32$, $CFI = .94$, $TLI = .91$, $RMSEA = .10$, $SRMR = .06$), as well as with the entire dataset including all three batches ($\chi^2 = 88.50$, $df = 32$, $CFI = .97$, $TLI = .96$, $RMSEA = .06$, $SRMR = .04$). Thus, subsequent analysis results are based on this 10-item measure.

Data from a total of 449 individuals across the three batches who passed attention checks were included for analysis. Correlation matrices between sleep variables (sleep climate, sleep quality, and sleep quantity) and other study variables are presented in Tables 4 through 7. Hypotheses 1a through 1i stated the expected relationships between OCM climate dimensions and sleep. For the remainder of the paragraph, hypothesis number as well as hypothesized relationships are in parentheses (positive as +, negative as -, and research questions as ?). All the dimensions showed significant correlations with sleep quality in the expected direction. However, few significant relationships were observed with sleep quantity, with the exceptions of efficiency (1d+), pressure to produce (1i-), and quality (1c?). Of these, efficiency and pressure to produce showed positive and negative relationships, respectively, with both sleep quality and quantity, but more so with quality. Thus, Hypothesis 1d and 1i were fully supported, and the rest of the hypotheses were partially supported. Research Questions 1a, 1b, and 1c, asked the direction of relationship between sleep and OCM dimensions outward focus, effort, and

quality. All were positively correlated with sleep quality, and only quality was negatively correlated with sleep quantity.

Hypotheses 3a through 3e stated the direction of relationship between the initially intended sleep climate dimensions (policies, practices, and procedures, norms and expectations, communication, values and beliefs, and leadership) and sleep. However, as mentioned before, this factor structure did not fit well with the data. Instead, the underlying factors communication, positive features, and negative features emerged. Therefore, with the exception of Hypothesis 3c which was about the communication dimension, these hypotheses were not tested. For the relationships between sleep climate dimensions and sleep, the positive features dimension correlated positively with sleep quantity, and the negative features correlated negatively with sleep quality. Interestingly, the communication dimension correlated with neither sleep variable; therefore, Hypothesis 3c was not supported.

Hypothesis 3h stated that sleep climate is a distinct construct from molar climate and health behavior climate. Examination of Table 4 suggests that sleep climate is distinct from molar climate dimensions, with the largest overlap being between the negative features dimension of sleep climate and the efficiency dimension of the OCM at $r = -.40$. Overall, the positive dimensions of sleep climate (communication and positive features) correlated positively and negatively with molar climate dimensions that organizational members are expected to react positively (e.g., supervisory support, welfare, innovation, reflexivity) and negatively (e.g., formalization, pressure to produce) to, respectively. On the other hand, the negative features dimension of sleep climate correlated positively and negatively with molar climate dimensions that are

organizational members would react negatively (e.g., pressure to produce) and positively (autonomy, supervisory support, welfare, efficiency, effort) to, respectively. Correlations were much larger between sleep climate and health behavior climate dimensions. This was to be expected, because both strategic climates target behaviors pertaining to health. Although the negative features dimension did not display large correlations with health behavior climate, the communication and positive features dimensions showed correlations with health behavior climate as large as $r = .61$ (between positive features and eating - organizational practices). Corrected for attenuation, this is a relationship of $\rho = .70$. However, considering the smaller correlations found between the negative features dimension and health behavior climate, there is not enough support to claim that sleep climate and health behavior climate are the same constructs. Therefore, Hypothesis 3h was partially supported; sleep climate seems to be a distinct construct from molar climate, but the relationship between sleep climate and health behavior climate but further investigation is needed to clarify the relationship between sleep climate and health behavior climate. Thus, additional factor analyses were performed to explore the factor structure underlying the health-related behavior (i.e., sleep, eating, exercising) climate items. Results are reported in the following section “Exploratory Analyses”.

Hypotheses 4a through 4u as well as Research Questions 2a through 2g pertained to the relationships between job characteristics and sleep. For the remainder of the paragraph, hypothesis number as well as hypothesized relationships are in parentheses (positive as +, negative as -, and research questions as ?). Positive correlations with sleep quality were found for all three types of autonomy (4a+, 4b+, 4c+), both types of feedback (2a?, 2b?), social support (4l+), work conditions (2f?), client friendliness (2q?),

and schedule consistency (2p?). On the other hand, negative correlations with sleep quality were found for information processing (4j-), received interdependence (4n-), physical demands (2e?), uncertainty in workload (4o-), and commute time (4t-). Sleep quantity correlated positively with schedule consistency (4p+), while it correlated negatively with task variety (4d+), job complexity (4i-), information processing (4j-), problem solving (4k-), skill variety (4g+), specialization (4h+), work pace (4r-), uncertainty in workload (4o-), commute time (4t-), and work duration (4s-). No significant relationship was found between sleep and task significance (4e+), task identity (4e+), initiated interdependence (4m-), interaction outside organization (2c?), ergonomics (2d?), and equipment use (2g?). Therefore, Hypotheses 4o, p, t, and s were supported, e, f, and m were not supported, and the rest were partially supported.

Hypothesis 4w stated that sleep climate will be a distinct construct from job characteristics. Table 6 shows that the correlations found between sleep climate and job characteristics were relatively small, with the largest being $r = -.38$ between negative features and schedule consistency. Therefore, Hypothesis 4w was supported.

Hypothesis 5 stated that sleep climate will have incremental validity over molar climate, health behavior climate, and job characteristics in predicting sleep behavior. To test this hypothesis, multiple hierarchical regression analyses were conducted. For each work context characteristic for which significant relationships were found between its dimensions and sleep, two models were run: one model with these dimensions as independent variables and the focal sleep behavior as the dependent variable, and another with the sleep climate dimension related to the focal sleep behavior added as an independent variable. Because none of the health behavior climate dimensions correlated

significantly with the sleep variables, a total of four models were run. The results are presented in Tables 8 and 9. Table 8 shows that the negative features dimension of sleep climate explained additional variance in sleep quality over and above those explained by a set of molar climate dimensions, resulting in a .028 increase in R^2 ($F = 15.229$, $p < .001$). On the other hand, the addition of the positive feature to a set of molar climate dimensions resulted in a .015 increase in R^2 , but this difference was not statistically significant ($F = 2.512$, $p = .114$). Table 9 shows that the negative and positive features dimensions of sleep climate explained additional variance in sleep quality and quantity, respectively, above and beyond that explained by job characteristics. Adding negative features resulted in an R^2 increase of .022 ($F = 10.470$, $p < .005$) for sleep quality and .010 ($F = 4.275$, $p = .039$) for sleep quantity. Although not presented in a table, two additional models were compared for each sleep outcome: one with all the molar climate and job characteristics predictors, and another with all of these predictors and the relevant sleep climate dimension added as a predictor (i.e., negative features for sleep quality and positive features for sleep quantity). Addition of the sleep climate dimension as a predictor did not result in significant increase in R^2 for either sleep outcome (sleep quality: $\Delta R^2 = .0058$, $F = 2.975$, $p = .085$; sleep quantity: $\Delta R^2 = .0076$, $F = 3.067$, $p = .081$). Therefore, Hypothesis 5 was partially supported.

Exploratory Analyses

A series of factor analyses were conducted to examine the factor structure underlying health behavior-related climate items. First, a few CFAs were conducted. Following the results of Sonnentag and Pundt (2016), a 9-factor model (Model 1) in which items represented one of nine health behavior climate factors (e.g., sleep climate

communication, sleep climate positive features, etc.) that correlated with one another, was tested first. This model displayed good fit with the data ($\chi^2 = 853.02$, $df = 314$, $CFI = .93$, $TLI = .92$, $RMSEA = .07$, $SRMR = .05$). Because some factors were highly correlated (e.g., eating values and expectations and eating organizational practices at .85), the presence of higher-order factors was assumed. Therefore, a model with higher-order factors (sleep climate, eating climate, exercise climate) subsuming three lower-order factors each (Model 2), was tested. This resulted in worse model fit ($\chi^2 = 1167.43$, $df = 338$, $CFI = .90$, $TLI = .88$, $RMSEA = .09$, $SRMR = .07$). Due to these results, I next suspected that the covariation among the lower-order factors may be due to one general health behavior climate factor rather than behavior-specific climate factors. Thus, a model with one higher-order factor and nine lower-order factors (Model 3) was tested next. This resulted in very little change in model fit ($\chi^2 = 1243.78$, $df = 341$, $CFI = .89$, $TLI = .87$, $RMSEA = .09$, $SRMR = .07$).

The Model 2 and 3 fit results relative to the Model 1 fit were puzzling considering the high correlation among the nine lower-order factors. Upon consultation with a colleague, it was suggested that a non-hierarchical model with a general factor (i.e., a bifactor solution) may provide a better fit to the data, as has been found for cognitive ability tests (Cucina & Byle, 2017). The implication of hierarchical models such as Models 2 and 3 is that the effects of higher-order factors influence indicators only through the lower-order factors (i.e., lower-order factors fully mediate the effects of higher-order factors on indicators; Cucina & Byle, 2017). However, it is possible that there exists a general health behavior climate factor that manifests as specific work context characteristics regarding sleep, eating, or exercise without having effects on

broad health behavior climates. Thus, exploratory factor analysis was used to recover a bifactor structure underlying the data.

The Schmid-Leiman (SL; Schmid & Leiman, 1957) and Direct Schmid-Leiman (DSL; Waller, 2018) approaches were taken using the *fungible* package (Waller, 2018a) in R because it has been found to perform the best among other exploratory bifactor analysis methods in recovering a bifactor structure (Giordano & Waller, 2019). Results of the SL and DSL solutions are presented in Tables 10 and 11, respectively. There are a few notable points about the results. First, most items loaded substantially (.50 to .70s) onto the general factor labeled “G”. This suggests that a general climate targeting a broad range of health behaviors explains variance in specific organizational practices, policies, and procedures regarding sleep, healthy eating, and exercise, independently of specific climates that target each of these behaviors.

Second, items of the negative features dimension of sleep climate showed near-zero (in the case of SL) or modest (in the case of DSL) loadings with the general factor. This, combined with the fact that the modest loadings found in the DSL solution were also positive, suggests that climates that interfere with members’ ability to engage in healthy behavior may be a separate construct from climates that facilitate healthy behavior, rather than the two being two opposite ends of a spectrum.

Third, the factor loading patterns for eating and exercise climate items were not as clean as those for the sleep climate. The majority of sleep climate items had a loading larger than .40 with its primary factor and there were no cross loadings. On the other hand, a number of eating and exercise climate items either a) did not exhibit the largest loading onto its hypothesized factor (e.g., Eat OP 1, Exercise OP 1), or b) had cross

loadings (Eat VE 2, Eat Com 3, Exercise OP 3). These results are likely due to the specific work context characteristics depicted in the items potentially being indicators of multiple dimensions of health behavior climate. For example, the item Exercise OP 3 “In this organization, there are posters featuring exercise and physical activity”, while originally meant to represent organizational practices regarding exercise, could be interpreted as communication regarding exercise, or indication that management of the organization values exercise (values and expectations dimension).

Fourth, the proportion of variance in items explained by all the modeled factors as well as the general factor alone were very large. There are three possible explanations for the large values found for the general factor. First, this may be because organizational members have difficulty differentiating between or accurately recalling climates that target different health-related behaviors. Second, it could be that organizations that look after their members well do so in a manner that does not differentiate between various health behaviors. This explanation may not be well supported by the current data considering the welfare dimension of molar climate did not correlate so highly with the communication and positive features dimensions of sleep climate ($r = .16$ and $.15$, respectively), while it showed stronger correlations with eating and exercise climates ($r = .23 \sim .38$). The third explanation is that the general factor is highly contaminated with a common method factor. To explore this possibility, I re-ran the SL and DSL approaches specifying two orthogonal general factors and eight group factors, based on the small loadings found for the ninth group factor. The results are presented in Tables 12 and 13, respectively. The magnitude of loadings differs between the two solutions; in the SL solution, the loadings for the second general factor are relatively small ($-.33$ to $.34$), while

in the DSL solution, the loadings for the second general factor are similar in size to the loadings of the first general factor and are relatively large (.10 to .60). This discrepancy between the two solutions is likely due to the Procrustes rotation used in the DSL method; this rotation is known to overfit the target matrix, confirming the analysts' hypothesis (Gorsuch, 2015). That is, because I used a target loadings matrix for the DSL method that specified two general factors, the solution was reached in a way that confirms this loading pattern. Therefore, it is safer to rely on the SL solution in this case which supports the presence of one general factor rather than two. Additionally, it is unlikely that a method factor explains more than 80% of the variance in the items, considering respondents were correctly able to differentiate the sleep climate negative features items from the other items. Thus, this general factor is best thought of as representing an organization's consideration for a broad range of members' health behaviors.

In addition to the underlying factor structure of health behavior-related climate items, confirmatory bifactor models were run to examine the degree of shared variance among sleep climate and sleep items due to common method. First, a model was run in which the sleep climate, sleep quality, and sleep quantity items loaded onto their respective factors (5 factors total), and all of these items also loaded onto a sixth factor that did not correlate with any of the other factors. This sixth factor was meant to represent the common survey method factor. Standardized loadings and factor intercorrelations are presented in Table 14 and Table 15, respectively. The model fit the data well ($\chi^2 = 194.98$, $df = 93$, $CFI = .97$, $TLI = .96$, $RMSEA = .05$, $SRMR = .03$). Interestingly, the common method factor explained more variance in negative features

and sleep quality items compared to communication and positive features items. Given that sleep quality items 1 through 4 were worded negatively (e.g., “Had trouble falling asleep”), the common method factor seemed to be representative of a “negative valence” factor rather than a general method factor. Additionally, the factor intercorrelations was not as expected, with the negative and positive features correlating positively, none of the sleep climate dimensions correlating significantly with sleep, and sleep quality and quantity negatively correlated.

Thus, a second model was fit with a positive valence factor and a negative valence factor replacing the common survey method factor. Standardized loadings and factor intercorrelations are presented in Table 16 and Table 17, respectively. The model had a similar fit to the data as the first model ($\chi^2 = 171.03$, $df = 93$, $CFI = .98$, $TLI = .97$, $RMSEA = .04$, $SRMR = .05$). The signs of the loadings on the negative valence factor was not consistent between negative features items and sleep quality items, suggesting this factor may not have represented a negative valence factor. However, the factor intercorrelations were more interpretable this time: no significant correlation was found between positive features and negative features, negative correlation found between negative features and sleep quality, and positive correlation found between sleep quality and quantity.

Next, a third model was fit with a climate method factor and a sleep method factor replacing the positive and negative valence item factors. Standardized loadings and factor intercorrelations are presented in Table 18 and Table 19, respectively. Again, the model had a similar fit to the data as the first and second models ($\chi^2 = 173.04$, $df = 94$, $CFI = .98$, $TLI = .97$, $RMSEA = .04$, $SRMR = .05$). In this model, most of the climate items

significantly loaded onto the climate method factor and all the sleep quality items loaded onto the sleep method factor. Furthermore, most of the sleep climate and sleep quality items loaded onto their respective substantive factors. Factor intercorrelations were similar as the second model, such that sleep climate dimensions correlated weakly with one another, negative features and sleep quality had a significant negative correlation, and sleep quality and quantity showed a significant positive correlation.

Study 1 Discussion

Overall, the results provided support for the notion that work context characteristics are related to sleep of organizational members, as well for the relationship between sleep climate and sleep. As expected, most work context characteristics were more strongly related to sleep quality than quantity. This, combined with the findings that workload-related characteristics (e.g., work duration, workload uncertainty) had larger correlations with sleep quantity compared to other characteristics, suggests that work context characteristics may have little impact on sleep quantity unless they directly constrain or free up time to sleep. Meanwhile, the positive features dimension of sleep climate, manifested as supervisor support for sleep and educational practices regarding sleep, yielded a small but positive correlation with sleep quantity. This hints at the potential that these features may have in motivating organizational members to sleep more.

Analyses were able to shed some light on the relationship between sleep climate and other constructs. Sleep climate dimensions seem to be distinct from molar climate dimensions and job characteristics based on the modest correlations found with these groups of constructs. On the other hand, sleep climate's relationship with health behavior

climate as conceptualized by Sonnentag and Pundt (2016) seems to be more complicated. On the one hand, confirmatory factor analyses suggested that the variance in health behavior-related climate items is explained by factors that represent nine dimensions of work context characteristics that target sleep, healthy eating, and exercise. However, when hierarchical models were tested, model fit worsened, suggesting the lack of a higher-order factor that explains covariation among the nine factors. Conversely, bifactor models revealed that a bulk of the variance in the items is explained by one general factor that seemingly represents an organization's characteristics that pertain to health-related behaviors broadly. Going back to the implications of bifactor models (Cucina & Byle, 2017), this general factor does *not* represent a higher-order factor that explains covariation among the nine factors pertaining to specific health-related behaviors. Rather, it is directly associated with the manifestation of the health behavior-related work characteristics depicted in the items, and the nine specific health behavior-related factors contribute to the manifestation of health behavior-related work context characteristics independently of the general factor. Therefore, study results suggest that it may be beneficial to consider an organizational or workplace climate for health more broadly in addition to attending to specific health behaviors.

Nevertheless, it is important to note that significant relationships were observed between sleep climate dimensions and sleep outcomes. Specifically, positive features and negative features dimensions of sleep climate correlated with sleep quantity and quality, respectively. The positive relationship found between positive features and sleep quantity is notable because of the content of items representing the positive features dimension (e.g., supervisor's interest in good sleep, education about sleep). These items do not

represent work context characteristics that directly place constraints or free up time that could be allocated to sleep, unlike other variables that were found to correlate with sleep quantity (e.g., efficiency, work pace, work duration), or characteristics of job tasks (e.g., information processing). This may suggest that improving the positive features of sleep climate could result in longer sleep of organizational members without altering the nature of job tasks or work hours.

Factor analyses on health behavior-related climate items suggested the presence of a broad health behavior climate that contributes to variance in health behavior climate indicators independently of specific health behavior climates. That is, rather than focusing on individual health-related behaviors such as diet, exercise, or sleep, organizations may be concerned about members' overall health. Although sleep climate may not be a salient feature of the work environment for many organizations, this finding suggests that organizations that have a positive health behavior climate but do not yet have practices in place that support employee sleep may be more willing to adopt such practices compared to organizations with a relatively negative health behavior climate.

A series of factor analyses were also conducted to investigate the level of common method bias among sleep climate and sleep items. Results showed that loadings onto method factors differed in magnitude depending on how the method factors were conceptualized. When a single survey method factor was modeled, this factor explained little variance in the sleep climate items, while it explained between 40% and 60% of the variance in sleep quality items. Factor intercorrelations were not as expected in this model, with positive and negative features correlating positively, and sleep quality and quantity showing a weak negative correlation. Strength and pattern of relationships

between factors and items seem to be closer to how they were intended to be when the method factors were modeled to reflect climate- versus sleep-methods, compared to positive- versus negative-valenced worded methods. In each of these models, communication and negative features items retained their loadings to their respective factor. Moreover, factor intercorrelations more closely mirrored what would be expected from both an empirical and conceptual standpoint: negative features correlated negatively with sleep quality and sleep quality and quantity correlated positively. Therefore, some support was obtained for the relationship between sleep climate and sleep after parsing out common method variance.

Despite serving as a good first step in exploring the construct of sleep climate and providing insight on the relationship between a broad range of work context characteristics and sleep, this study suffered from two major limitations. First, because this was a correlational study, the degree to which perceptions of sleep climate change over time and how they impact sleep over time could not be investigated. Second, data were collected from individuals whose membership in organizations was unknown. Because of this, I was only able to analyze the sleep climate as psychological climate—that is, as individuals' idiosyncratic perceptions of their organizations' climates. The two following studies will attempt to investigate these issues and also replicate some of the findings regarding the relationships between sleep and molar climate and job characteristics.

Study 2

Study 2 sought to investigate how perceptions of sleep climate will change in response to intervention. This serves the purpose of assessing the malleability of sleep

climate perceptions (Hypothesis 3g), as well as obtain support that it is a construct somewhat rooted in reality that exists outside of the raters' perception. Dr. Michael Howell at the Department of Neurology delivered a workshop on sleep for third-year medical school students in January, 2019, which provided a good opportunity to assess sleep climate perception and sleep behavior before and after the intervention. The workshop was expected to alter sleep climate perceptions of participants; specifically, the communication and positive features dimensions. This, in turn, should lead to better and longer sleep. Additional objectives of the study were to test Hypothesis 3f that the cognitive (motivational) and affective pathways mediate the relationship between sleep climate and sleep, and to replicate the sleep climate–sleep relationships found in Study 1.

Study 2 Participants

Participants were third-year medical students at the University of Minnesota. Of the 224 such students, 165 attended the workshop and completed the baseline survey. The average age was 26.48 years ($SD = 2.91$), 79 (47.88%) were male, and 125 (75.76%) identified as Caucasian. Of the 165 participants, 127 completed the follow-up survey. The average age of this sample was 26.49 ($SD = 2.80$), 33 (25.98%) were male, and 56 (44.09%) identified as Caucasian.

Study 2 Procedure

In January 2019, Dr. Michael Howell delivered his sleep workshop. This workshop was in a lecture format, lasting 90 minutes, and was tailored to third-year medical school students who had begun clerkships in the previous semester (Fall 2018). The purpose of this workshop was to equip third-year medical students who had recently begun clerkships with the knowledge and strategies to achieve good sleep amidst a hectic

work schedule. Four identical sessions were held over the course of two days, and the lectures were delivered through 106 Power Point slides. There was variability in how much time was spent on each topic, from a minimum of 3 slides to a maximum of 22 slides. The contents covered consequences of sleep deprivation, an exercise to discover one's natural circadian rhythm, and common causes for poor sleep difficulty. In addition, Dr. Howell offered evidence-based strategies to combat these sleep problems, such as not trying to fall asleep when one cannot fall asleep within 10 minutes of going into bed, use of a light box and sunglasses for individuals working night shifts, identifying maladaptive cognitive distortions about sleep (e.g., "I always have the worst call nights"), and tips on napping.

As students came in to take part in the workshop, they were handed a packet that included the consent form and the set of questionnaires described below. The students spent approximately 10 minutes at the beginning of the workshop to complete the survey. A month after the workshop, participants were sent an email that included a link to the follow-up online survey. This survey included the same items as the first survey, plus the negative affect and job satisfaction measures. Upon confirmation of survey completion, students were compensated with a \$2 Amazon gift card.

Study 2 Measures

The survey battery was kept brief due to two reasons: 1) there was very limited time to collect data in-person before the workshop, and 2) medical school students are frequently given requests to complete surveys and are generally reluctant to complete long surveys.

Sleep climate

Sleep climate was measured with the 10-item questionnaire constructed in the Study 1. The dimensions of communication, positive features, and negative features were assessed.

Sleep

Sleep quality was assessed with the same measure as the Study 1, which was an adaptation of the Jenkins et al. (1988) measure. Sleep quantity was assessed in two different ways: a direct self-report of the average sleep quantity in the past month (“This past month, how long have you slept on a typical night?”), and an indirect measure calculated based on the average bed- and wake-times in the past month.

Sleep knowledge

Sleep knowledge was assessed with six multiple-choice items developed by Dr. Michael Howell. These items check knowledge regarding the causes of insomnia, negative outcomes of sleep apnea, as well as evidence-based strategies to deal with sleep problems. Items are presented in Appendix F. Items were presented in a way that involved respondents choosing all the correct response options to a given stem, so scoring was performed in three different ways. The first method (A) was the strictest, in that participants earned one point per item by correctly choosing all the appropriate options and not choosing any of the inappropriate options. For example, for an item for which the correct response options were choices 1, 2, and 4, one had to choose 1, 2, and 4 and not choose 3 and 5 to earn a point for the item. The maximum total score participants could earn based on this method was 6 points. This scoring resulted in a severely positively skewed distribution of the total score. The second scoring method (B) was on the other

hand the most lenient scoring method. In this method, participants earned one point for choosing a correct response option, and were not penalized for choosing an incorrect response option. For example, for an item for which the correct response options were choices 1, 2, and 4, one could earn 3 points by selecting all the options from 1 to 5. This method was deemed appropriate given that none of the respondents chose all five response options for all six items at either time point. The maximum total score participants could earn based on this method was 16 points. Total scores calculated based on Method B was normally distributed. The third scoring method (C) was between A and B in terms of leniency. Participants earned one point for selecting a correct response and lost a point for selecting an incorrect one. For example, if a participant chose all five response options for an item for which the correct response options were 1, 2, and 4, the participant earned 1 point for the item (+3 for choosing 1, 2, and 4, and -2 for choosing 3 and 5). Total scores based on this method were also normally distributed.

Sleep motivation

Sleep motivation was measured with 5 items that each capture different aspects of motivation to sleep well: self-efficacy, commitment, value, behavioral intention, and prioritization. The items are in a 5-point Likert scale (strongly disagree ~ strongly agree) format. Sample items include “I was committed to sleeping well” and “I placed value on health sleep”; the full list of items are presented in Appendix G.

Negative affect

A total of 15 items of the general negative dimension and the sadness scales of PANAS-X (Watson & Clark, 1994) was used to measure negative affect. Participants responded the extent to which they have felt the emotions listed in the past month on a 6-

point Likert scale (very lightly or not at all ~ extremely). Because of time constraints before the workshop, this measure was omitted from the baseline survey, but was retained in the follow-up survey.

Job satisfaction

Job satisfaction was measured using a 5-item version of the Brayfield and Rothe (1951) measure of job satisfaction. This short version has been used in multiple studies in the organizational sciences and has shown good internal consistency reliability (e.g., Ilies & Judge, 2002; Judge, Locke, Durham, & Kluger, 1998). Items are in 5-point Likert scale format (strongly disagree ~ strongly agree). Because of time constraints before the workshop, this measure was omitted from the baseline survey, but was retained in the follow-up survey.

Study 2 Analysis and Results

Descriptive statistics and correlations of study variables from Time 1 and Time 2 are presented in Table 20 and Table 21, respectively. The relationships between sleep climate dimensions and sleep found in this sample differed from those found in the Study 1 sample. In Study 1, a positive relationship was found between positive features and sleep quantity, and a negative relationship was found between negative features and sleep quality. In the current sample, a positive relationship between positive features and sleep quality was found (non-significant at Time 1, significant at Time 2), and a negative relationship was found between negative features and sleep quantity (significant at Time 1, non-significant at Time 2). In addition, sleep motivation correlated with positive features at Time 1 and with communication and positive features at Time 2; sleep

motivation also correlated positively with both sleep quality and quantity. Interestingly, negative features did not correlate with sleep motivation at either time point.

Hypothesis 3g stated that sleep climate perceptions can be improved through a training intervention. Although this hypothesis focused on sleep climate, changes in sleep variables were examined as well. To test the hypothesis, three different approaches were taken. First, a paired-sample t-test was conducted on the variables between Times 1 and 2. Second, Cohen's d between Times 1 and 2 were calculated for each variable. Third, hierarchical linear regression analyses with individual participants as the grouping variable, focal variable as the dependent variable, and dummy variable of time (1 or 2) as the predictor, were conducted. The results of these approaches are presented in Table 22. Across the approaches, change in sleep climate dimension perceptions were consistently observed. Communication and positive features increased, while negative features decreased. Therefore, Hypothesis 3g was supported. Additionally, increase in sleep knowledge across all three scoring methods and sleep motivation were observed consistently across all approaches. For sleep behaviors, significant difference was observed between the two time points via paired-sample t-test, and a significant effect of time was found in the hierarchical linear regression analyses. However, the 95% confidence interval of the Cohen's d for these variables included zero (not shown). Although changes in the desired direction were observed for many of the study variables, one caveat to take into consideration is that the change cannot be fully attributed to the intervention. I will go into further detail on this issue in the Discussion section.

Hypothesis 3f stated that the relationship between sleep climate and sleep are mediated by the cognitive and affective pathways. Two approaches were used to test this

hypothesis. First, mediation effects of sleep motivation and affect were examined cross-sectionally at each time point. Sleep climate dimensions (along with sleep knowledge in the case of sleep motivation as the mediator) were thought to be the most distal predictors of sleep outcomes; these would thought to influence sleep motivation, which in turn would influence sleep outcomes. The models tested are depicted in Figures 2 and 3. These models were tested using linear regression procedures outlined by Hayes (2018). That is, to estimate direct and indirect effects between variables, a regression model was set up for each step of the mediation sequence (i.e., sleep climate and sleep knowledge, sleep climate and sleep knowledge \rightarrow sleep motivation, sleep motivation \rightarrow sleep) with all the variables up to that step included as predictors. Indirect effects were calculated as the product of paths leading to the sleep outcome (e.g., the indirect effect of communication on sleep was calculated as the product of a_1 and b_5). 95% confidence intervals for the indirect effects were formed using the Monte Carlo simulation method proposed by Selig and Preacher (2008). The estimates of the effects are presented in Tables 23 through 25, and the estimate of the indirect effects and its confidence intervals are presented in Table 26. The Labels of the paths correspond to the labels of paths in Figures 2 and 3, and the Slope values represent the non-standardized regression coefficient of the IVs. Based on the Baron and Kenny (1986) criteria, only the mediation effect of sleep motivation in the positive features – sleep quality relationship at Time 2 was supported. That is, in this relationship, the sleep climate dimension showed a non-zero relationship with a sleep outcome as well as with the mediator, and the relationship between the sleep climate dimension and sleep outcome weakened with the addition of the mediator. However, based on the 95% confidence interval of the indirect effect, the

mediation effect of negative affect in the negative features – sleep quality at Time 2 was also supported. Thus, Hypothesis 3f was partially supported by the cross-sectional linear regression procedure.

Second, HLM was used to test the within-individual relationships between variables over time. As mentioned in the results of analyses examining the effect of time on variables, time was associated with changes in all study variables in the series of HLM analyses. Thus, HLM analyses were conducted to investigate whether these changes were mediated by changes in sleep climate perceptions and sleep motivation. Essentially, a mediation model in which time predicts sleep climate and sleep knowledge, which in turn predicts sleep motivation, which in turn predicts sleep outcomes, was tested (Figure 4). Because there was no reason to believe that sleep climate dimensions would sequentially influence one another, they were thought to have parallel effects on sleep motivation. Thus, the model had sequential and parallel properties. The mediation effect of negative affect could not be conducted because its measure was only included at Time 2. In the following analyses, sleep climate and sleep motivation variables were person-centered, and person-level means were added as predictors to estimate both the between- and within-person effects simultaneously. This was important because the effect of time was strictly at the within-person level (i.e., there was no variability in time between persons); thus, only the within-person effect of the mediating variables had to be examined (Preacher et al., 2010).

Two full models (one for each sleep outcome) were tested. Like the cross-sectional analyses, mediation was tested following the recommendations outlined in Hayes (2018), and 95% confidence intervals were formed for the indirect effects using

the Monte Carlo simulation method proposed by Selig and Preacher (2008). The estimate of the fixed effects involved in the models are presented in Table 27, and the estimates of the indirect effect through each mediation channel (i.e., communication, positive features, negative features, sleep knowledge) for every sleep knowledge scoring method used are presented in Table 28. Analyses using only the second scoring method for sleep knowledge (Sleep knowledge B) are presented in Table 27, because the distribution of sleep knowledge scored this way was the closest to a normal distribution, and the results were similar across scoring methods. The Labels column in Table 21 corresponds to the labels of paths in Figure 4, and the Fixed effect values represent the non-standardized within-person effect of the IV on the DV (i.e., fixed effect of the person-centered IV). It can be observed that for sleep quality, all the direct paths involved were non-zero only for the path involving communication. Passage of time was associated with increase in sleep climate communication perception, which led to increase in sleep motivation, which in turn led to increase in sleep quality. Consistent with this finding, the 95% CI of the indirect effect through the communication path excluded zero across all the sleep knowledge scoring methods. For sleep quantity, the 95% CI of the indirect effects through communication only barely excluded zero, and all of the other CIs included zero, suggesting that the increase in sleep quantity over time did not occur due to changes in sleep climate perceptions, sleep knowledge, or sleep motivation. Overall, Hypothesis 3f was supported in various ways depending on the mediation analysis approach used; however, strongest support was provided for the causal effect of the sleep climate communication dimension on sleep quality through sleep motivation, since the within-person linkages between variables over time were observed.

Study 2 Discussion

The primary objectives of Study 2 were to examine the extent to which sleep climate perceptions can be altered through an intervention, test the mediation effect involved in the sleep climate–sleep relationship, and replicate the sleep climate–sleep relationships. Results supported the notion that perception of all three dimensions of sleep climate can change in response to an intervention, with mean perception of all three dimensions increasing toward a desirable direction over time. Despite the workshop being focused primarily on imparting knowledge, social aspects regarding sleep changed in a desirable direction. One caveat of this finding, however, is that the current sample was medical students who may place higher value on health-related behaviors and therefore may bring up health-related topics such as sleep in everyday interactions. Thus, one must be cautious about generalizing these findings to a broader population.

Cross-sectional analyses provided support for the effects of positive features and negative features on sleep quality through sleep motivation and negative affect, respectively. On the other hand, when within-person effects of the intervention were examined, support was found for the effect of the intervention on changes in sleep quality through communication and sleep motivation. What was remarkable regarding this finding was that the effect was independent of the effect of sleep knowledge. This echoes findings from reviews on sleep interventions that knowledge-based sleep interventions have had mixed effects on sleep behavior, despite being consistently effective in increasing sleep knowledge (Blunden et al., 2012; Cassoff et al., 2013). Together, the results of the current study and these reviews suggest that interventions to improve sleep behavior of organizational members may benefit from focusing more on encouraging

organizational members to talk about sleep and make it a more salient element in their life, rather than focusing solely on increasing sleep knowledge.

Support for the mediation effect of sleep climate on sleep quantity was weaker compared to that for sleep quality. This is to be expected; sleep quantity is highly subject to time availability, which is less likely to change as a result of change in climate perceptions compared to sleep quality. However, there was a larger effect of intervention on sleep quantity through sleep motivation that was not mediated by sleep climate or sleep knowledge (indirect effect: .09, 95% CI [.02, .18]), suggesting that at least some of the increase in sleep was due to increase in sleep motivation. Cassoff et al. (2013) postulated that many sleep promotion programs fail to influence sleep behaviors because the programs do not target sleep motivation, but the above finding suggests that programs can be designed to enhance sleep motivation. The particular intervention conducted by Dr. Howell in the current study included segments on specific strategies to overcome sleep onset difficulties and night shifts. These contents may have increased the self-efficacy of participants to carry out healthy sleep practices and contributed to the increase in sleep motivation. Thus, it may not be wise to completely disregard programs that focus on sleep knowledge; providing knowledge on *how* to modify one's sleep behavior, rather than *what* constitutes (un)healthy sleep behavior may be useful. Additionally, tailoring the sleep strategies to the specific audience is likely to increase the effectiveness of the intervention. Strategies included in Dr. Howell's presentation were tailored specifically to third-year medical students that have started clerkships and were completely implementable by the participants (e.g., wear sunglasses on the way home from a night shift, take a nap seated and without blankets). On the other hand, tips on healthy sleep

behaviors that are in theory effective and ideal (e.g., have consistent bed and wake times, exercise every day) may not be implementable for the target audience and may have no impact on their sleep motivation. To this end, including a subject matter expert on the target audience in addition to experts on sleep is important in designing an effective sleep intervention.

The cross-sectional relationships found between sleep climate and sleep behaviors in Study 1 were not replicated in the current study. In Study 1, positive features correlated with sleep quantity ($r = .10$) whereas negative features correlated with sleep quality ($r = -.34$). In the current study, significant relationships were found between negative features and sleep quantity at Time 2 ($r = -.17$) and between positive features and sleep quality at Time 2 ($r = .21$). Although it may be problematic to overanalyze these correlations based on a relatively small sample size, there are a couple of potential explanations for these relationships. First, participants may have grown resistant to negative features to the point that sleep was no longer affected by them. On the other hand, participants may have retained information from the workshop that they were able to use to their advantage when perception of positive features was higher, allowing them to achieve higher quality sleep. The second possible explanation is the lower reliability of the sleep climate scale found in the current study compared to Study 1, which will be discussed later.

There were a few limitations to this study. First, time was used as a proxy for the intervention effect. A control condition could not be set up in the current study because participation in the sleep workshop was a requirement for all the third-year medical school students, resulting in this study being a one group pretest-posttest design (Cook et

al., 1990). Studies with this design are subject to multiple threats to internal validity, such as history, statistical regression, and maturation (Cook et al., 1990). However, there is some reason to believe that these threats may not be the most plausible explanations for the positive effects of time (the intervention) in this study. First, to my knowledge, there was no major event that occurred between Time 1 and Time 2 other than the workshop that would have led to the increase in sleep climate perception, sleep motivation, and sleep knowledge, as well as improvements in sleep behavior. The intervention was given near the end of the winter break, and other workshops given during the same week handled topics other than sleep. At Time 2, all students were placed in a clerkship different from the one at Time 1; while it is possible that students on average transferred to clerkships with a more favorable sleep climate compared to the one at Time 1, it is unlikely. Second, the measures of sleep outcomes referred to the past month. This means that at Time 1, students reported their typical sleep behaviors during winter break, when students would have likely had work schedules more conducive to consistent sleep schedules and longer sleep per night compared to during the school year. That students reported improved sleep quality and longer sleep at Time 2 indicates these effects occurred despite switching to a more strenuous schedule gives more power to the argument that improvements in sleep were due to the intervention rather than other causes. Taken together, these observations suggest that the choice to use the effect of time as a proxy for the effect of the intervention was not unreasonable. Nonetheless, future intervention studies on sleep climate should employ an experimental design to estimate the intervention effect as accurately as possible.

Second, the internal consistency of the sleep climate scales was found to be lower in the current sample compared to the Study 1 sample. Specifically, whereas the alpha of communication, positive features, and negative features were .84, .86, and .73, respectively, in Study 1, they were .68, .68, and .63 at Study 2 Time 1 and .72, .61, and .56 at Time 2. This may be due to the way some of the items were reworded to fit the context the medical students were placed in. That is, in items that included the word “supervisor”, this word was changed to “attending physician”. This was done to avoid confusion regarding who “supervisor” referred to for third-year medical students; because these students were under supervision of their respective clerkship’s physicians, the more specific term was used. However, this may have resulted in the items referring to sleep climate of two different targets: one of the medical school as a whole and another of the clerkship. Therefore, any inconsistencies in indicators of sleep climate between these two entities may have led to the decrease in internal consistency of the scales and attenuated the correlations between sleep climate and sleep variables.

Support for the relationship between sleep climate and sleep behaviors as well as the malleability of sleep climate has been obtained through Studies 1 and 2. However, up until now sleep climate has been measured strictly at the individual level; in Study 1, participants presumably all belonged to a different organization, and in Study 2, all participants belonged to a single medical school. With these samples, it was not possible to analyze the extent to which sleep climate perceptions were shared within a single organization or workplace. To be consistent with the definition of organizational climate, the degree of sharedness of sleep climate within workplaces must be determined; Study 3 was conducted to clarify this.

Study 3

The primary goal of Study 3 was to examine the extent to which members within the same workplace perceive sleep climate similarly. Due to a distinction made between idiosyncratic individual-level perceptions (i.e., psychological climate) and collective perceptions (i.e., organizational climate) in the climate literature, agreement among individuals within a single workplace regarding sleep climate must be examined to justify aggregation of sleep climate to a group level construct (L. R. James & Jones, 1974). This examination was not possible in Study 1 because organizational membership information was not collected, nor in Study 2 in which all participants belonged to the same cohort in the same medical school program. In Study 3, data were collected from resident physicians affiliated with the University of Minnesota medical school who were located in multiple learning sites across multiple residency programs. This enabled the examination of rater agreement of sleep climate, molar climate, and job characteristics within learning sites and residency programs, as well as analysis of the ratio of between-versus within-learning site and residency program variance that exists in these work context characteristics. Additional goals of the study included replication of the work context–sleep relationships found in Studies 1 and 2, and testing of the mediation effects of affect, sleep motivation, and detachment (Hypotheses 1j, 3f, 4u, and 4v).

A notable characteristic of the current dataset is its cross-classified structure. That is, level-1 units (i.e., individuals) are nested within multiple level-2 units (i.e., residency programs and learning sites). Therefore, analyses considered individuals' membership to both grouping units.

Study 3 Participants

Participants were resident physicians affiliated with the University of Minnesota. At the time of the study, 928 such residents worked across 42 learning site combinations and belonged to one of 83 residency programs. Compensation was offered in the form of an opportunity to enter a random drawing to win a \$50 Amazon gift card. Data were collected at two time points, approximately one month apart, to investigate the stability of sleep climate perceptions. Of the 928 residents, 289 responded to the Time 1 survey, and 138 responded to both Time 1 and Time 2 surveys. The average age of the participants at Time 1 was 30.97 (SD = 3.57), 106 (37%) were male, and 185 (64%) were Caucasian. The average age of those who responded to both surveys was 30.82 years (SD = 3.57), 68 (49%) were male, and 113 (82%) were Caucasian.

Study 3 Procedure

Prior to the distribution of emails containing the survey link, an email introducing the study was sent to all residents from the Director of Evaluation of the Graduate Medical Education Office. This email contained a brief description of the purpose of the study, study procedures, how findings of the study could benefit residents, and compensation information. Because residents constantly receive requests to complete surveys, it was important to advertise the current study in such fashion to encourage participation. Two days after this introduction was sent, an email containing the link to the Time 1 online survey was sent through the Contact List feature in Qualtrics. Thirty days after the first survey was sent, an email containing a link to the Time 2 survey was sent to individuals who completed the Time 1 survey.

Planned missingness

The current study utilized the planned missingness design (Graham et al., 2006). At early stages of study design, the Director of Evaluation at the University of Minnesota Medical School emphasized that residents typically have a high workload and in addition constantly receive requests to complete various surveys; therefore, it was crucial that the survey length be kept at a minimum. However, in the current study there was need to administer items from a wide variety of scales. One way to combat this issue of measuring a large number of scales with a limited number of items is to combine planned missingness with advanced data imputation techniques (Graham et al., 2006). Advanced imputation techniques such as multiple imputation and maximum likelihood have been shown to be capable of reproducing parameter estimates with great accuracy, so long as data are missing at random (MAR) or are missing completely at random (MCAR; e.g., Graham, Hofer, & MacKinnon, 1996; Putka & Williams, 2011). Random administration of item subsets across study participants makes the MCAR assumption reasonable, which enables imputation techniques to provide unbiased estimated of population parameters (Newman, 2014).

The capacity of multiple imputation to restore relationships between variables was tested with data from the third batch in Study 1. This dataset was chosen because it contained full responses of the largest number of variables that was scheduled to be included in the Study 3 survey. From this dataset, multiple datasets containing varying degrees of missingness were created, and the *mice* package (van Buuren & Groothuis-Oudshoorn, 2011) was used to conduct multiple imputation on these datasets. Then, the residual between the correlation of scale scores between the complete dataset and the

imputed datasets were computed. Even when scales were missing half of its items (rounded down for scales with an odd number of items; e.g., 2 items missing for a 5-item scale), the average residual between the complete and imputed datasets were .029. Thus, this level of planned missingness was adopted. The specific number of items for each scale is presented under the description of the measures.

To create planned missingness in the online survey, a feature in Qualtrics was utilized which enables random administration of items within a given block of items. The online survey was set up so that each scale constituted its own block, and a certain number of items (specified below for each scale) from each block was administered randomly to each participant. Additionally, an option of the randomization feature that evens out the number of times each item is selected was used so that the proportion of missingness was approximately equal across items.

Study 3 Measures

Sleep climate

Sleep climate was measured with the items developed in Study 1. In this study, participants received a subset of a larger pool of items than the 10-item measure that was used for most of the analyses in Study 1 and in Study 2. These items had been administered to participants in the third data collection batch of Study 1 but was not used later because the 10-item measure worked well with the entire Study 1 sample. However, these items were reintroduced in this study because the three dimensions of the 10-item scale displayed low internal consistency in the Study 2 sample. Participants received three out of five items for the communication dimension, and four out of seven items in the positive and negative features dimensions. Participants reported their perceptions

regarding sleep climate at the learning site as well as the residency program for each item.

Molar climate and job characteristics

To replicate some of the findings from the Study 1, a select number of dimensions from the molar climate and job characteristics measures were included. Not all dimensions could be included because even with the planned missingness design, survey length could not be kept at a reasonable length with the large number of dimensions in the OCM and WDQ. Therefore, several dimensions that showed stronger relationships with sleep compared to other dimensions in Study 1 were included in the survey. The included dimensions (number of items randomly assigned to participants/total number of items) were as follows. From the OCM, welfare (2/4), efficiency (2/4), and pressure to produce (3/5) were included. From the WDQ and additional job characteristic scales, information processing (2/4), social support (3/6), workload uncertainty (2/2) and schedule consistency (3/5) were included.

Sleep

Sleep quality was assessed with the same measure as Study 1, an adaptation of the Jenkins et al. (1988) measure. Three out of the six items were randomly administered to each participant. Sleep quantity was assessed as a direct self-report of the average sleep quantity in the past month (“This past month, how long have you slept on a typical night?”).

Sleep motivation

Sleep motivation was measured the same 5 items as used in Study 2. Three out of five items were randomly administered to each participant.

Affect

Five items of positive and negative affect were taken from the short form PANAS by Thompson (2007) and Mackinnon et al. (1999), respectively for a total of ten items. Participants responded the extent to which they have felt the emotions listed in the past month on a 5-point Likert scale (very lightly or not at all ~ extremely). Three items per scale were randomly administered to each participant.

Psychological detachment

Psychological detachment from work was measured using a four-item measure by Sonnentag et al. (2008). The items and directions were altered to reference participants' detachment from work in the past month. An example item is "I did not think about work at all". Items were in 5-point Likert scale format (strongly disagree ~ strongly agree), and two out of the four items were randomly administered to each participant.

Learning site and residency program-related questions

Residents were also asked about their current learning site and residency program membership, how long they have been at their current learning site, average daily work hours in the past month, and the number of days in the past month they were on a night shift.

Study 3 Analysis and Results

Multiple imputation was carried out as follows. First, membership data (i.e., residency programs and learning site) were examined and modified. Because *mice* (van Buuren & Groothuis-Oudshoorn, 2011) cannot handle factors with more than 50 levels, the levels of residency programs had to be reduced. There were originally 59 programs. To reduce the number, all programs with an N of 1 were grouped together into "Other",

which resulted in a total of 38 programs. Locations were originally coded in the form of *learning rotations*, which are specific fixed term learning programs for residents to get hands-on experience. Because there were 239 such rotations, they were re-classified into learning sites where the rotations took place. As was the case with residency programs, learning sites with an N of 1 were grouped together into “Other”. Additionally, for participants who worked multiple learning rotations across sites were coded as “Multiple”. This resulted in 19 learning sites. Next, predictors used for each variable was determined. In the case of datasets with a large number of columns, [van Buuren \(2018\)](#) recommends that a subset of predictors are used to impute each variable. Thus, 20 variables that showed the strongest bivariate correlations with the target variable along with the sleep variables, membership variables (i.e., program and learning site), and demographics were used as predictors. Finally, predicting mean matching was used with 30 iterations to generate 50 complete datasets using the mice package (van Buuren & Groothuis-Oudshoorn, 2011) in R. For Time 2 data, only the data of those that completed the Time 2 survey (N = 138) were imputed because of substantial person-level missingness. Because of this, analyses involving only Time 1 variables were conducted with N = 289, while those that involved both Time 1 and Time 2 data were conducted with N = 138.

Descriptive statistics and correlations

Descriptive statistics of the study variables are shown in Table 29. To my knowledge, there was no major event between Times 1 and 2 that would have altered sleep climate perceptions and/or sleep behaviors. This was confirmed by the data; no noticeable differences in means between Times 1 and 2 were found; however, standard

deviations were generally smaller at Time 2, suggesting that the values obtained at Time 2 were range-restricted near the mean. Perception of sleep climate dimensions were approximately around the middle point of a 5-point scale, with the negative features dimension being slightly higher than the communication and positive features dimensions. Considering the relatively stressful nature of the occupation, sleep quality was rather high with a mean of 3.86 (T1) and 3.91 (T2), on a 6-point scale. The mean of typical sleep quantity per night was 6.74 (T1) and 6.78 (T2) hours, not quite reaching the recommended 7-hour mark (Consensus Conference Panel et al., 2015). Interestingly, the current sample was characterized by moderate positive affect (3.23 at T1, 3.13 at T2) and low negative affect (2.21 at T1, 2.17 at T2). With regards to job characteristics, information processing was high (4.68 at both time points), workload uncertainty was also high (3.82 at T1, 3.84 at T2), and schedule consistency was low (2.29 at T1, 2.37 at T2), as can be expected from the profession. Participants also reported high social support (3.97 at T1, 3.92 at T2), and were able to psychologically detach somewhat from work (2.85 at T1, 2.93 at T2). For molar climate, participants perceived that they were moderately being cared for by the organization (mean of welfare 3.57 at T1, 3.64 at T2), but they also perceived the organization to be somewhat inefficient (mean of reverse-coded efficiency 3.50 at T1, 3.48 at T2), and work demands somewhat high (mean of pressure to produce 3.69 at T1, 3.60 at T2).

Individual-level correlations are displayed in Table 30. Correlations at Times 1 and 2 are displayed below and above the diagonal, respectively. Perceptions of the sleep climate dimensions with different referents (e.g., Communication [Site] and Communication [Program]) correlated highly with each other. This may suggest the

idiosyncrasy of sleep climate perceptions as well as the difficulty of differentiating between sources of sleep climate (i.e., learning site vs. residency program). Generally, relationships between work context characteristics and sleep were stronger at Time 1 than at Time 2. To explore this change, descriptive statistics and correlations were calculated on the subset of the Time 1 sample that also completed the survey at Time 2. Results are presented in Appendices J and K. Based on descriptive statistics, the difference in characteristics of participants at the two points seemed to be negligible. However, the correlation matrix demonstrates that even when the individual participants are held constant across the two time points, the relationships among variables are stronger at Time 1. One potential reason for this is that participants were better able to differentiate aspects of the work environment at Time 2 after having taken the survey at Time 1. Additionally, with respect to the sleep – work context correlations, participants may have established a level of sleep quality and quantity that is less likely to be affected by the work context. However, given the short time lapse between the two time points and the fact that many participants had already been at their respective sites for some time at Time 1, this is an unlikely explanation.

ICC and Agreement

One of the primary objectives of the current study was to examine the extent to which individuals within a workplace agree on perceptions of sleep climate. Three approaches were taken to achieve this. The first was to calculate the intraclass correlation (ICC1) of the sleep climate scales. ICC1 is an index of interrater reliability, and is calculated as the ratio of between-cluster variance to total variance (Bliese, 2000). Because individuals were nested within two clusters (i.e., sites and programs), three types

of ICC1s could be calculated for each variable: ratio of the sum of between-site and between-program variance to total variance, ratio of between-site variance to total variance, and ratio of between-program variance to total variance. These are presented in Table 31. The values in the Total column represent the proportion of variance in the variable that is attributed to both learning site and residency program membership. These proportions of variance are further broken down into amount of variance attributed to learning site and residency program in the Site and Program columns, respectively. The values in parentheses are the SD of the values across imputed datasets. ICCs for most of the sleep climate scales exceeded .10 which suggests a degree of non-independence of sleep climate perception within learning sites and residency programs. Interestingly, most of the non-independence was driven by program membership rather than learning site membership, even when the referent of sleep climate items was the learning site. For example, 13% of the variance in the communication scale referencing the learning site was attributed to program membership and only 3% to site membership. This trend was observed for the other study variables as well as at Time 2. However, variance attributed to learning site increased slightly at Time 2. Furthermore, values found for sleep climate scales were comparable to those found for other work context variables (i.e., job characteristics and molar climate), providing some support for the justification for the aggregation of sleep climate to a group-level variable.

The second and third approaches to examining the level of similarity in sleep climate perception within workplaces were the use of interrater agreement indices. Various such indices have been used in the organizational sciences, each with its advantages and disadvantages (O'Neill, 2017). Of these, two indices were calculated for

the current dataset, the $r_{wg(j)}$ (L. R. James et al., 1984) and the s_{wg} (Schmidt & Hunter, 1989) $r_{wg(j)}$ was chosen because of its popularity and it allows for modeling of the null distribution in which there is no systematic agreement regarding the target construct. s_{wg} on the other hand was chosen because of its straightforward interpretation, simply being the standard deviation of the scale scores within a given group.

An issue with the $r_{wg(j)}$ is that the values depend strongly on the null distribution that is selected for calculation. Despite being widespread, use of the rectangular distribution in calculating the $r_{wg(j)}$ has been criticized because it likely inflates observed $r_{wg(j)}$ values by overestimating the degree of variance in the null distribution and it does not consider the presence of response bias (Smith-Crowe et al., 2014). Therefore, four different null distributions were used to calculate the $r_{wg(j)}$ for the current dataset: the rectangular distribution, normal distribution, slightly skewed distribution, and bimodal distribution. The normal, slightly skewed, and bimodal distributions were chosen to represent situations in which random responding results in larger of individuals selecting the central response option, more individuals responding toward one side of the scale, and individuals divided into two sides of the scale, respectively.

The average $r_{wg(j)}$ across learning sites and residency programs are presented in Tables 31 and 32, respectively. The values in parentheses are the SD of the values across the imputed datasets. It is immediately noticeable that the values based on the rectangular distribution are much larger than the values based on the other types of distributions in both tables. Thus, it is important to consider the values based on the rectangular distribution as a liberal estimate of agreement under the assumption of maximal variance in the null distribution. Comparing across the variables, values found for the sleep

climate scales were somewhat comparable to values found for other work context variables other than information processing and social support. This suggests that individuals within the same workplace agree on the perception of sleep climate dimensions to a similar extent as they do more general climate and job characteristics. Interestingly, degree of agreement in variables that are not properties of the workplace such as sleep motivation and affect was as high, if not higher than many of the work context variables. No noticeable differences in the $r_{wg(j)}$ values were found across cluster (i.e., learning site and residency program) or time.

Table 34 presents the average values of s_{wg} found across sites and programs; again, the values in parentheses are the SDs of the s_{wg} s across imputed datasets. As was the case with ICC1 and $r_{wg(j)}$, the difference in values between sleep climate dimensions and other work context variables are not large, with most values being around 1 scale point. Similar to the findings regarding $r_{wg(j)}$, there was higher level of agreement for information processing and social support. Potential reasons for this will be discussed later. As was the case for $r_{wg(j)}$, there were no noticeable differences in values across time.

Work context – sleep relationships

Another objective of the current study was to replicate work context – sleep relationships found in Studies 1 and 2. In the first two studies, inference could be made only regarding individual-level perceptions of the work context (e.g., individuals with high perception of social support have higher sleep quality than those with low perception of social support). To be consistent with this, the within-cluster (i.e., learning site and residency program) relationships between work context variables and sleep were examined. In doing so, the variance captured by regression slopes in HLM had to be

considered. Slopes for raw level-1 predictors in hierarchical linear models capture both within- and between-cluster variance, and within-cluster centering is the recommended method to separate the effects at the two levels (Enders & Tofighi, 2007). However, to my knowledge, an appropriate way to perform within-cluster centering in cross-classified data has not been established. Meanwhile, it has been shown that using the level-1 predictor in its raw form and adding its cluster mean as a predictor yields the same fixed slope for the level-1 predictor as within-cluster centering (Kreft et al., 1995). Although this method is known to produce different random variance component estimates than within-cluster centering, I adopted this method because the focus of the current analyses was the investigation of within-cluster relationships between work context variables and sleep.

Pooled results of the hierarchical models across imputed datasets with sleep quality and quantity as the dependent variable are presented in Table 35 and Table 36, respectively. The effect of each predictor is broken down in the Level column into *Variable*, *Site Mean*, and *Program Mean*, which each represent the HLM regression coefficient for the uncentered predictor, learning site mean of the predictor, and residency program mean of the predictor, respectively, as entered simultaneously in the model. The estimates of these are indicated in the Estimate column. As explained earlier, the *Variable* values are the average fixed level-1 slope of the predictor across imputed datasets and represents the average within-cluster relation between the predictor and the dependent variable. Therefore, these mostly closely replicate the relationships found between work context variables and sleep in Study 2. On the other hand, estimates for Site Mean and Program Mean reflect the between-site and between-program

relationships, respectively, between work context variables and sleep. The Lower and Upper columns represent the lower and upper bounds of 95% CIs of the estimated coefficients, respectively. Values in parentheses are the SDs of the respective estimates across imputed datasets. At Time 1, the within-person relationships largely mirrored those of Study 1, with the Variable coefficients for the positive and negative features dimensions of sleep climate exhibiting positive and negative relationships with sleep outcomes, respectively. Relationships with sleep quality were also replicated for workload uncertainty, schedule consistency, welfare, efficiency, pressure to produce, and work hours. Sleep quantity had a negative relation with negative features across all types of item sets, and a positive relationship with positive features item sets that referenced the residency program. Negative relationships found between sleep quantity and work context variables were also retained for workload uncertainty, schedule consistency, efficiency, pressure to produce, and work hours. However, many of these relationships did not replicate at Time 2, which may be due to the smaller sample size (138 at Time 2 as opposed to 289 at Time 1) as well as the smaller variance found for many of the variables (Table 29). Interestingly, between-group relationships were found only between the program mean of workload uncertainty and sleep quantity at Time 1.

Given the relative degree of variance due to residency program membership over learning site membership, the same HLMs were run with only the residency program as the grouping variable. These results are presented in Appendices H and I. Relationships found here largely mirrored those presented in Tables 34 and 35.

To examine the degree of association between the work context and sleep across time and remove shared variance due to the common test-taking situation, hierarchical

linear models were tested with Time 2 sleep as the dependent variable and Time 1 work context characteristics as the independent variable. Results are presented in Table 37. The relationships between sleep quality and negative features, sleep motivation, and positive affect were largely retained in this analysis. Similarly, relationships between sleep quantity and positive features, negative features, and sleep motivation were found here as well. These results provide support for the notion that work context – sleep relationships will be retained when common variance due to the same testing occasion is removed.

Mediation analyses

Hypotheses 1j, 3f, 4u, and 4v pertained to mediation involved in the relationship between the work context and sleep. In the current study, indirect effects through each hypothesized pathway as well as the total indirect effect was estimated and confidence intervals were constructed with the same method as in Study 2. The difference here was that for the reasons explained above, predictors were not centered and instead, the site and program cluster means were included as predictors in each model. This was done for each imputed dataset and the results were pooled. The average finding across datasets will be presented. Hypothesis 1j stated that the relationship between molar climate and sleep will be mediated by positive and negative affect. Table 38 presents the indirect effects, lower and upper bounds for the 95% CI of these indirect effects, and the SD of these estimates across imputed datasets. At Time 1, the indirect effect on sleep quality through positive affect was non-zero for welfare and pressure to produce. For efficiency, the total indirect effect on sleep quality was non-zero despite the 95% CI of each individual indirect effect including zero. None of the molar climate dimensions demonstrated non-zero indirect effects on sleep quantity. On the other hand, all of the CIs

for the indirect effects at Time 2 included zero. Therefore, Hypothesis 1j was partially supported.

Hypothesis 3f stated that the relationship between sleep climate and sleep will be mediated by affect and sleep motivation. Table 39 and Table 40 present the indirect effects, lower and upper bounds of the 95% CI of these indirect effects, and the SD of these estimates across imputed datasets for sleep quality and sleep quantity, respectively. There were three consistent findings regarding sleep quality. First, although bivariate relationships between communication and sleep were null, here, positive relationships between communication and sleep quality were consistently found at Time 1. Within these relationships, the pathway through positive affect seemed to be the most prominent. Second is the indirect effect between negative features and sleep quality at Time 1; all CIs of the total indirect effect excluded zero, and CIs of the indirect effect through sleep motivation excluded zero when the old negative features items were used. Third, all of the CIs of the total indirect effects between positive features and sleep excluded zero, and the CIs of the indirect effect through positive affect excluded zero. Indirect effects between sleep climate and sleep quantity were much weaker, with majority of the 95% CIs including zero. However, there were signs that sleep motivation mediates the link between negative features and sleep quantity. As was the case with bivariate relationships between sleep climate and sleep, none of the CIs excluded zero at Time 2. Overall, partial support was found for Hypothesis 3f.

Hypotheses 4u and 4v pertained to the mediation involved in the relationship between job characteristics and sleep. Specifically, affect was posited to mediate the relationship between sleep and social support, workload uncertainty, and schedule

consistency, and detachment was posited to mediate the relationship between sleep and information processing. The results regarding these hypotheses are presented in Table 41. For social support, workload uncertainty, and schedule consistency, the 95% CI for the indirect through positive affect and total indirect effect excluded zero when the dependent variable was sleep quality. On the other hand, all the 95% CIs included zero when the dependent variable was sleep quantity. For information processing, the 95% CI for all effects included zero. Therefore, Hypothesis 4u was partially supported and Hypothesis 4v was not supported.

Stability of Sleep Climate Perceptions

To examine the stability of sleep climate perceptions over time, a hierarchical linear model for each variable was run in which the Time 2 variable was regressed on the corresponding Time 1 variable and a “same location” dummy variable as well as an interaction term of the two, and the site and residency program as the grouping variables. The same location dummy variable indicated whether the participant was at the same learning site at both Time 1 and 2; this variable was included to examine whether staying at the same location changed the strength of relationship between variables at Time 1 and Time 2. This variable was coded ‘0’ indicated that the participant had transferred learning sites between Time 1 and 2, whereas ‘1’ indicated that the participant stayed at the same learning site for both survey administrations.

The results of these models are presented in Table 42. The “Estimate”, “Lower”, and “Upper” columns correspond to the unstandardized HLM coefficient of the predictors (Time 1 variable and the same location dummy variable), lower bound of the 95% CI of the coefficient, and upper bound of the 95% CI of the coefficient, respectively.

The parentheses indicate the SD of each of these estimates across imputed datasets. Results show that all variables correlated positively at Times 1 and 2, and with the exception of the new items pertaining to the Communication dimension and the number of night shifts in the past month, the 95% CIs of the coefficients excluded zero. More importantly, the coefficients of the sleep climate dimensions did not differ greatly from other work context variables that were measured on the same 5-point Likert scale and had similar SDs. Although no hypotheses were formulated regarding the influence of being at the same learning site at both time points, it would be expected that there would be a stronger relationship between Time 1 and Time 2 variables if participants stayed in the same learning site. However, none of the 95% CIs of the same location dummy variable or the interaction terms excluded zero, suggesting that being at the same learning site neither had an effect on the perceptions of the work environment at Time 2 nor was associated with the strength of relationship between Time1 – Time 2 work environment perceptions.

Study 3 Discussion

Study 3 was conducted for a few purposes: analysis of the degree of sharedness of sleep climate within workplaces, tests of the proposed mechanisms involved in the relationship between work context and sleep, and replication of sleep climate – sleep relationships found in Studies 1 and 2. For the first purpose regarding the sharedness of sleep climate perceptions within workplaces, it was found that the degree of dependency in sleep climate perceptions was similar to or more than that of other work context variables, with about 10 – 30% of the total variance being attributed to group

membership. For example, at Time 1, 27% of the variance of sleep climate communication dimension was attributed to learning site and residency program membership. This is stronger dependency than the job characteristic with the largest ICC, social support, of which 16% of its variance was attributed to group membership.

Interestingly, residency program membership consistently explained more variance compared to learning site membership across variables. This trend held even for sleep climate with learning site as the referent. One explanation for this is that even within learning sites, the specific work environment is determined by the residency program that one belongs to. Residency programs are tied to medical specialties such as anesthesiology, neurology, or surgery. It can be expected that each of these specialties has its own ways of how people in the specialty work and interact with one another, and with the attitudes members hold toward various topics, including sleep. These characteristics of specialties may be so strong that they shape residents' work environment perceptions more so than the general work environment of learning sites. Additionally, medical staff with similar specialties may be more likely to work together within a learning site, making the culture of the specialty tied to one's residency program more salient for residents.

Sleep climate showed similar agreement as most of the other work context variables based on agreement indices as well. Interestingly, there was similar level of agreement between work context variables and variables that reference individuals (e.g., sleep motivation and affect). The reason for this is not clear; however, one explanation may be the number of items in these scales. $r_{wg(j)}$ values are known to be influenced by the number of items in the scale, with larger number of items corresponding to larger

$r_{wg(j)}$ (Smith-Crowe et al., 2014). Therefore, with a similar SD and number of items, it is somewhat expected that sleep motivation and affect will have similar $r_{wg(j)}$ as the work context variables. On this note, it is important to exercise caution in interpreting the values in Tables 25 and 26 because of the different number of items in these scales. For instance, the negative features scales composed only of the old items from Studies 1 and 2 (Negative features (Site) Old and Negative features (Program) Old) have lower $r_{wg(j)}$ than scales composed only of the new items (Negative features (Site) New and Negative features (Program) New). This does not necessarily reflect the differences in agreement regarding the contents of the items, but may simply reflect the fact that the old scales are made up of 3 items whereas the new scales are made up of 4 items.

A second explanation for the similar agreement between work context and non-group variables is the shared format of the questions used to measure these variables (i.e., Likert scales). The similar response format may have elicited similar response patterns from participants, which may have led to similar agreement values across variables. However, a couple of findings suggest that participants were able to differentiate variables and put thought into their responses. First, the agreement on the job characteristic information processing was high regardless of type of agreement index. Because being a physician requires processing large amounts of information regardless of specialty, it is expected that participants would rate this variable highly. This was supported by data; information processing had a higher mean rating and a smaller standard deviation compared to other variables. Second, social support also had a high level of agreement. The evaluation of social support involves evaluation of interactions between two or more individuals; thus, the agreement on this variable is expected to be

higher than agreement on variables that do not involve interaction between people. Therefore, it is unlikely that the similar level of agreement between work context and non-group variables is completely due to similarity in response format; rather, it may be a sign that residents working in the same environment develop similar affective and behavioral patterns.

Another issue to note is the large variability in $r_{wg(j)}$ values across imputed datasets. For values computed under the normal or bimodal null distribution, the standard deviation is just as large as the estimates themselves for some variables. Thus, agreement estimates under those null distributions must be taken with a grain of salt, as they could be gross over- or under-estimations of the true value.

Single-predictor models largely replicated relationships that were found between work context variables and sleep in Studies 1 and 2. Furthermore, these relationships were retained when the independent and dependent variables were separated by time. Combined with the results of factor analysis modeling method factors in Study 1, these results provide support that the observed relationships between the work context, particularly sleep climate, and sleep are not completely due to common method bias.

Meanwhile, only some of the proposed mediation pathways linking the work context to sleep were supported. There were five notable findings in these analyses. First, no mediational hypothesis was supported when sleep quantity was the dependent variable. This suggests that the mechanism through which the work context influences sleep duration is not through affect or sleep motivation. It is expected that work characteristics that influence sleep do so through their effects on availability of time that

can be allocated to sleep. Thus, organizations that want their members to sleep longer should schedule work hours that allow longer sleep.

The second notable finding is that positive affect mediated the relationship between many work characteristics and sleep. When sleep has been studied as an outcome in the IWOP literature, the relationship between work context and sleep has been depicted in a way such that negative aspects of the work context positively correlated with sleep disturbance (e.g., Åkerstedt et al., 2002; De Lange et al., 2009). Coupled with meta-analytic findings showing relationships between sleep and negative-valenced affective, health, and attitudinal constructs such as anxiety and negative affect (Litwiller et al., 2017), the implication has been that the work context *disturbs* sleep or sleep; the best organizations could do to support healthy sleep was to *reduce the negative influence* of work characteristics on sleep. However, the current findings suggest that some aspects of the work environment can increase positive affect, which in turn *promote* good sleep. This difference is important for organizations that want to consider sleep as a strategic resource and want to maximize its benefits. In addition to designing work environments that do not disturb sleep, it may be possible for organizations to implement practices that enhance the sleep quality of members so they can fully enjoy its positive effects on work and health related outcomes.

The third notable finding is the mediation effect of sleep motivation. Out of the three sleep climate dimensions, sleep motivation only mediated the relationship between negative features and sleep quality. This result differs from the Study 2 results that showed the mediation effect of sleep motivation in the communication – sleep relationship. Study 3 findings suggest that sleep climate could only work against sleep

motivation and organizations should work to minimize practices that act as barriers to healthy sleep.

The fourth notable finding is that like in Study 2, the communication dimension of sleep climate showed a relationship with sleep quality when mediation analysis was conducted, while this relationship seemed to be absent in bivariate analyses. This suggests that suppression may be at play (MacKinnon et al., 2000). That is, there are some variables through which communication has negative effects on sleep; these variables may have cancelled out any positive effect communication has on sleep quality in bivariate analyses. Negative topics about sleep, such as incorrect sleep hygiene information (e.g., assumption that one must engage in one hour of vigorous exercise to attain good sleep) and negative sleep norms (e.g., speculation that others in the workplace do not have healthy sleep habits) may function in this way. Thus, organizations must be wary of what is being communicated about sleep if communication were to be used as a sleep intervention.

The fifth notable finding is that detachment did not mediate the relationship between information processing and sleep. The rationale for this hypothesized mediation effect was that people who perceive higher need to deal with large amounts of information on the job will have trouble distancing themselves from thoughts of work during their time off, which in turn will lead to worse sleep; the latter part of this relationship has been empirically supported (Sonnentag et al., 2008). There are two explanations for why this effect was not found. The first is that there may be no substantive relationship between information processing and detachment. The degree to which individuals are able to free themselves from thoughts about work during off-times

may be largely due to individual differences such as neuroticism, and very weakly associated with information processing. That is, regardless of the amount of information processing or cognitive effort required for a job, those with high neuroticism may worry about some aspects of work and thus have difficulty detaching from work. The second and more likely explanation is the range restriction of information processing in this sample. As pointed out before, information was rated highly by this sample with an estimated mean of 4.68 out of 5, and a standard deviation of .32. This was noticeably smaller than the other study variables rated on a 5-point scale which typically had estimated standard deviations between .60 and .90. Thus, this mediation effect may have been detected in a sample with a broader range of information processing.

As an exploratory analysis, the stability of sleep climate perception was examined. The relationship between Time 1 and Time 2 sleep climate was on par with other work context variables. Interestingly, whether or not the participant worked at the same learning site at the two time points did not change the relationships between Time 1 and Time 2 sleep climate. This is contrary to the expectation that the relationship would be stronger if the participant was at the same site at both times. The this was not the case provides further support for the notion that sleep climate perception of residents in this particular sample is shaped more by how sleep is treated in the residency program that the residents belong to, rather than the learning site.

There were a couple of limitations in the current study. First, the sample size was not large relative to the number of levels in the grouping variables (i.e., learning site, residency program). There were many cases in which the site-program combination only had a sample size of 1. Therefore, much of the results based on HLM may reflect

individual differences rather than differences between groups, and thus must be taken with a grain of salt. Second, and related to the first issue, some of the computed statistics were highly instable across imputed datasets. For example, $r_{wg(j)}$ values for some variables had a standard deviation as large as .30 across imputations; this large range made it difficult to interpret some of the results regarding within-group agreement of work context variables. This instability may have been due to the small sample size per group level, because group membership was used to impute missing data. Future studies studying similar group-level constructs in similar populations (i.e., medical professionals) should invest more effort in building relationships with target organizations and get internal support to increase response rate as well as employ strategies to minimize effort required for survey completion.

General discussion

The three studies collectively uncovered a broader range of work context characteristics related to sleep than has previously been studied, and provide an initial examination of the sleep climate construct. Although past research has focused on a handful of work context characteristics that correlate with sleep (e.g., workload, work hours, perceived control, support; [Litwiller et al., 2017](#)), Studies 1 and 3 showed that sleep is associated with a broader range of job characteristics (schedule consistency and workload uncertainty) and climate (welfare, efficiency, pressure to produce). Furthermore, dimensions of strategic climate targeting sleep were found to correlate with sleep outcomes.

Interestingly, in Study 3 it was found that most of the relationships between sleep and job characteristics (e.g., social support) or general climate (e.g., pressure to produce)

were mediated by affect. These findings underscore the importance of building a broad positive work environment that goes beyond specific practices that target sleep. The consistent themes among the job characteristics and climate dimensions found to correlate with sleep seem to be a sense of support for employees (e.g., social support, welfare, pressure to produce) and predictability (e.g., schedule consistency, workload uncertainty). Organizations do not have to go to great lengths to foster a supportive work environment. Although employees will be very happy to have a great benefits package if the employer can afford it, something simple as providing training sessions for supervisors on how to interact positively with subordinates, or hosting occasional office events may be enough to let employees know that the company cares about them. Lack of predictability may be more difficult to address, because some jobs by nature involve a high degree of uncertainty in workload and scheduling. These characteristics may not be easily changed, but their negative effects may be attenuated by communicating realistic expectations about the possible range of workload and work times.

Results from the Study 1 suggest that sleep climate should be considered a part of a broader health climate, rather than an isolated construct. A general factor explaining a substantial amount of variance in sleep climate and the Sonnentag and Pundt (2016) health behavior climate items was found. This general factor could represent the degree to which an organization supports its members' health, suggesting that organizations that promote a given health behavior are likely to be considerate of other health behaviors as well. Holistic support of organizational member health is likely to be beneficial, because sleep, exercise, and healthy diet have been associated with one another. For example, healthy diet containing low fat is associated with longer sleep duration, and exercising is

associated with better sleep quality ([Grandner et al., 2010](#); [National Sleep Foundation, 2013](#)). Because the dimensions and items of the sleep climate measure were partially based on the health behavior climate scale ([Sonnetag & Pundt, 2016](#)), specific practices depicted in the items are also similar (e.g., communication and education about the health behavior). These practices could be implemented in a way that targets multiple health behaviors at once.

Limitations

There were two major limitations in the current series of studies. The first is that all data were collected through self-report surveys. Under this research method, observed relationships between variables may be inflated due to common method bias ([Podsakoff et al., 2003](#)). Due to sample availability, not all remedies recommended by [Podsakoff et al. \(2003\)](#) could be implemented to control for such bias. However, some measures were taken to reduce the effects of bias: Study 1 modeled method factors and examined the degree to which relationships between key variables were retained, Studies 2 and 3 temporally separated the measurement of variables, and Study 2 applied a single group pre-post design to examine whether a change in one variable due to an intervention would be associated with another variable. After implementing these measures, the relationships between variables of interest, particularly between sleep climate and sleep, were retained. Therefore, the current series of studies support a substantial relationship between certain work context characteristics and sleep. Nevertheless, future studies should utilize alternate means of collecting data. For example, Actigraphs and smartphone applications could be used to collect sleep data.

Another major limitation is that in Studies 2 and 3, data were collected in a medical setting. This may have reduced the variability of responses on many work context variables because it could be argued that all medical school students and all medical residents work in a very similar environment. This may have posed problems for statistical analyses due to range restriction and reduced the generalizability of findings. However, reasonable amount of variance was found for most study variables in these studies; thus, although some of the relationships between variables found may have been underestimated, it does not take away from the notable relationships that were found (e.g., negative features and sleep quality). What may be a bigger issue is the higher concern and knowledge about sleep and health more broadly in the medical setting. Mediation analyses in Studies 2 and 3 suggest that some relationships between the work context and sleep involve sleep motivation as its mechanism. Research in the goal-setting domain suggests that task-related ability influences the relationship between goals and performance (Kanfer & Ackerman, 1989; Locke et al., 1984). Individuals in the medical field may have more knowledge and self-control capabilities to translate the goals of sleeping well to behavior compared to the general population. Although some degree of support was obtained between the work context and sleep in Study1, future studies should attempt to investigate the mechanism through which these work context characteristics influence behavior in individuals who work outside of the medical field.

Implication for practice, future direction, and conclusion

The results of the series of studies can be used as a basis for exploring the potential causes of unhealthy sleep habits of organizational members and the development of interventions to improve their sleep. One of the reasons sleep climate for

the introduction of sleep climate was to propose a range of work context characteristics that relate to sleep and are relatively more malleable than characteristics that have previously been found to correlated with sleep, such as work hours, workload, and autonomy. Communication about sleep can be changed by formally including them as topics in meetings or by making it more salient in the workplace newsletters or emails. In light of the potential suppression effects suggested in Study 2 and 3, it is important to be attentive to what is communicated about sleep and how. For example, bringing up poor sleep health as an organization-wide problem in meetings may have a negative effect in that organizational members could interpret that as poor sleep being the norm, which in turn may prevent them from trying to improve their sleep habits. Similarly, providing a large list of sleep hygiene behaviors that must be adhered to may set too high of a bar for what constitutes good sleep hygiene and may demotivate individuals from practicing any of these behaviors. Positive features, while its linkage with sleep was not consistently supported, could be enhanced by providing workshops on appropriate sleep hygiene or upper management expressing support for organizational members' health. Negative features may be the most difficult dimension of sleep climate to alter, because there may be times deadlines must be met, and at these times supervisors may have to encourage subordinates to stay late to catch up on work. However, it is important that this does not happen constantly, and when these situations do arise, that supervisors communicate in a way that does not give off the impression that they completely disregard the sleep or health of subordinates. Another potential source of negative sleep climate is the top management's attitudes toward sleep. CEOs and individuals in upper management may disregard the importance of sleep and may even treat sleep deprivation as a sign of hard

work. Such attitude could be detrimental for other employees in that it may contribute to the belief that one must give up sleep to be successful and treat sleep as a luxury (Barnes & Spreitzer, 2015), and also for the organization as a whole because negative attitudes and poor sleep habits of employees could in turn lead to poor employee performance and bottom line (Hafner et al., 2016). As such, understanding and internalization of the health and performance implications of sleep should be the first step in promoting healthy sleep in organizations.

Promotion of sleep in the work context is a relatively new topic. With the relationships that have been found between sleep and important work outcomes, sleep could be considered a strategic resource for organizations (Barnes & Spreitzer, 2015). The construct of sleep climate as well as other work context characteristics associated with sleep in the current series of studies could be targets of interventions to promote healthy sleep in organizations and reap its benefits. The current series of studies is an early attempt to encourage organizations to promote better sleep. Further studies must be conducted to confirm the relationship between sleep and sleep climate, and to inform actionable recommendations for organizations. Potential research ideas include: the introduction of sleep promotion programs in real workplaces and examination of its impact on sleep climate and sleep behavior, effectiveness of workshops targeting top level management about the impact of sleep, and comparison of the effectiveness of various interventions. Additionally, because sleep is a personal, private activity, ethical and legal implications for organizational sleep interventions must also be considered. With the broad health and performance implications of sleep, organizations must become more aware of this important resource and reap the benefits of it.

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Tables and Figures

Table 1. Dimensions of the Organizational Climate Measure (Patterson et al., 2005)

Dimension	Description
Autonomy	Extent to which jobs are designed to allow employees wide scope to carry out work
Supervisory support	Extent to which employees experience support and understanding from immediate supervisor
Welfare	Extent to which the organization values and cares for its employees
Formalization	Extent to which the organization is concerned with formal rules and procedures
Tradition	Extent to which established ways of doing things are valued
Innovation & flexibility	Extent to which the organization possesses an orientation toward change and supports new ideas and innovation
Outward focus	Extent to which the organization is responsive to customers and the marketplace
Reflexivity	Extent to which the organization is concerned with being adaptive to the external environment by ways of reviewing objectives, strategies, and work processes
Efficiency	Extent to which importance is placed on work efficiency and productivity

Effort	Extent to which organizational members work hard to achieve organizational goals
Pressure to produce	Extent to which pressures are placed on organizational members to meet targets
Quality	Extent to which quality procedures are valued and emphasized

Table 2. Dimensions of the Work Design Questionnaire (Morgeson & Humphrey, 2006)

Dimension	Description
Work scheduling autonomy	The amount of freedom, independence, and discretion to make decision about the order and schedule of work
Decision-making autonomy	The amount of freedom, independence, and discretion to take initiative and make decisions
Work methods autonomy	The amount of freedom, independence, and discretion to choose work methods
Task variety	Extent to which the job requires performance of a wide range of tasks
Task significance	Extent to which the job influences the lives or work of others
Task identity	Extent to which the job involves completing a discernible piece of work
Feedback from job	Extent to which the job provides clear information about how well the individual is performing
Job complexity	Extent to which the job involves tasks that are complex and difficult to perform
Information processing	Extent to which the job requires thinking and processing many pieces of information
Problem solving	Extent to which the job requires individuals to deal with ambiguous problems and come up with unique ideas or solutions

Skill variety	Extent to which the job requires individuals to use a variety of skills to complete tasks
Specialization	Extent to which the job involves high-level knowledge and skills in a particular area
Social support	Extent to which the job provides opportunities to foster relationships with others and how much others take personal interest in the individual
Initiated interdependence	Extent to which other individuals depend on the job for completion of their work
Received interdependence	Extent to which the job depends on the completion of other jobs for its completion
Interaction outside organization	Extent to which the job requires interaction and communication with individuals outside of the organization
Feedback from others	Extent to which other individuals in the organization provide how well the individual on the job is performing
Ergonomics	Extent to which the jobs allows correct or appropriate posture and movement
Physical demands	Level of physical exertion required on the job
Work conditions	Noise, temperature, cleanliness of the work environment as well as the extent to which the work environment contains health hazards
Equipment use	Level of variety and complexity of the technology and equipment used in the job

Table 3. EFA results of the Sleep Climate Scale (Study 1)

Item	Mean	SD	Factor Pattern		
			Factor 1 "Positive features"	Factor 2 "Communi- cation"	Factor 3 "Negative features"
Here, you talk among colleagues about how well or poorly you are sleeping. ^c	3.35	1.14	-0.08	0.86	0.07
Here we openly discuss healthy and unhealthy sleep behaviors.	3.12	1.27	0.14	0.68	-0.08
Here we talk openly about how to sleep well. ^c	3.05	1.30	0.26	0.67	0.00
Here there are many opportunities to talk about healthy sleep behaviors. ^c	2.94	1.25	0.30	0.62	-0.04
In informal settings (e.g., during lunch), my supervisor talks about sleep.	2.87	1.36	0.32	0.54	-0.07
In formal settings (e.g., during meetings), my supervisor talks about sleep.	2.46	1.36	0.64	0.26	-0.03
Here, we tell others when we have had a good night's sleep.	3.18	1.24	0.11	0.74	-0.01
Here, we tell others when we have had a poor night's sleep.	3.52	1.17	-0.19	0.87	0.10
My supervisor shows an interest in good sleep habits. ^a	2.85	1.46	0.52	0.31	-0.02
In this organization, it is common to have a healthy sleep pattern.	2.87	1.42	0.47	0.06	-0.13
In this organization, you are expected to perform well regardless of how well you have slept.	4.03	1.42	-0.30	0.17	0.27
My supervisor considers healthy sleep to be important.	2.96	1.56	0.33	0.22	0.05
My supervisor expects employees to sacrifice sleep to get work done. ^b	3.03	1.45	0.19	-0.03	0.60
Here, you are looked at disapprovingly when you don't get enough sleep.	2.48	1.36	0.48	0.04	0.26
Here, you are looked at disapprovingly if you prioritize sleep over work.	3.21	1.39	0.11	0.01	0.57
Your supervisor praises employees for working at the expense of sleep.	2.97	1.41	0.26	0.08	0.41
If you're tired, you're expected to consume caffeine to fight it instead of getting some sleep.	3.51	1.37	-0.21	0.06	0.61
My supervisor makes sure that one gets enough sleep.	2.55	1.44	0.63	0.11	-0.05
If you are interested in getting better sleep, you will get support from the supervisor.	2.65	1.37	0.65	0.08	-0.05
Where I work, there is ample information about healthy sleep habits. ^a	2.54	1.49	0.80	0.11	-0.04

Table 3. EFA results of the Sleep Climate Scale (Study 1; continued)

Item	Mean	SD	Factor Pattern			h ²
			Factor 1 "Positive features"	Factor 2 "Communi cation"	Factor 3 "Negative features"	
In this organization there are brochures and information on the Internet about healthy sleep habits. ^a	2.38	1.52	0.77	0.10	-0.06	0.65
Choose Agree for this item (attention check)	4.01	0.20				
There are policies in this organization that reward employees who have healthy sleep habits.	2.29	1.52	0.78	-0.12	0.02	0.52
There are policies in this organization that punish employees who have poor sleep habits.	2.21	1.43	0.75	-0.06	0.13	0.56
Overall, my coworkers have healthy sleep habits.	2.94	1.47	0.38	0.14	0.00	0.17
This organization educates its people on how to sleep well. ^a	2.30	1.43	0.67	0.11	-0.05	0.51
I am required to report on how well I have slept.	2.08	1.49	0.81	-0.06	0.04	0.60
Overall, my coworkers have poor sleep habits. ^b	2.74	1.52	0.17	0.06	0.54	0.38
There are policies in this organization that reward employees who have poor sleep habits.	2.25	1.47	0.63	-0.12	0.23	0.40
Employees here sacrifice sleep in order to get more work done. ^b	3.14	1.45	0.10	0.03	0.64	0.44
People here work with clients in other time zones which prevents them from having a regular sleep schedule.	2.65	1.49	0.52	-0.07	0.29	0.34
Workers in this organization consume caffeine to fight sleep deprivation rather than improve their sleep habits.	3.64	1.30	-0.21	0.08	0.57	0.31

a. Items retained and included in the Positive features dimension

b. Items retained and included in the Negative features dimension

c. Items retained and included in the Communication dimension

Factor correlations were: between 1 and 2: .16, between 1 and 3: .46, between 2 and 3: .10

**Table 4. Descriptive statistics of the OCM and correlations with sleep variables
(Study 1)**

	Mean	SD	alpha	Sleep climate Communication	Sleep climate Positive features	Sleep climate Negative features	Sleep quality	Sleep quantity
Autonomy	3.15	.89	.81	.02	.04	-.29	.22	-.01
Supervisory support	3.69	.94	.93	.23	.20	-.24	.22	.05
Welfare	3.58	.99	.89	.16	.15	-.26	.30	.05
Formalization	3.52	.87	.81	-.10	-.25	.00	-.09	-.08
Tradition	3.22	.94	.82	.02	.00	.23	-.28	-.04
Innovation	3.27	1.00	.92	.28	.32	-.10	.23	.00
Outward focus	3.69	.93	.82	-.06	-.24	-.26	.21	-.04
Reflexivity	3.53	.83	.83	.30	.26	-.02	.13	-.04
Efficiency	2.84	1.08	.88	-.14	.00	-.40	.36	.11
Effort	3.58	.90	.85	.06	-.01	-.22	.24	.02
Pressure to produce	3.20	.89	.78	-.12	-.15	.35	-.30	-.10
Quality	3.96	.86	.83	.04	-.11	-.16	.10	-.11

Note. Correlations $\geq |.09|$ are significant at $p < .05$

Table 5. Descriptive statistics and intercorrelations of sleep-related variables (Study 1)

	Mean	SD	1	2	3	4	5
1. Sleep climate Communication	2.88	1.10	.84				
2. Sleep climate Positive features	2.29	1.13	.57	.86			
3. Sleep climate Negative features	2.82	1.18	.11	.12	.73		
4. Sleep quality	4.01	1.19	-.04	.06	-.34	.82	
5. Sleep quantity	7.27	1.38	.02	.10	-.06	.21	–

Note. alphas are on the diagonal. Correlations $\geq |.09|$ are significant at $p < .05$

Table 6. Descriptive statistics of job characteristics and correlations with sleep variables (Study 1)

	Mean	SD	alpha	Sleep climate Communication	Sleep climate Positive features	Sleep climate Negative features	Sleep quality	Sleep quantity
Scheduling autonomy	3.45	1.09	.84	.21	.22	-.07	.12	.02
Decision making autonomy	3.61	1.06	.88	.19	.12	-.08	.13	-.04
Methods autonomy	3.61	1.08	.90	.19	.13	-.09	.12	.02
Task variety	3.82	1.00	.89	.10	.05	.10	.01	-.09
Task significance	3.43	1.10	.89	.21	.25	.13	.04	-.05
Task identity	3.83	.91	.85	.14	.07	-.06	.08	-.03
Feedback from job	3.84	.95	.87	.15	.08	-.07	.11	-.06
Job complexity	3.31	1.10	.86	-.19	-.30	.04	-.02	-.08
Information processing	3.94	.91	.84	.11	-.02	.12	-.10	-.13
Problem solving	3.44	1.00	.81	.14	.12	.17	.00	-.11
Skill variety	3.87	.95	.89	.14	.07	.12	.02	-.10
Specialization	3.70	1.04	.89	.17	.09	.10	.04	-.14
Social support	3.89	.78	.85	.25	.14	-.12	.21	-.02
Initiated interdependence	3.48	1.08	.83	.14	.14	.14	-.04	-.08
Received interdependence	3.60	1.03	.81	.20	.07	.07	-.11	-.09
Interaction outside organization	3.33	1.19	.88	.12	.16	.09	-.01	-.01
Feedback from others	3.56	.99	.85	.23	.21	-.04	.10	-.06
Ergonomics	3.36	.82	.56	.24	.23	.00	.08	-.08
Physical demands	2.40	1.35	.94	.21	.25	.20	-.11	-.01
Work conditions	3.72	.99	.71	.11	.09	-.17	.12	-.05
Equipment use	3.24	1.09	.67	.25	.25	.20	-.01	-.05
Work pace	7.02	2.40	.81	.12	-.08	-.13	.08	-.13
Workload uncertainty	3.33	1.18	.84	.13	.08	.32	-.28	-.18
Client friendliness	3.08	.78	-.08	.06	.02	-.25	.18	.02
Schedule consistency	3.33	.99	.77	-.12	-.09	-.38	.29	.07
Commute time (minutes, one-way)	25.36	19.17	–	.20	.24	.21	-.14	-.09
Work duration (hours)	8.72	1.70	–	.06	.02	.09	-.10	-.14

Note. Correlations $\geq |.09|$ are significant at $p < .05$ except for Work duration (only the correlation with sleep quality and quantity are significant)

Table 7. Descriptive statistics of health behavior climate and correlations with sleep variables (Study 1)

	Mean	SD	alpha	Sleep climate Communication	Sleep climate Positive features	Sleep climate Negative features	Sleep quality	Sleep quantity
Eating Values & Expectations	3.10	1.37	.88	.46	.54	.01	.09	.07
Eating Organizational Practices	2.73	1.62	.88	.40	.61	.04	.05	.04
Eating Communication	3.12	1.50	.90	.56	.49	.00	.04	-.02
Exercise Values & Expectations	2.96	1.37	.86	.40	.54	.18	.01	.01
Exercise Organizational Practices	2.65	1.40	.81	.44	.57	.15	.07	.04
Exercise Communication	3.26	1.41	.90	.52	.42	.06	.05	-.04

Note. Correlations $\geq |.09|$ are significant at $p < .05$

Table 8. Incremental validity of sleep climate over molar climate in predicting sleep (Study 1)

Independent variable	DV: Sleep quality		DV: Sleep quantity	
	Molar climate	Molar climate + Sleep climate	Molar climate	Molar climate + Sleep climate
<i>Molar climate</i>				
Autonomy	-.01	-.03		
Supervisory support	-.04	-.07		
Welfare	.14	.14		
Tradition	-.06	-.06		
Innovation	.03	.06		
Outward focus	.08	.06		
Reflexivity	-.06	-.03		
Efficiency	.20	.15	.14	.14
Effort	.08	.08		
Pressure to produce	-.16	-.12	-.06	-.05
Quality	-.10	-.11	-.16	-.15
<i>Sleep climate</i>				
Positive features				.08
Negative features		-.19		
R ²	.193	.221	.039	.054
Adjusted R ²	.173	.199	.032	.043
ΔR^2		.028		.015

Values corresponding to work context characteristic labels represent standardized regression coefficients.

Values in bold are significant at $p < .05$

Table 9. Incremental validity of sleep climate over job characteristics in predicting sleep (Study 1)

Independent variable	DV: Sleep quality		DV: Sleep quantity	
	Job characteristics	Job characteristics + Sleep climate	Job characteristics	Job characteristics + Sleep climate
<i>Job characteristics</i>				
Scheduling autonomy	0.05	0.05		
Decision making autonomy	.14	.14		
Methods autonomy	-.10	-.11		
Feedback from job	.03	.02		
Information processing	-.04	-.02	-.03	-.01
Problem solving			-.06	-.07
Skill variety			.13	.13
Specialization			-.11	-.12
Social support	.17	.16		
Received interdependence	-.11	-.11		
Feedback from others	.03	.03		
Physical demands	.00	.01		
Work conditions	.01	-.01		
Work pace			-.17	-.15
Workload uncertainty	-.18	-.15	-.13	-.13
Client friendliness	.01	-.01		
Schedule consistency	.19	.15	.02	.02
Commute time	-.09	-.06		
Work duration			-.10	-.10
<i>Sleep climate</i>				
Positive features				.11
Negative features		-.17		
R ²	.186	.208	.078	.088
Adjusted R ²	.157	.177	.058	.066
ΔR^2		.022		.010

Values corresponding to work context characteristic labels represent standardized regression coefficients. Values in bold are significant at $p < .05$

Table 10. EFA of health behavior-related climate items using Schmid-Leiman approach – One general factor (Study 1)

Item	G	F1	F2	F3	F4	F5	F6	F7	F8	F9	Communality
Sleep Com 1	.42	-.04	-.04	-.03	.69	.03	.06	-.02	.06	.15	.68
Sleep Com 2	.54	.11	.03	.04	.59	-.01	-.02	-.01	.05	-.10	.67
Sleep Com 3	.56	.15	.13	.04	.52	-.02	-.03	.02	-.06	-.21	.68
Sleep PF 1	.54	.34	.03	.06	.17	.02	.08	-.04	.04	-.05	.45
Sleep PF 2	.59	.57	.02	.00	.08	.06	.03	.05	-.02	-.12	.70
Sleep PF 3	.57	.65	-.04	.03	.02	-.01	-.04	.06	.04	.05	.76
Sleep PF 4	.55	.57	.01	.02	.00	.01	.07	-.01	.01	.06	.64
Sleep NF 1	.07	.08	.03	-.02	-.07	.82	.04	-.06	.01	.00	.69
Sleep NF 2	.08	-.07	.00	.10	.09	.48	-.08	-.01	.04	.13	.29
Sleep NF 3	.04	-.06	-.04	.02	.05	.76	-.03	.07	-.01	-.04	.59
Eat VE 1	.76	.00	.01	.08	.12	.06	.42	.12	.07	.00	.80
Eat VE 2	.64	.15	-.01	.12	-.04	-.14	.32	-.01	.21	.01	.62
Eat VE 3	.71	.03	.04	.09	.02	-.04	.52	-.01	.07	.01	.80
Eat OP 1	.71	.07	.11	-.05	.03	.01	.42	.17	-.01	-.04	.73
Eat OP 2	.75	.05	.00	.03	-.01	.00	.11	.54	.05	-.05	.87
Eat OP 3	.71	.13	.00	.05	-.02	-.02	.00	.51	.07	.09	.79
Eat Com 1	.66	-.01	.08	.02	.12	-.01	.04	.12	.47	.02	.70
Eat Com 2	.72	.08	.10	.00	.05	.02	.10	.03	.55	-.02	.85
Eat Com 3	.73	-.01	.14	.08	.09	-.04	.01	.24	.30	-.29	.79
Exercise VE 1	.71	-.12	.07	.36	.12	-.01	.18	.12	-.03	.06	.73
Exercise VE 2	.58	.04	.01	.55	-.02	.02	-.02	-.03	.02	-.05	.64
Exercise VE 3	.74	.11	.03	.45	-.01	.06	.09	.05	.03	.03	.77
Exercise OP 1	.64	.12	.05	.26	.06	.04	.07	.14	-.05	.10	.54
Exercise OP 2	.62	.08	.33	-.02	.08	.00	.08	.15	-.10	.24	.60
Exercise OP 3	.66	.13	.23	.20	.01	.02	-.04	.18	-.07	.34	.70
Exercise Com 1	.69	-.02	.51	.07	-.01	-.04	.08	.02	.01	-.14	.77
Exercise Com 2	.67	.01	.44	.08	.04	.01	-.03	-.03	.22	.10	.70
Exercise Com 3	.70	.00	.49	.00	.08	.04	.05	-.01	.12	.04	.76

Variance in items explained by all the factors: .974

Variance in items explained by the general factor: .813

Table 11. EFA of health behavior-related climate items using Direct Schmid-Leiman approach – One general factor (Study 1)

Item	G	F1	F2	F3	F4	F5	F6	F7	F8	F9	Communality
Sleep Com 1	.50	-.02	.00	.61	-.11	.05	-.08	.02	.10	.16	.68
Sleep Com 2	.61	.12	.03	.54	-.06	-.04	-.06	-.05	.11	-.08	.71
Sleep Com 3	.63	.16	.10	.48	-.02	-.07	-.03	-.08	.03	-.19	.71
Sleep PF 1	.57	.31	.01	.15	.06	.05	-.01	-.03	.06	-.03	.46
Sleep PF 2	.65	.54	-.04	.08	.02	.00	.10	-.02	-.04	-.07	.74
Sleep PF 3	.60	.61	-.06	.02	.08	-.04	.15	-.06	.00	.10	.78
Sleep PF 4	.58	.52	-.01	.00	.08	.05	.07	-.04	.00	.10	.63
Sleep NF 1	.25	.01	-.06	-.12	-.03	-.12	-.15	.73	-.14	.02	.67
Sleep NF 2	.19	-.08	.00	.03	.08	-.16	-.07	.46	-.05	.12	.31
Sleep NF 3	.23	-.07	-.12	-.03	-.02	-.16	-.05	.68	-.17	-.01	.59
Eat VE 1	.74	-.03	.03	.04	.11	.45	.13	-.03	.14	-.01	.80
Eat VE 2	.57	.10	.01	-.05	.14	.37	.06	-.18	.28	-.01	.61
Eat VE 3	.66	-.03	.06	-.03	.14	.55	.02	-.12	.17	-.01	.81
Eat OP 1	.68	.03	.10	-.02	.02	.45	.19	-.10	.07	-.05	.73
Eat OP 2	.70	.08	.01	-.10	.10	.22	.56	-.09	.06	-.05	.89
Eat OP 3	.66	.15	.04	-.09	.13	.11	.55	-.08	.06	.08	.82
Eat Com 1	.62	-.04	.11	.11	-.04	.10	.14	-.04	.53	-.03	.72
Eat Com 2	.68	.02	.10	.06	-.07	.14	.06	-.02	.61	-.06	.88
Eat Com 3	.68	-.01	.12	.07	.01	.08	.23	-.11	.38	-.32	.80
Exercise VE 1	.66	-.12	.16	.02	.41	.22	.12	-.04	.06	.02	.71
Exercise VE 2	.55	.04	.08	-.07	.56	-.01	-.02	.02	.06	-.08	.64
Exercise VE 3	.71	.10	.09	-.09	.50	.10	.07	.03	.07	.01	.80
Exercise OP 1	.63	.12	.10	-.01	.33	.09	.17	.01	-.02	.08	.57
Exercise OP 2	.57	.03	.38	.04	.11	.11	.20	-.04	-.01	.19	.57
Exercise OP 3	.61	.10	.32	-.04	.34	.00	.24	.01	-.02	.29	.74
Exercise Com 1	.62	-.09	.51	.00	.13	.08	.04	-.11	.20	-.23	.78
Exercise Com 2	.61	-.06	.48	.05	.11	-.03	.00	-.01	.36	.01	.75
Exercise Com 3	.66	-.08	.51	.09	.06	.04	.01	-.02	.28	-.05	.80

Variance in items explained by all the factors: .975

Variance in items explained by the general factor: .815

Table 12. EFA of health behavior-related climate items using Schmid-Leiman approach – Two general factors (Study 1)

Item	G1	G2	F1	F2	F3	F4	F5	F6	F7	F8	Communality
Sleep Com 1	.46	-.13	.02	-.02	.59	.11	-.04	.06	-.10	.11	.62
Sleep Com 2	.59	-.12	.02	.08	.61	-.01	-.01	.00	.02	-.05	.74
Sleep Com 3	.59	-.07	.04	.09	.56	-.08	.03	-.04	.08	-.07	.69
Sleep PF 1	.53	.03	.03	.32	.19	.08	-.03	.02	.06	-.03	.44
Sleep PF 2	.57	.09	-.04	.52	.14	-.01	.07	.04	.04	-.06	.64
Sleep PF 3	.54	.14	-.01	.65	.02	-.03	.05	-.01	.01	.02	.74
Sleep PF 4	.52	.13	.01	.56	.01	.07	-.01	.01	.02	.05	.62
Sleep NF 1	.02	.17	.03	.06	-.06	.02	-.05	.78	.00	-.01	.65
Sleep NF 2	.04	.15	.06	-.04	.05	-.04	-.03	.50	.04	.08	.29
Sleep NF 3	.00	.16	-.05	-.06	.05	-.04	.06	.75	.02	-.03	.61
Eat VE 1	.76	.00	.01	-.01	.13	.42	.14	.06	.07	.01	.81
Eat VE 2	.66	-.05	.09	.17	-.04	.37	.00	-.13	.07	-.08	.64
Eat VE 3	.72	-.03	.03	.02	.03	.52	.02	-.05	.09	.01	.80
Eat OP 1	.72	-.01	.04	.04	.06	.35	.20	-.02	.01	.02	.68
Eat OP 2	.73	.10	-.02	.04	.01	.08	.54	.00	.02	-.02	.85
Eat OP 3	.67	.15	.04	.15	-.03	.02	.48	.00	.00	.06	.73
Eat Com 1	.72	-.19	.35	.04	.08	.14	.10	.02	-.07	-.16	.75
Eat Com 2	.78	-.22	.39	.12	.03	.20	.03	.05	-.08	-.23	.93
Eat Com 3	.78	-.15	.25	-.02	.13	.01	.24	-.04	.08	-.32	.88
Exercise VE 1	.65	.21	.06	-.10	.11	.20	.12	.01	.31	.10	.65
Exercise VE 2	.49	.29	.05	.08	.00	.04	-.03	.06	.47	-.04	.56
Exercise VE 3	.65	.29	.06	.14	-.01	.13	.05	.09	.38	.03	.70
Exercise OP 1	.57	.25	.02	.13	.06	.08	.14	.06	.22	.13	.50
Exercise OP 2	.56	.17	.25	.06	.07	.04	.16	-.01	.00	.30	.53
Exercise OP 3	.56	.34	.22	.15	-.02	-.02	.16	.05	.14	.34	.65
Exercise Com 1	.67	.02	.41	-.06	.06	.00	.06	-.08	.16	-.02	.66
Exercise Com 2	.66	.00	.55	.02	.02	-.01	-.03	.01	.06	.05	.75
Exercise Com 3	.70	-.01	.51	-.02	.09	.02	.01	.02	.04	.07	.76

Variance in items explained by all the factors: .971

Variance in items explained by the general factors: .806

Table 13. EFA of health behavior-related climate items using Direct Schmid-Leiman approach – Two general factors (Study 1)

Item	G1	G2	F1	F2	F3	F4	F5	F6	F7	F8	Communality
Sleep Com 1	.21	.47	-.01	.02	.62	-.09	.06	-.07	.05	.04	.67
Sleep Com 2	.46	.42	.10	.00	.53	-.10	-.06	-.10	-.05	.08	.71
Sleep Com 3	.57	.35	.12	.05	.46	-.10	-.10	-.09	-.10	.01	.71
Sleep PF 1	.43	.40	.29	-.03	.14	.02	.04	-.06	-.03	.01	.46
Sleep PF 2	.53	.41	.50	-.11	.06	-.03	-.04	.05	-.03	-.06	.72
Sleep PF 3	.40	.48	.60	-.11	.01	.06	-.06	.11	-.05	-.04	.79
Sleep PF 4	.38	.46	.51	-.06	.00	.07	.03	.04	-.03	-.06	.63
Sleep NF 1	.17	.13	.01	-.09	-.11	-.05	-.13	-.13	.74	-.12	.66
Sleep NF 2	.06	.18	-.07	-.02	.04	.09	-.16	-.07	.48	-.05	.31
Sleep NF 3	.17	.10	-.08	-.15	-.03	-.04	-.18	-.03	.69	-.12	.59
Eat VE 1	.55	.55	-.06	-.01	.03	.07	.43	.08	-.04	.05	.81
Eat VE 2	.41	.46	.08	.00	-.06	.10	.37	-.01	-.19	.19	.61
Eat VE 3	.48	.49	-.05	.03	-.04	.10	.54	-.02	-.13	.06	.80
Eat OP 1	.54	.48	.00	.06	-.04	-.02	.41	.15	-.11	.00	.73
Eat OP 2	.58	.50	.03	-.05	-.14	.07	.15	.49	-.13	.04	.90
Eat OP 3	.47	.55	.12	-.02	-.13	.13	.06	.49	-.11	.03	.83
Eat Com 1	.41	.55	-.06	.14	.08	-.06	.11	.04	-.07	.45	.72
Eat Com 2	.45	.58	.00	.14	.03	-.10	.16	-.05	-.05	.52	.87
Eat Com 3	.67	.40	-.08	.08	.02	-.07	.04	.09	-.17	.36	.80
Exercise VE 1	.52	.49	-.15	.08	.00	.38	.19	.04	-.05	-.02	.72
Exercise VE 2	.51	.33	.00	-.01	-.10	.49	-.03	-.13	.00	.02	.64
Exercise VE 3	.57	.50	.06	.00	-.11	.45	.07	-.02	.02	-.01	.80
Exercise OP 1	.46	.48	.09	.03	-.02	.31	.06	.11	.00	-.08	.57
Exercise OP 2	.34	.52	.02	.33	.03	.14	.07	.17	-.03	-.12	.56
Exercise OP 3	.33	.60	.10	.26	-.06	.39	-.04	.19	.03	-.13	.76
Exercise Com 1	.62	.36	-.14	.44	-.04	.07	.03	-.07	-.16	.10	.78
Exercise Com 2	.43	.52	-.09	.46	.02	.10	-.04	-.10	-.03	.22	.75
Exercise Com 3	.51	.51	-.11	.48	.05	.03	.01	-.08	-.04	.15	.80

Variance in items explained by all the factors: .975

Variance in items explained by the general factors: .909

Table 14. Factor loadings of the single survey method factor model (Study 1)

Item	Survey factor	Communication	Positive features	Negative features	Sleep quality	Sleep quantity
Communication 1	.14	.71				
Communication 2	-.02	.87				
Communication 3	-.08	.81				
Positive features 1	-.08		.62			
Positive features 2	-.14		.86			
Positive features 3	-.09		.85			
Positive features 4	-.09		.76			
Negative features 1	.29			.75		
Negative features 2	.22			.45		
Negative features 3	.30			.70		
Sleep quality 1	-.67				.29	
Sleep quality 2	-.77				.46	
Sleep quality 3	-.78				.43	
Sleep quality 4	-.70				.21	
Sleep quality 5	-.71				-.64	
Sleep quality 6	-.63				-.63	
Sleep quantity	-.21					.51

Note . Loadings in bold are statistically significant at $p < .05$.

Table 15. Factor intercorrelations of the single survey method factor model (Study 1)

Factor	Communication	Positive features	Negative features	Sleep quality
Positive features	.62			
Negative features	.04	.12		
Sleep quality	.03	.07	.12	
Sleep quantity	.04	.18	.01	-.12

Note. Correlations in bold are significant at $p < .05$

**Table 16. Factor loadings of the positive-negative wording methods factor model
(Study 1)**

Item	Positive wording	Negative wording	Communication	Positive features	Negative features	Sleep quality	Sleep quantity
Communication 1	.43		.57				
Communication 2	.61		.64				
Communication 3	.63		.50				
Positive features 1	.73			.17			
Positive features 2	.82			-.19			
Positive features 3	.79			-.55			
Positive features 4	.71			-.24			
Negative features 1		.13			.78		
Negative features 2		.15			.48		
Negative features 3		.14			.76		
Sleep quality 1		-.67				.28	
Sleep quality 2		-.85				.25	
Sleep quality 3		-.85				.28	
Sleep quality 4		-.63				.37	
Sleep quality 5		.00				1.00	
Sleep quality 6	.00					.86	
Sleep quantity	.09						.73

Note . Loadings in bold are statistically significant at $p < .05$.

Table 17. Factor intercorrelations of the positive-negative wording methods factor model (Study 1)

Factor	Communication	Positive features	Negative features	Sleep quality
Positive features	.22			
Negative features	.00	-.01		
Sleep quality	-.08	.03	-.35	
Sleep quantity	-.09	-.04	-.09	.27

Note. Correlations in bold are statistically significant at $p < .05$.

Table 18. Factor loadings of the climate-sleep methods factor model (Study 1)

Item	Climate method	Sleep method	Communication	Positive features	Negative features	Sleep quality	Sleep quantity
Communication 1	.45		.57				
Communication 2	.64		.61				
Communication 3	.66		.47				
Positive features 1	.73			-.01			
Positive features 2	.77			.36			
Positive features 3	.66			.68			
Positive features 4	.64			.40			
Negative features 1	.11				.78		
Negative features 2	.09				.50		
Negative features 3	.06				.77		
Sleep quality 1		.21				.70	
Sleep quality 2		.35				.82	
Sleep quality 3		.33				.83	
Sleep quality 4		.11				.72	
Sleep quality 5		-.77				.60	
Sleep quality 6		-.71				.51	
Sleep quantity		-.09					.73

Note. Loadings in bold are statistically significant at $p < .05$.

Table 19. Factor intercorrelations of the climate-sleep methods factor model (Study 1)

Factor	Communication	Positive features	Negative features	Sleep quality
Positive features	-.04			
Negative features	-.02	-.02		
Sleep quality	-.12	.04	-.38	
Sleep quantity	-.05	.12	-.09	.27

Note. Correlations in bold are statistically significant at $p < .05$.

Table 20. Descriptive statistics and intercorrelations of Study 2 variables at Time 1 (Study 2)

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Sleep climate Communication	2.77	.69	.68													
2. Sleep climate Positive features	2.37	.66	.53	.68												
3. Sleep climate Negative features	3.89	.77	.02	-.05	.63											
4. Sleep quality	4.06	.94	.02	.14	-.04	.81										
5. Sleep quantity	6.73	.82	-.01	.09	-.17	.22	—									
6. Sleep onset latency	22.49	19.58	.05	-.08	.16	-.40	-.25	—								
7. Time spent in bed after waking	15.94	15.66	-.10	-.04	.06	-.23	-.29	.48	—							
8. Bed time	10.78	.98	-.05	.00	.08	-.15	-.46	.26	.37	—						
9. Wake time	5.77	.88	.04	.10	.05	.13	.23	.00	.10	.39	—					
10. Sleep knowledge A	.13	.14	.10	.08	.05	.05	.04	.03	-.07	.01	.01	—				
11. Sleep knowledge B	1.41	.40	.09	.18	.05	.11	-.02	-.16	-.16	.02	.02	.41	—			
12. Sleep knowledge C	.57	.46	.10	.04	-.05	.13	-.03	-.12	-.15	.02	.01	.69	.68	—		
13. Sleep motivation	3.43	.69	.11	.22	-.05	.42	.46	-.29	-.24	-.41	.00	.05	.18	.15	.81	
14. Weekly clerkship hours	52.74	11.71	.10	-.21	-.01	.01	-.17	-.10	-.19	-.19	-.40	-.02	-.02	-.02	-.08	—

Note. Alphas are on the diagonal. Correlations $\geq |.16|$ are significant at $p < .05$

**Table 21. Descriptive statistics and intercorrelations of Study 2 variables at Time 2
(Study 2)**

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Sleep climate Communication	3.12	.75	.72															
2. Sleep climate Positive features	2.64	.66	.49	.61														
3. Sleep climate Negative features	3.65	.85	.05	-.21	.56													
4. Sleep quality	4.23	.81	.11	.21	-.06	.76												
5. Sleep quantity	6.92	.76	.06	.03	-.15	.41	—											
6. Sleep onset latency	18.18	13.50	-.19	-.13	.07	-.30	-.18	—										
7. Time spent in bed after waking	16.81	17.35	-.17	.05	-.15	-.25	-.13	.31	—									
8. Bed time	10.53	.87	-.09	-.03	.03	-.07	-.31	.19	.22	—								
9. Wake time	5.93	1.70	-.13	-.01	.03	.10	.33	.02	.10	.43	—							
10. Sleep knowledge A	.24	.16	.03	.14	.08	-.05	-.03	.01	-.02	-.01	-.02	—						
11. Sleep knowledge B	1.82	.37	.00	.10	.21	-.07	-.01	-.21	-.09	-.10	-.18	.38	—					
12. Sleep knowledge C	1.04	.47	.02	.12	.09	.03	.05	-.22	-.08	-.15	-.10	.71	.72	—				
13. Sleep motivation	3.71	.72	.27	.31	-.05	.49	.57	-.29	-.19	-.37	.16	-.01	.06	.06	.86			
14. Weekly clerkship hours	52.33	12.99	.03	.00	.05	.01	-.18	-.02	-.15	-.06	-.17	-.03	-.11	-.11	-.02	—		
15. Negative affect	1.93	.64	.02	.11	.16	-.31	-.28	.19	.16	.10	.01	.28	.18	.23	-.16	.07	.92	
16. Job satisfaction	3.72	.66	-.06	.03	-.17	.25	-.04	-.03	.04	.07	-.01	-.23	-.27	-.22	.10	-.06	-.40	.86

Note. Alphas are on the diagonal. Correlations $\geq |.18|$ are significant at $p < .05$

Table 22. Pre-post analysis of variables measured at both Times 1 and 2 (Study 2)

Variable	Paired-sample T-test			HLM		
	T-statistic	Estimate of Mean change	95% CI	<i>d</i>	Fixed slope for time	95% CI
1. Sleep climate Communication	4.61	.31	.18, .44	.41	.98	.60, 1.36
2. Sleep climate Positive features	4.90	.30	.18, .42	.44	1.15	.68, 1.61
3. Sleep climate Negative features	-3.67	-.25	-.38, -.11	-.33	-.73	-1.12, -0.35
4. Sleep quality	2.22	.15	.02, .29	.20	.93	.14, 1.72
5. Sleep quantity	2.27	.14	.02, .27	.20	.16	.04, .28
6. Sleep onset latency	-4.40	-4.55	-6.59, -2.50	-.40	-4.50	-6.53, -2.46
7. Time spent in bed after waking	.46	.68	-2.26, 3.62	.04	.77	-2.08, 3.63
8. Bed time	-2.36	-.15	-0.27, -0.02	-.21	-.18	-.30, -.06
9. Wake time	1.40	.12	-.08, .32	.12	.17	-.11, .45
10. Sleep knowledge A	6.74	.66	0.47, 0.85	.60	.67	.49, .86
11. Sleep knowledge B	11.76	2.53	2.11, 2.96	1.05	2.51	2.10, 2.92
12. Sleep knowledge C	9.91	2.90	2.32, 3.48	.88	2.86	2.30, 3.41
13. Sleep motivation	4.29	.23	.13, .34	.38	1.26	.75, 1.79
14. Weekly clerkship hours	-.70	-1.05	-4.00, 1.91	-.06	-.49	-3.20, 2.23

Note . Differences are calculated as Time 2 - Time 1; positive values indicate increase.

Table 23. Cross-sectional mediation effects of sleep motivation at Time 1 (Study 2)

IV	Step 1: Sleep motivation as DV			Step 2a: Sleep quality as DV			Step 2b: Sleep quantity as DV		
	Label	Slope	95% CI	Label	Slope	95% CI	Label	Slope	95% CI
Communication	a1	.03	-.27, .33	b1	-.28	-.75, .18	b1	-.03	-.10, .03
Positive features	a2	.24	0, .48	b2	.29	-.09, .67	b2	.02	-.03, .07
Negative features	a3	-.09	-.31, .14	b3	-.07	-.42, .28	b3	-.05	-.10, 0
Sleep knowledge	a4	.21	-.01, .43	b4	.07	-.28, .42	b4	-.03	-.08, .02
Sleep motivation				b5	.68	.42, .91	b5	.11	.08, .15

Table 24. Cross-sectional mediation effects of sleep motivation at Time 2 (Study 2)

IV	Step 1: Sleep motivation as DV			Step 2a: Sleep quality as DV			Step 2b: Sleep quantity as DV		
	Label	Slope	95% CI	Label	Slope	95% CI	Label	Slope	95% CI
Communication	a1	0.25	-.07, .56	b1	-.15	-.55, .25	b1	.01	-.06, .06
Positive features	a2	0.31	.03, .59	b2	.19	-.16, .54	b2	-.06	-.11, -.01
Negative features	a3	-0.03	-.28, .23	b3	.02	-.29, .34	b3	-.05	-.09, 0
Sleep knowledge	a4	0.06	-.23, .34	b4	-.24	-.59, .11	b4	.00	-.05, .05
Sleep motivation				b5	.65	.42, .87	b5	.13	.10, .16

Table 25. Cross-sectional mediation effects of negative affect at Time 2 (Study 2)

IV	Step 1: Negative affect as DV			Step 2a: Sleep quality as DV			Step 2b: Sleep quantity as DV		
	Label	Slope	95% CI	Label	Slope	95% CI	Label	Slope	95% CI
Communication	a1	-0.37	-1.24, .50	b1	-.04	-.45, .38	b1	.02	-.04, .09
Positive features	a2	0.7	-.06, 1.45	b2	.48	.11, .84	b2	.00	-.06, .06
Negative features	a3	0.79	.11, 1.47	b3	.10	-.23, .43	b3	-.03	-.09, .02
Negative affect				b5	-.17	-.26, -.09	b5	-.02	-.03, -.01

Table 26. Estimate of the indirect effects in cross-sectional mediation (Study 2)

Mediation path	Mediator: Sleep motivation				Mediator: Negative affect	
	Time 1		Time 2		Time 2	
	DV: Sleep quality	DV: Sleep quantity	DV: Sleep quality	DV: Sleep quantity	DV: Sleep quality	DV: Sleep quantity
Communication a1*b5	.02 (-.17, .22)	0 (-.03, .04)	.16 (-.04, .38)	.03 (-.01, .08)	.07 (-.09, .24)	.01 (-.01, .03)
Positive features a2*b5	.16 (0, .35)	.03 (0, .06)	.20 (.02, .40)	.04 (0, .08)	-.12 (-.29, .01)	-.01 (-.04, 0)
Negative features a3*b5	-.06 (-.23, .09)	-.01 (-.04, .01)	-.02 (-.19, .15)	0 (-.04, .03)	-.14 (-.29, -.02)	-.02 (-.04, 0)
Sleep knowledge a4*b5	.14 (0, .30)	.02 (0, .05)	.04 (-.15, .23)	.01 (-.03, .05)	–	–
Total effect (a1+a2+a3+a4)*b5	.26 (-.07, .63)	.04 (-.01, .10)	.38 (.01, .80)	.05 (-.01, .12)	-.19 (-.48, .03)	-.02 (-.06, 0)

Note. Bold values indicate that the 95% CI does not include zero

Table 27. Fixed within-person effects in mediation model involving sleep climate dimensions, sleep knowledge, and sleep motivation (Study 2)

IV	Step 1: Sleep climate and Sleep knowledge as DV			Step 2: Sleep motivation as DV		Step 3a: Sleep quality as DV		Step 3b: Sleep quantity as DV				
	Label*	Fixed effect	95% CI	Label*	Fixed effect	95% CI	Label*	Fixed effect	95% CI			
Time	a1	0.98	.60, 1.36	b5	1.06	.31, 1.82	c5	.17	-.98, 1.33	e5	.06	-.11, .23
	a2	1.15	.68, 1.61									
	a3	-0.73	-1.12, -.35									
	a4	2.51	2.10, 2.92									
Communication				b1	.30	.06, .54	c1	.24	-.14, .61	c1	-.02	-.07, .04
Positive features				b2	.00	-.21, .21	c2	-.12	-.44, .21	c2	.00	-.05, .05
Negative features				b3	-.10	-.33, .13	c3	-.01	-.36, .35	c3	.00	-.06, .05
Sleep knowledge				b4	-.05	-.27, .16	c4	.07	-.26, .39	c4	.00	-.05, .05
Sleep motivation							c6	.41	.14, .68	c6	.09	.05, .13

*Path labels consistent with those in Figure 4

Table 28. Indirect effect estimates and their 95% confidence intervals (Study 2)

Mediation path	Sleep knowledge A		Sleep knowledge B		Sleep knowledge C	
	DV: Sleep quality	DV: Sleep quantity	DV: Sleep quality	DV: Sleep quantity	DV: Sleep quality	DV: Sleep quantity
Communication	.13 (.02, .30)	.02 (.00*, .06)	.12 (.02, .29)	.03 (.00*, .06)	.13 (.02, .30)	.03 (.00*, .06)
Positive features	.01 (-.10, .13)	0 (-.04, .06)	0 (-.11, .11)	0 (-.02, .02)	0 (-.11, .11)	0 (-.02, .02)
Negative features	.03 (-.05, .12)	0 (-.01, .02)	.03 (-.04, .12)	0 (-.01, .02)	.03 (-.04, .13)	0 (-.01, .03)
Sleep knowledge	-.15 (-.36, -.01)	-.03 (-.07, .00*)	-.05 (-.31, .17)	-.01 (-.06, .04)	-.10 (-.35, .09)	-.02 (-.06, .02)
Total indirect effect	.02 (-.22, .27)	0 (-.04, .05)	.10 (-.18, .43)	.02 (-.04, .09)	.07 (-.20, .36)	.01 (-.04, .07)

Note. Bold values indicate that the 95% CI does not include zero

*Zero due to rounding error

Table 29. Descriptive statistics of variables (Study 3)

Variable	Time 1		Time 2	
	Mean* (SD**)	SD* (SD**)	Mean* (SD**)	SD* (SD**)
1. Communication (Site) [☆]	2.84 (.13)	.66 (.02)	2.92 (.09)	.63 (.05)
2. Communication (Program)	3.01 (.14)	.71 (.02)	3.04 (.10)	.66 (.06)
3. Positive features (Site)	2.78 (.11)	.73 (.03)	2.75 (.07)	.57 (.04)
4. Positive features (Program)	2.92 (.11)	.75 (.03)	2.95 (.09)	.57 (.04)
5. Negative features (Site)	3.22 (.16)	.73 (.03)	3.12 (.10)	.62 (.03)
6. Negative features (Program)	3.27 (.14)	.75 (.03)	3.16 (.09)	.62 (.03)
7. Communication (Site) Old	2.90 (.03)	.75 (.02)	2.94 (.13)	.70 (.06)
8. Communication (Program) Old	3.04 (.03)	.81 (.02)	3.05 (.13)	.71 (.07)
9. Positive features (Site) Old	2.68 (.03)	.83 (.02)	2.68 (.10)	.65 (.05)
10. Positive features (Program) Old	2.86 (.03)	.83 (.02)	2.77 (.13)	.70 (.05)
11. Negative features (Site) Old	3.28 (.23)	.82 (.05)	3.25 (.15)	.81 (.06)
12. Negative features (Program) Old	3.39 (.22)	.81 (.05)	3.24 (.13)	.80 (.06)
13. Communication (Site) New	2.73 (.33)	.85 (.05)	2.90 (.14)	.84 (.07)
14. Communication (Program) New	2.96 (.35)	.91 (.05)	3.03 (.14)	.90 (.07)
15. Positive features (Site) New	2.91 (.26)	.78 (.05)	2.85 (.09)	.74 (.05)
16. Positive features (Program) New	3.01 (.26)	.82 (.05)	3.18 (.11)	.75 (.06)
17. Negative features (Site) New	3.17 (.21)	.80 (.03)	3.02 (.12)	.71 (.05)
18. Negative features (Program) New	3.17 (.20)	.84 (.03)	3.10 (.10)	.72 (.05)
19. Sleep quality	3.86 (.21)	.72 (.04)	3.91 (.14)	.73 (.05)
20. Sleep quantity	6.74 (.01)	.88 (.01)	6.78 (.01)	.91 (.01)
21. Sleep motivation	3.55 (.19)	.62 (.03)	3.45 (.08)	.52 (.03)
22. PANAS (Positive)	3.23 (.03)	.65 (.02)	3.13 (.09)	.53 (.04)
23. PANAS (Negative)	2.21 (.13)	.71 (.03)	2.17 (.11)	.58 (.03)
24. Information processing	4.68 (.10)	.32 (.03)	4.68 (.05)	.26 (.02)
25. Social support	3.97 (.16)	.55 (.03)	3.92 (.08)	.49 (.04)
26. Workload uncertainty	3.82 (.02)	.79 (.01)	3.84 (.04)	.82 (.03)
27. Schedule consistency	2.29 (.12)	.69 (.03)	2.37 (.11)	.63 (.04)
28. Detachment	2.85 (.29)	.75 (.07)	2.93 (.15)	.66 (.06)
29. Welfare	3.57 (.30)	.66 (.05)	3.64 (.10)	.54 (.05)
30. Efficiency [†]	3.50 (.26)	.63 (.04)	3.48 (.13)	.57 (.04)
31. Pressure to produce	3.69 (.11)	.63 (.02)	3.60 (.09)	.52 (.03)
32. Tenure at site	227.83 (8.07)	350.87 (12.41)	230.43 (8.07)	361.67 (12.41)
33. Average work hours per day	10.69 (.06)	1.96 (.03)	10.48 (.06)	2.23 (.03)
34. Night shifts in the past month	3.72 (.13)	5.35 (.08)	3.46 (.13)	4.36 (.08)

Note. Values are adjusted by the number of items in the scale.

*Mean estimate across the 50 imputed datasets.

**Standard deviations of the estimate across the 50 imputed datasets.

[☆]Variables 1 through 18 are sleep climate dimensions. Word in parentheses denotes the referent of sleep climate (i.e., residency program or learning site).

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

Variables 1 ~ 18, 21 ~ 31 are on a 5-point scale; variable 20 is on a 6-point scale.

[†]Reverse-coded. Higher value represents lower efficiency

Table 30. Correlation matrix of study variables (Study 3)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1. Communication (Site)		.60	.47	.39	-.12	-.11	.87	.52	.40	.33	-.05	-.06	.79	.49	.38	.29	-.14	-.12	-.01	.13	.09	.19	-.14	-.02	.15	-.11	.06	-.01	.20	-.11	-.07	.10	-.09	.04
2. Communication (Program)	.82		.37	.50	-.11	-.18	.55	.87	.32	.44	-.07	-.12	.44	.81	.29	.34	-.12	-.17	-.07	.15	.10	.15	-.11	-.02	.21	-.14	.13	.00	.19	-.12	-.09	.04	-.13	-.05
3. Positive features (Site)	.51	.47		.54	-.19	-.19	.42	.32	.86	.45	-.13	-.14	.36	.31	.79	.41	-.18	-.17	.13	.20	.10	.20	-.19	.02	.18	-.10	.08	.02	.25	-.14	-.13	.03	-.18	-.09
4. Positive features (Program)	.50	.55	.84		-.18	-.24	.34	.41	.44	.84	-.12	-.17	.30	.43	.45	.75	-.18	-.22	.07	.18	.09	.15	-.13	-.01	.21	-.15	.14	.02	.23	-.17	-.12	-.03	-.20	-.11
5. Negative features (Site)	-.28	-.28	-.38	-.41		.75	-.08	-.12	-.11	-.10	.80	.60	-.13	-.07	-.21	-.20	.86	.63	-.16	-.28	-.15	-.26	.31	.13	-.24	.28	-.18	-.12	-.24	.08	.32	-.11	.33	.18
6. Negative features (Program)	-.26	-.26	-.38	-.43	.87		-.09	-.17	-.12	-.15	.62	.79	-.10	-.13	-.20	-.25	.63	.86	-.14	-.25	-.14	-.25	.25	.14	-.24	.31	-.21	-.09	-.20	.08	.31	-.08	.27	.16
7. Communication (Site) Old	.88	.77	.48	.48	-.28	-.27		.55	.36	.30	-.03	-.05	.38	.36	.32	.23	-.09	-.09	-.04	.08	.03	.14	-.12	.02	.11	-.09	.00	-.04	.16	-.07	-.03	.13	-.06	.01
8. Communication (Program) Old	.74	.88	.46	.54	-.27	-.27	.83		.29	.38	-.07	-.13	.29	.42	.23	.26	-.11	-.15	-.08	.10	.08	.14	-.09	.01	.17	-.12	.06	-.01	.17	-.09	-.07	.09	-.10	-.08
9. Positive features (Site) Old	.50	.45	.93	.79	-.32	-.31	.47	.44		.43	-.07	-.08	.30	.24	.36	.25	-.11	-.12	.09	.11	.07	.13	-.13	.02	.14	-.06	.05	.04	.20	-.10	-.08	.04	-.11	-.08
10. Positive features (Program) Old	.50	.53	.81	.93	-.35	-.36	.48	.52	.83		-.06	-.09	.23	.36	.29	.27	-.10	-.14	.04	.11	.03	.08	-.06	-.02	.13	-.12	.11	.00	.17	-.11	-.08	-.04	-.13	-.12
11. Negative features (Site) Old	-.23	-.23	-.34	-.38	.87	.77	-.24	-.23	-.27	-.32		.72	-.06	-.03	-.15	-.14	.37	.34	-.14	-.20	-.10	-.20	.24	.10	-.20	.19	-.16	-.10	-.16	.04	.24	-.08	.24	.11
12. Negative features (Program) Old	-.22	-.21	-.34	-.39	.75	.86	-.24	-.22	-.28	-.33	.85		-.05	-.07	-.16	-.19	.32	.36	-.12	-.20	-.13	-.20	.21	.10	-.19	.23	-.17	-.09	-.13	.06	.23	-.07	.19	.07
13. Communication (Site) New	.78	.57	.36	.34	-.16	-.15	.39	.33	.35	.34	-.13	-.11		.46	.29	.25	-.15	-.10	.01	.15	.13	.18	-.12	-.06	.14	-.10	.10	.03	.18	-.11	-.08	.02	-.09	.06
14. Communication (Program) New	.61	.78	.30	.36	-.18	-.16	.38	.39	.29	.35	-.15	-.12	.71		.27	.32	-.08	-.14	-.03	.16	.09	.11	-.09	-.04	.17	-.12	.15	.01	.15	-.11	-.08	-.02	-.12	-.01
15. Positive features (Site) New	.40	.39	.86	.72	-.39	-.38	.38	.39	.61	.58	-.35	-.35	.28	.25		.45	-.19	-.18	.13	.23	.10	.21	-.18	.02	.16	-.11	.10	-.01	.22	-.14	-.14	.01	-.20	-.07
16. Positive features (Program) New	.39	.46	.71	.87	-.40	-.42	.38	.45	.55	.64	-.37	-.38	.26	.30	.77		-.19	-.22	.07	.20	.12	.18	-.16	.01	.22	-.13	.12	.04	.20	-.16	-.12	-.01	-.19	-.05
17. Negative features (Site) New	-.26	-.27	-.35	-.36	.93	.79	-.27	-.26	-.29	-.31	.61	.55	-.16	-.18	-.35	-.36		.69	-.12	-.26	-.14	-.23	.27	.11	-.20	.26	-.14	-.10	-.23	.08	.30	-.10	.31	.19
18. Negative features (Program) New	-.25	-.25	-.34	-.39	.81	.93	-.25	-.25	-.29	-.33	.60	.63	-.15	-.16	-.34	-.38	.84		-.12	-.21	-.11	-.21	.20	.13	-.21	.28	-.18	-.07	-.19	.07	.28	-.06	.24	.18
19. Sleep quality	.08	.05	.20	.20	-.31	-.30	.08	.02	.17	.19	-.28	-.27	.06	.07	.19	.17	-.28	-.28		.16	.17	.23	-.19	-.02	.13	-.04	.10	.14	.13	-.04	-.03	-.03	-.08	-.01
20. Sleep quantity	.11	.09	.23	.25	-.39	-.38	.11	.08	.18	.23	-.36	-.36	.07	.07	.25	.22	-.34	-.34	.28		.31	.14	-.22	-.06	.15	-.16	.23	.16	.13	-.11	-.11	-.05	-.41	-.20
21. Sleep motivation	.07	.06	.09	.09	-.15	-.17	.09	.04	.06	.07	-.15	-.17	.02	.07	.11	.11	-.12	-.14	.31	.31		.16	-.15	-.09	.15	-.07	.13	.15	.12	-.10	-.08	.07	-.18	-.05
22. PANAS (Positive)	.26	.26	.27	.28	-.39	-.37	.27	.25	.22	.23	-.36	-.33	.16	.17	.28	.29	-.34	-.33	.29	.07	.20		-.29	.06	.27	-.13	.13	.05	.20	-.10	-.14	.04	-.17	-.04
23. PANAS (Negative)	-.18	-.14	-.20	-.22	.35	.34	-.17	-.14	-.16	-.19	.31	.28	-.12	-.09	-.20	-.21	.33	.32	-.24	-.10	-.11	-.44		-.07	-.28	.21	-.12	-.13	-.24	.11	.21	-.03	.24	.07
24. Information processing	.06	.10	-.03	.02	.00	.01	.05	.10	-.05	.01	.02	.03	.04	.06	.00	.02	-.02	-.01	-.08	-.05	-.01	.04	.05		.08	.16	-.14	-.03	.05	.00	.05	.05	.07	.10
25. Social support	.31	.34	.29	.34	-.26	-.27	.28	.29	.24	.30	-.21	-.22	.23	.28	.29	.31	-.26	-.26	.13	.13	.12	.33	-.32	.14		-.04	.07	.15	.24	-.14	-.12	.03	-.16	-.01
26. Workload uncertainty	-.08	-.09	-.16	-.20	.36	.36	-.06	-.07	-.14	-.18	.29	.29	-.09	-.09	-.15	-.17	.35	.35	-.29	-.20	-.16	-.21	.24	.10	-.09		-.39	.02	-.18	.14	.32	.00	.29	.11
27. Schedule consistency	.12	.09	.20	.20	-.34	-.37	.09	.08	.17	.18	-.28	-.32	.11	.08	.18	.18	-.32	-.34	.24	.18	.14	.13	-.21	-.08	.10	-.48		.04	.16	-.11	-.19	.03	-.17	-.06
28. Detachment	.09	.09	.15	.15	-.24	-.26	.08	.06	.12	.12	-.20	-.19	.06	.10	.15	.17	-.24	-.26	.18	.19	.17	.18	-.15	-.02	.15	-.11	.12		.14	.01	-.03	.08	-.01	.04
29. Welfare	.28	.25	.38	.38	-.36	-.32	.29	.25	.32	.34	-.30	-.29	.17	.16	.37	.34	-.35	-.30	.23	.16	.13	.31	-.31	.01	.31	-.23	.20	.16		-.13	-.22	.01	-.14	.01
30. Efficiency	-.14	-.13	-.16	-.15	.17	.18	-.15	-.14	-.15	-.16	.16	.17	-.09	-.08	-.13	-.10	.14	.15	-.17	-.15	-.13	-.11	.11	.05	-.12	.24	-.08	.01	-.24		.05	.07	-.01	.00
31. Pressure to produce	-.24	-.19	-.32	-.31	.44	.41	-.23	-.17	-.28	-.27	.36	.35	-.17	-.16	-.30	-.29	.42	.39	-.30	-.21	-.15	-.23	.32	.08	-.21	.30	-.31	-.22	-.36	.14		.05	.19	.14
32. Tenure at site	.09	.05	.09	.08	-.13	-.13	.06	.04	.08	.08	-.11	-.11	.09	.04	.08	.08	-.12	-.13	.01	.01	-.04	.13	-.07	.04	.09	.04	.07	.01	.02	.04	-.01		-.02	.08
33. Average work hours per day	-.18	-.18	-.30	-.28	.36	.33	-.17	-.18	-.26	-.25	.30	.31	-.11	-.10	-.28	-.25	.33	.28	-.21	-.39	-.09	-.19	.16	.10	-.15	.19	-.24	-.21	-.18	-.02	.30	-.05		.33
34. Night shifts in the past month	-.12	-.10	-.17	-.16	.21	.22	-.10	-.11	-.16	-.15	.20	.20	-.10	-.04	-.14	-.15	.18	.19	-.11	-.14	-.05	-.08	.13	.02	-.06	.08	-.16	-.03	-.08	-.07	.15	.00	.33	

Note. Values are the mean estimate across the 50 imputed datasets.

Variables 1 through 18 are sleep climate dimensions. Word in parentheses denotes the referent of sleep climate (i.e., residency program or learning site).

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

Correlations at Times 1 and 2 are displayed below and above the diagonal, respectively.

Table 31. ICC1s of variables (Study 3)

Variable	Time 1			Time 2		
	Total (SD)	Site (SD)	Program (SD)	Total (SD)	Site (SD)	Program (SD)
1. Communication (Site)	.16 (.05)	.03 (.03)	.13 (.04)	.17 (.09)	.07 (.06)	.10 (.07)
2. Communication (Program)	.19 (.06)	.05 (.03)	.14 (.04)	.17 (.08)	.05 (.05)	.12 (.07)
3. Positive features (Site)	.15 (.04)	.00 (.00)	.15 (.04)	.12 (.08)	.04 (.05)	.08 (.07)
4. Positive features (Program)	.13 (.04)	.00 (.01)	.13 (.04)	.09 (.07)	.03 (.05)	.06 (.06)
5. Negative features (Site)	.15 (.06)	.07 (.04)	.08 (.03)	.27 (.09)	.08 (.06)	.19 (.10)
6. Negative features (Program)	.19 (.05)	.05 (.04)	.15 (.03)	.31 (.07)	.03 (.04)	.28 (.07)
7. Communication (Site) Old	.27 (.06)	.04 (.03)	.24 (.05)	.23 (.11)	.10 (.09)	.13 (.09)
8. Communication (Program) Old	.29 (.05)	.04 (.02)	.24 (.05)	.15 (.08)	.07 (.07)	.08 (.07)
9. Positive features (Site) Old	.13 (.04)	.00 (.01)	.13 (.04)	.12 (.08)	.03 (.04)	.09 (.06)
10. Positive features (Program) Old	.12 (.05)	.01 (.01)	.11 (.05)	.12 (.08)	.06 (.05)	.06 (.06)
11. Negative features (Site) Old	.10 (.06)	.05 (.05)	.05 (.03)	.25 (.11)	.08 (.07)	.16 (.10)
12. Negative features (Program) Old	.19 (.06)	.05 (.04)	.14 (.04)	.25 (.09)	.04 (.06)	.20 (.09)
13. Communication (Site) New	.09 (.04)	.03 (.03)	.06 (.03)	.08 (.06)	.04 (.04)	.05 (.06)
14. Communication (Program) New	.12 (.07)	.06 (.06)	.06 (.02)	.15 (.10)	.04 (.05)	.11 (.09)
15. Positive features (Site) New	.17 (.05)	.01 (.02)	.16 (.05)	.13 (.08)	.06 (.07)	.07 (.07)
16. Positive features (Program) New	.16 (.05)	.01 (.02)	.15 (.04)	.12 (.10)	.03 (.04)	.08 (.08)
17. Negative features (Site) New	.17 (.07)	.07 (.05)	.10 (.05)	.20 (.07)	.05 (.06)	.15 (.08)
18. Negative features (Program) New	.17 (.05)	.06 (.04)	.12 (.04)	.24 (.09)	.04 (.05)	.20 (.07)
19. Sleep quality	.05 (.04)	.03 (.02)	.03 (.04)	.15 (.10)	.07 (.06)	.08 (.06)
20. Sleep quantity	.14 (.03)	.02 (.01)	.12 (.03)	.05 (.02)	.00 (.01)	.05 (.02)
21. Sleep motivation	.02 (.02)	.00 (.01)	.01 (.02)	.08 (.07)	.04 (.05)	.05 (.06)
22. PANAS (Positive)	.16 (.07)	.03 (.03)	.13 (.04)	.25 (.10)	.17 (.08)	.09 (.07)
23. PANAS (Negative)	.12 (.05)	.04 (.03)	.08 (.04)	.22 (.09)	.06 (.06)	.16 (.08)
24. Information processing	.06 (.05)	.01 (.02)	.05 (.04)	.09 (.06)	.04 (.04)	.05 (.05)
25. Social support	.16 (.05)	.07 (.04)	.09 (.05)	.20 (.11)	.07 (.06)	.12 (.09)
26. Workload uncertainty	.03 (.02)	.00 (.00)	.03 (.02)	.01 (.02)	.01 (.02)	.00 (.00)
27. Schedule consistency	.17 (.04)	.02 (.02)	.15 (.04)	.11 (.07)	.04 (.04)	.08 (.06)
28. Detachment	.15 (.09)	.05 (.04)	.10 (.06)	.14 (.11)	.05 (.05)	.09 (.09)
29. Welfare	.19 (.09)	.04 (.03)	.15 (.07)	.19 (.10)	.05 (.06)	.14 (.09)
30. Efficiency	.14 (.08)	.03 (.03)	.11 (.06)	.08 (.07)	.04 (.05)	.05 (.05)
31. Pressure to produce	.17 (.05)	.00 (.01)	.16 (.05)	.15 (.09)	.06 (.05)	.09 (.07)
32. Tenure at site	.15 (.02)	.02 (.02)	.13 (.02)	.20 (.02)	.17 (.02)	.03 (.01)
33. Average work hours per day	.36 (.02)	.03 (.01)	.33 (.02)	.45 (.07)	.20 (.02)	.26 (.07)
34. Night shifts in the past month	.09 (.01)	.01 (.01)	.08 (.02)	.08 (.03)	.08 (.03)	.00 (.00)

Note. Values in parentheses are SDs of the estimate across 50 imputed datasets.

Values in bold denote that value is significantly different from zero at $p < .05$.

(Site) and (Program) denote referent of the sleep climate items.

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

Table 32. $r_{wg(j)}$ of variables across learning sites (Study 3)

Variable	Time 1				Time 2			
	Rectangular	Normal	Slight skew	Bimodal	Rectangular	Normal	Slight skew	Bimodal
Communication (Site)	.80 (.07)	.27 (.17)	.54 (.17)	.24 (.16)	.77 (.12)	.26 (.24)	.48 (.23)	.22 (.23)
Communication (Program)	.79 (.07)	.22 (.18)	.45 (.21)	.20 (.17)	.69 (.17)	.17 (.22)	.36 (.25)	.14 (.20)
Positive features (Site)	.83 (.04)	.34 (.14)	.58 (.12)	.31 (.14)	.79 (.11)	.18 (.21)	.42 (.26)	.14 (.19)
Positive features (Program)	.83 (.06)	.27 (.15)	.50 (.15)	.24 (.15)	.71 (.16)	.09 (.17)	.28 (.26)	.07 (.14)
Negative features (Site)	.78 (.08)	.17 (.09)	.33 (.17)	.16 (.08)	.67 (.19)	.10 (.16)	.25 (.25)	.08 (.14)
Negative features (Program)	.79 (.08)	.18 (.12)	.36 (.18)	.16 (.12)	.63 (.19)	.08 (.14)	.22 (.24)	.07 (.13)
Communication (Site) Old	.74 (.08)	.30 (.16)	.51 (.14)	.27 (.16)	.72 (.14)	.32 (.25)	.48 (.24)	.28 (.25)
Communication (Program) Old	.73 (.08)	.24 (.16)	.46 (.16)	.22 (.16)	.64 (.19)	.23 (.23)	.38 (.26)	.20 (.22)
Positive features (Site) Old	.76 (.06)	.29 (.16)	.51 (.16)	.27 (.16)	.70 (.16)	.20 (.22)	.39 (.27)	.17 (.20)
Positive features (Program) Old	.74 (.10)	.25 (.16)	.44 (.17)	.23 (.16)	.59 (.21)	.12 (.18)	.26 (.25)	.10 (.16)
Negative features (Site) Old	.59 (.15)	.13 (.12)	.25 (.19)	.12 (.11)	.46 (.25)	.10 (.17)	.18 (.23)	.09 (.15)
Negative features (Program) Old	.62 (.14)	.15 (.13)	.29 (.19)	.14 (.13)	.45 (.26)	.11 (.16)	.19 (.23)	.09 (.15)
Communication (Site) New	.59 (.15)	.19 (.16)	.33 (.20)	.18 (.15)	.53 (.20)	.18 (.19)	.29 (.22)	.16 (.18)
Communication (Program) New	.55 (.19)	.18 (.15)	.28 (.21)	.17 (.15)	.46 (.22)	.14 (.17)	.23 (.22)	.12 (.16)
Positive features (Site) New	.71 (.09)	.26 (.15)	.43 (.16)	.25 (.14)	.61 (.18)	.15 (.18)	.29 (.23)	.13 (.17)
Positive features (Program) New	.68 (.11)	.21 (.14)	.37 (.18)	.20 (.13)	.56 (.20)	.14 (.18)	.27 (.24)	.12 (.16)
Negative features (Site) New	.69 (.11)	.21 (.10)	.33 (.15)	.20 (.09)	.61 (.20)	.16 (.20)	.31 (.25)	.14 (.18)
Negative features (Program) New	.68 (.11)	.19 (.11)	.30 (.15)	.18 (.11)	.56 (.21)	.13 (.18)	.26 (.25)	.11 (.16)
Sleep motivation	.80 (.09)	.30 (.22)	.55 (.20)	.27 (.21)	.77 (.11)	.31 (.23)	.51 (.21)	.27 (.22)
PANAS (Positive)	.85 (.05)	.44 (.17)	.68 (.11)	.40 (.18)	.83 (.09)	.43 (.28)	.63 (.22)	.39 (.29)
PANAS (Negative)	.81 (.07)	.36 (.17)	.58 (.15)	.33 (.17)	.83 (.10)	.39 (.27)	.60 (.23)	.35 (.27)
Information processing	.96 (.02)	.92 (.05)	.94 (.04)	.92 (.05)	.97 (.01)	.95 (.02)	.96 (.01)	.94 (.02)
Social support	.91 (.04)	.65 (.23)	.81 (.12)	.62 (.24)	.86 (.07)	.46 (.29)	.66 (.22)	.41 (.29)
Workload uncertainty	.75 (.01)	.38 (.03)	.55 (.02)	.36 (.03)	.71 (.02)	.38 (.04)	.54 (.04)	.33 (.04)
Schedule consistency	.76 (.10)	.19 (.14)	.41 (.20)	.17 (.13)	.63 (.18)	.09 (.15)	.25 (.24)	.07 (.12)
Detachment	.64 (.18)	.19 (.19)	.31 (.24)	.18 (.18)	.55 (.23)	.13 (.20)	.25 (.25)	.11 (.18)
Welfare	.81 (.09)	.39 (.26)	.59 (.23)	.37 (.26)	.83 (.09)	.47 (.28)	.64 (.21)	.43 (.28)
Efficiency	.79 (.09)	.33 (.22)	.55 (.18)	.30 (.21)	.78 (.11)	.32 (.27)	.54 (.24)	.27 (.26)
Pressure to produce	.87 (.04)	.49 (.21)	.72 (.12)	.46 (.21)	.85 (.06)	.42 (.28)	.66 (.19)	.36 (.28)
Sleep quality	.73 (.11)	.09 (.09)	.24 (.18)	.47 (.21)	.49 (.26)	.01 (.05)	.10 (.19)	.22 (.26)

Note. Values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

Table 33. $r_{wg(j)}$ of variables across residency programs (Study 3)

Variable	Time 1				Time 2			
	Rectangular	Normal	Slight skew	Bimodal	Rectangular	Normal	Slight skew	Bimodal
Communication (Site)	.81 (.09)	.34 (.23)	.57 (.20)	.31 (.23)	.78 (.15)	.37 (.28)	.55 (.27)	.33 (.28)
Communication (Program)	.78 (.10)	.27 (.20)	.49 (.21)	.25 (.20)	.73 (.18)	.29 (.28)	.46 (.29)	.26 (.27)
Positive features (Site)	.84 (.06)	.39 (.22)	.62 (.16)	.36 (.22)	.79 (.14)	.29 (.28)	.50 (.28)	.24 (.27)
Positive features (Program)	.82 (.08)	.31 (.21)	.56 (.17)	.28 (.21)	.73 (.18)	.18 (.24)	.38 (.30)	.15 (.21)
Negative features (Site)	.77 (.13)	.19 (.17)	.39 (.23)	.17 (.16)	.69 (.21)	.18 (.22)	.33 (.29)	.15 (.21)
Negative features (Program)	.78 (.11)	.22 (.20)	.44 (.23)	.20 (.20)	.70 (.21)	.20 (.24)	.35 (.30)	.17 (.23)
Communication (Site) Old	.79 (.10)	.41 (.23)	.59 (.19)	.39 (.23)	.73 (.18)	.41 (.29)	.54 (.28)	.38 (.29)
Communication (Program) Old	.75 (.11)	.34 (.21)	.53 (.19)	.32 (.21)	.66 (.21)	.33 (.27)	.45 (.28)	.30 (.27)
Positive features (Site) Old	.77 (.09)	.36 (.20)	.55 (.17)	.33 (.20)	.69 (.19)	.28 (.28)	.44 (.28)	.25 (.27)
Positive features (Program) Old	.73 (.10)	.29 (.20)	.49 (.18)	.26 (.20)	.62 (.23)	.21 (.24)	.35 (.28)	.19 (.23)
Negative features (Site) Old	.63 (.17)	.25 (.19)	.37 (.22)	.23 (.19)	.50 (.28)	.19 (.24)	.28 (.29)	.18 (.23)
Negative features (Program) Old	.69 (.15)	.29 (.22)	.44 (.24)	.27 (.21)	.52 (.28)	.22 (.25)	.31 (.29)	.20 (.24)
Communication (Site) New	.55 (.19)	.21 (.20)	.32 (.23)	.19 (.19)	.58 (.24)	.28 (.25)	.38 (.27)	.25 (.24)
Communication (Program) New	.51 (.20)	.19 (.18)	.28 (.21)	.18 (.17)	.55 (.26)	.28 (.26)	.36 (.28)	.26 (.26)
Positive features (Site) New	.71 (.14)	.31 (.22)	.47 (.22)	.29 (.21)	.65 (.21)	.29 (.26)	.41 (.28)	.27 (.25)
Positive features (Program) New	.69 (.14)	.25 (.21)	.42 (.23)	.24 (.20)	.59 (.24)	.23 (.24)	.35 (.27)	.21 (.23)
Negative features (Site) New	.64 (.17)	.17 (.18)	.32 (.22)	.16 (.17)	.63 (.23)	.22 (.25)	.35 (.29)	.20 (.23)
Negative features (Program) New	.63 (.18)	.17 (.19)	.32 (.23)	.15 (.18)	.64 (.23)	.24 (.26)	.37 (.30)	.22 (.25)
Sleep motivation	.80 (.10)	.37 (.25)	.58 (.22)	.34 (.25)	.79 (.13)	.37 (.27)	.56 (.24)	.33 (.27)
PANAS (Positive)	.87 (.06)	.51 (.22)	.71 (.15)	.48 (.22)	.82 (.13)	.45 (.30)	.63 (.25)	.41 (.30)
PANAS (Negative)	.85 (.06)	.50 (.21)	.67 (.15)	.47 (.21)	.80 (.13)	.41 (.29)	.59 (.26)	.37 (.29)
Information processing	.97 (.02)	.92 (.06)	.95 (.04)	.92 (.06)	.97 (.01)	.94 (.03)	.96 (.02)	.94 (.03)
Social support	.90 (.07)	.63 (.28)	.78 (.19)	.61 (.30)	.84 (.13)	.47 (.32)	.64 (.26)	.43 (.32)
Workload uncertainty	.73 (.02)	.47 (.04)	.59 (.03)	.45 (.04)	.67 (.04)	.46 (.05)	.55 (.05)	.44 (.05)
Schedule consistency	.77 (.10)	.33 (.20)	.51 (.20)	.30 (.20)	.64 (.21)	.20 (.25)	.35 (.29)	.18 (.24)
Detachment	.58 (.24)	.16 (.21)	.28 (.27)	.15 (.20)	.60 (.27)	.22 (.29)	.34 (.32)	.19 (.27)
Welfare	.78 (.14)	.41 (.29)	.57 (.27)	.39 (.29)	.81 (.13)	.50 (.31)	.65 (.25)	.47 (.31)
Efficiency	.76 (.12)	.37 (.26)	.55 (.23)	.35 (.26)	.75 (.16)	.35 (.29)	.51 (.27)	.31 (.29)
Pressure to produce	.88 (.06)	.57 (.21)	.73 (.15)	.55 (.22)	.81 (.12)	.44 (.28)	.62 (.22)	.40 (.28)
Sleep quality	.68 (.17)	.08 (.11)	.25 (.23)	.44 (.25)	.48 (.30)	.06 (.13)	.16 (.23)	.27 (.29)

Note. Values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

Table 34. Hunter-Schmidt SD (*s_{wg}*) of variables (Study 3)

Variable	Time 1		Time 2	
	Site	Program	Site	Program
Communication (Site)	.94 (.09)	.90 (.12)	.96 (.14)	.87 (.18)
Communication (Program)	.98 (.10)	.95 (.12)	1.03 (.15)	.92 (.19)
Positive features (Site)	.94 (.08)	.92 (.11)	1.01 (.12)	.93 (.16)
Positive features (Program)	.96 (.08)	.95 (.10)	1.08 (.12)	1.00 (.16)
Negative features (Site)	1.00 (.09)	.99 (.12)	1.09 (.13)	1.01 (.17)
Negative features (Program)	1.02 (.09)	.98 (.12)	1.11 (.14)	.99 (.17)
Communication (Site) Old	.91 (.10)	.83 (.14)	.91 (.17)	.81 (.23)
Communication (Program) Old	.94 (.10)	.89 (.14)	.99 (.18)	.90 (.23)
Positive features (Site) Old	.95 (.10)	.92 (.13)	.99 (.15)	.93 (.21)
Positive features (Program) Old	.97 (.11)	.95 (.12)	1.08 (.17)	1.01 (.21)
Negative features (Site) Old	1.05 (.15)	.96 (.17)	1.13 (.21)	1.04 (.27)
Negative features (Program) Old	1.02 (.15)	.92 (.17)	1.13 (.22)	1.03 (.28)
Communication (Site) New	1.00 (.16)	1.01 (.19)	1.04 (.22)	.95 (.27)
Communication (Program) New	1.03 (.17)	1.03 (.19)	1.10 (.23)	.96 (.29)
Positive features (Site) New	.93 (.11)	.92 (.16)	1.04 (.16)	.93 (.22)
Positive features (Program) New	.96 (.11)	.94 (.15)	1.07 (.18)	.99 (.24)
Negative features (Site) New	.97 (.10)	1.02 (.15)	1.06 (.17)	.99 (.21)
Negative features (Program) New	1.02 (.11)	1.03 (.15)	1.10 (.18)	.97 (.21)
Sleep motivation	.93 (.12)	.88 (.14)	.93 (.13)	.86 (.16)
PANAS (Positive)	.87 (.08)	.80 (.11)	.85 (.14)	.81 (.18)
PANAS (Negative)	.89 (.10)	.81 (.12)	.84 (.15)	.82 (.18)
Information processing	.42 (.11)	.37 (.12)	.36 (.09)	.35 (.11)
Social support	.73 (.11)	.72 (.14)	.83 (.14)	.79 (.18)
Workload uncertainty	.81 (.01)	.82 (.04)	.85 (.03)	.80 (.05)
Schedule consistency	.97 (.11)	.92 (.13)	1.07 (.16)	1.00 (.21)
Detachment	1.01 (.16)	1.04 (.21)	1.09 (.20)	.99 (.25)
Welfare	.85 (.14)	.85 (.18)	.80 (.16)	.74 (.20)
Efficiency	.90 (.11)	.89 (.16)	.91 (.16)	.86 (.20)
Pressure to produce	.82 (.09)	.78 (.12)	.88 (.12)	.83 (.17)
Tenure at site	264.52 (15.64)	241.01 (31.05)	292.52 (14.89)	234.58 (29.13)
Average work hours per day	1.60 (.05)	1.44 (.12)	1.78 (.09)	1.56 (.13)
Night shifts in the past month	4.15 (.09)	3.59 (.35)	3.28 (.19)	3.55 (.24)

Note. Values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

Table 35. HLM coefficients of work context variables on sleep quality (Study 3)

Predictor	Level*	Time 1 [‡]						Time 2 [‡]					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper
Communication (Site)	Variable	.07 (.08)	-.10 (.08)	.24 (.08)	.05 (.06)	-.08 (.06)	.18 (.06)	-.04 (.20)	-.33 (.21)	.25 (.21)	-.03 (.15)	-.23 (.15)	.17 (.15)
	Site Mean	.13 (.21)	-.44 (.24)	.71 (.22)	.03 (.05)	-.10 (.05)	.17 (.05)	.16 (.29)	-.58 (.34)	.90 (.29)	.05 (.09)	-.16 (.09)	.27 (.10)
	Program Mean	.13 (.16)	-.24 (.15)	.50 (.16)	.05 (.06)	-.09 (.06)	.19 (.06)	.01 (.20)	-.50 (.20)	.53 (.22)	.00 (.09)	-.21 (.09)	.22 (.09)
Communication (Program)	Variable	.03 (.07)	-.13 (.07)	.19 (.07)	.02 (.06)	-.11 (.06)	.16 (.06)	-.12 (.18)	-.39 (.18)	.16 (.19)	-.09 (.13)	-.29 (.13)	.11 (.13)
	Site Mean	.04 (.18)	-.46 (.20)	.55 (.19)	.01 (.05)	-.12 (.05)	.15 (.05)	.15 (.31)	-.63 (.34)	.92 (.35)	.05 (.09)	-.17 (.09)	.26 (.11)
	Program Mean	.15 (.14)	-.20 (.13)	.50 (.14)	.06 (.05)	-.08 (.05)	.20 (.05)	.05 (.21)	-.45 (.23)	.55 (.21)	.02 (.09)	-.20 (.10)	.24 (.09)
Positive features (Site)	Variable	.15 (.05)	.04 (.05)	.26 (.05)	.18 (.05)	.05 (.05)	.31 (.05)	.16 (.13)	-.06 (.14)	.38 (.14)	.14 (.11)	-.05 (.12)	.34 (.11)
	Site Mean	-.14 (.16)	-.57 (.19)	.30 (.17)	-.04 (.05)	-.18 (.05)	.09 (.05)	.06 (.25)	-.56 (.26)	.68 (.29)	.02 (.08)	-.18 (.09)	.22 (.09)
	Program Mean	.10 (.07)	-.13 (.07)	.32 (.08)	.06 (.04)	-.08 (.04)	.19 (.04)	-.05 (.19)	-.47 (.20)	.36 (.20)	-.03 (.10)	-.23 (.10)	.18 (.10)
Positive features (Program)	Variable	.15 (.05)	.05 (.05)	.26 (.06)	.19 (.06)	.06 (.06)	.32 (.06)	.07 (.12)	-.15 (.12)	.29 (.12)	.06 (.10)	-.13 (.11)	.26 (.10)
	Site Mean	-.16 (.14)	-.52 (.15)	.20 (.16)	-.06 (.05)	-.19 (.05)	.07 (.05)	.12 (.26)	-.52 (.30)	.76 (.28)	.04 (.09)	-.16 (.10)	.25 (.10)
	Program Mean	.10 (.08)	-.13 (.08)	.33 (.08)	.06 (.05)	-.07 (.05)	.19 (.05)	-.02 (.18)	-.44 (.19)	.40 (.20)	-.01 (.10)	-.22 (.10)	.20 (.10)
Negative features (Site)	Variable	-.25 (.06)	-.36 (.06)	-.15 (.06)	-.30 (.07)	-.43 (.07)	-.18 (.07)	-.13 (.10)	-.34 (.10)	.08 (.11)	-.13 (.10)	-.34 (.10)	.08 (.10)
	Site Mean	.10 (.12)	-.22 (.12)	.41 (.13)	.04 (.05)	-.09 (.05)	.17 (.05)	-.11 (.23)	-.61 (.24)	.40 (.25)	-.05 (.11)	-.28 (.11)	.17 (.11)
	Program Mean	-.09 (.11)	-.34 (.12)	.15 (.10)	-.05 (.05)	-.18 (.06)	.08 (.05)	-.01 (.17)	-.40 (.19)	.38 (.17)	.00 (.11)	-.24 (.11)	.23 (.11)
Negative features (Program)	Variable	-.26 (.06)	-.36 (.06)	-.16 (.06)	-.32 (.06)	-.44 (.06)	-.19 (.07)	-.15 (.12)	-.38 (.13)	.07 (.13)	-.15 (.12)	-.36 (.12)	.06 (.12)
	Site Mean	.11 (.12)	-.22 (.11)	.44 (.13)	.04 (.05)	-.09 (.04)	.17 (.05)	-.13 (.24)	-.67 (.26)	.42 (.25)	-.06 (.10)	-.27 (.10)	.16 (.10)
	Program Mean	.00 (.09)	-.22 (.10)	.22 (.09)	.00 (.06)	-.13 (.06)	.14 (.05)	.07 (.15)	-.30 (.16)	.43 (.15)	.04 (.10)	-.19 (.10)	.28 (.11)
Communication (Site) Old	Variable	.07 (.14)	-.19 (.13)	.34 (.14)	.04 (.07)	-.10 (.07)	.17 (.07)	-.17 (.36)	-.61 (.37)	.28 (.36)	-.07 (.17)	-.28 (.16)	.13 (.17)
	Site Mean	.30 (.35)	-.49 (.38)	1.09 (.35)	.05 (.06)	-.08 (.06)	.19 (.06)	.34 (.47)	-.69 (.46)	1.36 (.53)	.08 (.10)	-.14 (.10)	.29 (.11)
	Program Mean	.13 (.20)	-.37 (.20)	.63 (.21)	.04 (.06)	-.11 (.06)	.18 (.06)	.07 (.34)	-.70 (.35)	.83 (.37)	.02 (.10)	-.20 (.10)	.24 (.10)
Communication (Program) Old	Variable	-.03 (.11)	-.27 (.11)	.22 (.11)	-.01 (.06)	-.15 (.06)	.12 (.06)	-.28 (.35)	-.70 (.36)	.14 (.34)	-.13 (.16)	-.33 (.16)	.07 (.16)
	Site Mean	.13 (.30)	-.61 (.32)	.86 (.31)	.02 (.06)	-.12 (.06)	.16 (.05)	.41 (.43)	-.73 (.45)	1.53 (.52)	.08 (.09)	-.13 (.09)	.30 (.09)
	Program Mean	.18 (.18)	-.29 (.19)	.65 (.19)	.06 (.06)	-.09 (.06)	.20 (.06)	.16 (.35)	-.62 (.36)	.95 (.36)	.04 (.10)	-.17 (.10)	.26 (.10)
Positive features (Site) Old	Variable	.21 (.07)	.05 (.07)	.38 (.07)	.16 (.05)	.04 (.05)	.29 (.05)	.14 (.20)	-.19 (.20)	.48 (.21)	.08 (.12)	-.11 (.12)	.28 (.11)
	Site Mean	-.24 (.30)	-.93 (.34)	.45 (.30)	-.05 (.06)	-.18 (.06)	.09 (.06)	-.03 (.44)	-.102 (.44)	.94 (.50)	-.01 (.11)	-.22 (.11)	.20 (.11)
	Program Mean	.11 (.13)	-.26 (.12)	.47 (.14)	.04 (.05)	-.10 (.05)	.18 (.05)	.06 (.28)	-.60 (.29)	.71 (.29)	.02 (.10)	-.19 (.10)	.23 (.10)
Positive features (Program) Old	Variable	.24 (.09)	.07 (.09)	.41 (.09)	.19 (.07)	.06 (.07)	.31 (.06)	.04 (.17)	-.28 (.17)	.36 (.17)	.02 (.10)	-.17 (.11)	.22 (.10)
	Site Mean	-.29 (.23)	-.86 (.25)	.29 (.22)	-.07 (.05)	-.20 (.05)	.07 (.05)	.11 (.41)	-.75 (.47)	.97 (.41)	.03 (.11)	-.18 (.11)	.24 (.12)
	Program Mean	.11 (.14)	-.25 (.14)	.47 (.14)	.04 (.05)	-.09 (.05)	.17 (.05)	.04 (.25)	-.56 (.27)	.64 (.26)	.02 (.10)	-.20 (.09)	.23 (.10)
Negative features (Site) Old	Variable	-.47 (.12)	-.68 (.12)	-.25 (.12)	-.27 (.06)	-.39 (.06)	-.14 (.07)	-.19 (.24)	-.57 (.23)	.19 (.25)	-.11 (.12)	-.31 (.12)	.10 (.13)
	Site Mean	.20 (.30)	-.54 (.32)	.94 (.29)	.04 (.05)	-.09 (.05)	.16 (.05)	-.08 (.37)	-.100 (.43)	.84 (.39)	-.02 (.09)	-.24 (.09)	.21 (.09)
	Program Mean	-.22 (.25)	-.76 (.29)	.32 (.22)	-.05 (.05)	-.18 (.06)	.08 (.05)	-.11 (.36)	-.81 (.37)	.57 (.38)	-.04 (.12)	-.27 (.12)	.19 (.12)
Negative features (Program) Old	Variable	-.50 (.11)	-.73 (.11)	-.28 (.12)	-.28 (.06)	-.41 (.06)	-.16 (.06)	-.20 (.24)	-.59 (.24)	.19 (.26)	-.11 (.13)	-.31 (.13)	.10 (.13)
	Site Mean	.24 (.34)	-.56 (.35)	1.03 (.36)	.04 (.06)	-.09 (.06)	.17 (.06)	-.07 (.47)	-.108 (.57)	.98 (.48)	-.01 (.10)	-.23 (.10)	.21 (.11)
	Program Mean	.04 (.21)	-.46 (.25)	.54 (.20)	.01 (.06)	-.12 (.06)	.15 (.06)	-.02 (.33)	-.70 (.36)	.67 (.34)	-.01 (.11)	-.24 (.11)	.22 (.11)
Communication (Site) New	Variable	.14 (.15)	-.19 (.15)	.46 (.15)	.05 (.06)	-.07 (.06)	.18 (.06)	.08 (.39)	-.43 (.41)	.60 (.39)	.03 (.15)	-.16 (.16)	.22 (.14)
	Site Mean	-.08 (.48)	-.123 (.54)	1.07 (.50)	-.01 (.06)	-.14 (.06)	.13 (.06)	.03 (.72)	-.148 (.76)	1.52 (.74)	.00 (.11)	-.21 (.11)	.22 (.11)
	Program Mean	.27 (.42)	-.55 (.38)	1.10 (.49)	.04 (.06)	-.09 (.06)	.18 (.07)	-.06 (.40)	-.109 (.40)	.97 (.44)	-.01 (.09)	-.22 (.08)	.20 (.09)
Communication (Program) New	Variable	.14 (.16)	-.16 (.16)	.44 (.16)	.06 (.06)	-.07 (.06)	.19 (.06)	.00 (.29)	-.51 (.29)	.50 (.30)	.00 (.12)	-.20 (.12)	.20 (.11)
	Site Mean	-.07 (.37)	-.108 (.43)	.94 (.39)	-.01 (.05)	-.14 (.05)	.13 (.05)	-.06 (.67)	-.159 (.72)	1.45 (.75)	-.01 (.10)	-.23 (.10)	.21 (.12)
	Program Mean	.34 (.38)	-.46 (.34)	1.14 (.43)	.05 (.06)	-.08 (.06)	.19 (.06)	-.07 (.45)	-.102 (.47)	.87 (.46)	-.02 (.11)	-.24 (.11)	.21 (.11)
Positive features (Site) New	Variable	.30 (.12)	.06 (.12)	.54 (.12)	.16 (.07)	.03 (.07)	.30 (.06)	.31 (.23)	-.08 (.24)	.70 (.23)	.15 (.11)	-.04 (.11)	.35 (.10)
	Site Mean	-.17 (.34)	-.106 (.38)	.72 (.46)	-.03 (.05)	-.16 (.05)	.10 (.05)	.24 (.41)	-.86 (.45)	1.36 (.52)	.05 (.08)	-.16 (.09)	.26 (.08)
	Program Mean	.24 (.17)	-.24 (.17)	.73 (.18)	.07 (.05)	-.07 (.05)	.20 (.05)	-.20 (.32)	-.94 (.35)	.54 (.31)	-.06 (.09)	-.26 (.09)	.15 (.09)
Positive features (Program) New	Variable	.25 (.11)	.02 (.11)	.48 (.11)	.15 (.06)	.02 (.06)	.28 (.06)	.19 (.22)	-.20 (.22)	.57 (.24)	.09 (.11)	-.11 (.11)	.29 (.11)
	Site Mean	-.23 (.32)	-.97 (.33)	.52 (.39)	-.04 (.06)	-.18 (.06)	.09 (.06)	.20 (.56)	-.101 (.61)	1.42 (.60)	.04 (.11)	-.18 (.11)	.25 (.11)
	Program Mean	.26 (.17)	-.22 (.17)	.74 (.19)	.07 (.05)	-.06 (.05)	.21 (.05)	-.15 (.35)	-.90 (.38)	.59 (.34)	-.04 (.10)	-.25 (.10)	.17 (.10)

Note. Values outside of parentheses are regression coefficients of the predictors in the HLM and values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

*Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

†In this column, Variable, Program Mean, and Site Mean correspond to the raw predictor variable, learning site mean of the variable, and residency program mean of the variable, respectively.

‡For Time 1 analysis, sample size was 289; number of programs 38; number of sites 19.

§For Time 2 analysis, sample size was 138; number of programs 35; number of sites 17.

Values in bold indicate that the 95% CI excluded zero.

Table 35. HLM coefficients of work context variables on sleep quality (Study 3; continued)

Predictor	Level	Time 1 ^a						Time 2 ^b					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper
Negative features (Site) New	Variable	-36 (10)	-53 (10)	-19 (10)	-27 (07)	-40 (07)	-14 (08)	-16 (.16)	-48 (.16)	-17 (.16)	-10 (.10)	-30 (.10)	-10 (.11)
	Site Mean	-10 (.21)	-39 (.21)	-59 (.22)	.03 (.05)	-10 (.05)	-16 (.06)	-27 (.42)	-10 (.44)	-55 (.45)	-08 (.12)	-30 (.11)	-14 (.12)
	Program Mean	-12 (.16)	-50 (.17)	-25 (.15)	-04 (.05)	-17 (.06)	.09 (.05)	.03 (.24)	-.56 (.26)	-.62 (.25)	.01 (.10)	-.22 (.10)	-.24 (.10)
Negative features (Program) New	Variable	-36 (10)	-52 (10)	-20 (10)	-28 (07)	-41 (07)	-15 (08)	-18 (.17)	-50 (.18)	-14 (.18)	-11 (.11)	-32 (.11)	-.09 (.11)
	Site Mean	-15 (.18)	-33 (.17)	-.64 (.20)	.04 (.05)	-.09 (.05)	-.17 (.05)	-.27 (.36)	-1.14 (.40)	-.60 (.40)	-.07 (.10)	-.29 (.10)	-.14 (.10)
	Program Mean	-.05 (.15)	-.41 (.16)	-.30 (.15)	-.02 (.06)	-.15 (.06)	-.11 (.06)	.09 (.24)	-.48 (.24)	-.65 (.25)	.03 (.10)	-.19 (.10)	-.26 (.10)
Sleep motivation	Variable	46 (11)	30 (11)	62 (11)	33 (07)	21 (08)	45 (07)	-.26 (.18)	-.07 (.18)	-.58 (.18)	-.15 (.10)	-.04 (.11)	-.34 (.10)
	Site Mean	-10 (.35)	-.69 (.38)	.88 (.38)	.01 (.06)	-.12 (.06)	-.14 (.05)	-.05 (.44)	-1.03 (.54)	-.94 (.46)	-.01 (.10)	-.21 (.11)	-.19 (.10)
	Program Mean	-.19 (.19)	-.66 (.20)	-.27 (.21)	-.06 (.05)	-.18 (.06)	-.07 (.05)	.15 (.29)	-.52 (.31)	-.82 (.29)	.05 (.09)	-.15 (.09)	-.25 (.09)
PANAS (Positive)	Variable	38 (08)	22 (08)	55 (08)	29 (06)	17 (06)	42 (06)	41 (17)	07 (16)	75 (18)	24 (09)	04 (09)	44 (09)
	Site Mean	.08 (.25)	-.52 (.26)	.68 (.27)	.02 (.05)	-.11 (.06)	-.15 (.05)	-.03 (.27)	-.79 (.32)	-.73 (.27)	.00 (.08)	-.22 (.08)	-.21 (.09)
	Program Mean	.00 (.15)	-.36 (.16)	-.36 (.16)	.00 (.06)	-.13 (.06)	-.13 (.06)	-.05 (.20)	-.68 (.23)	-.58 (.22)	-.02 (.07)	-.24 (.08)	-.20 (.07)
PANAS (Negative)	Variable	-29 (09)	-45 (08)	-14 (09)	-24 (07)	-37 (07)	-12 (08)	-.29 (.20)	-.60 (.19)	-.03 (.20)	-.19 (.12)	-.39 (.12)	-.01 (.13)
	Site Mean	.08 (.14)	-.42 (.15)	-.57 (.16)	.02 (.04)	-.11 (.04)	-.16 (.04)	-.10 (.33)	-.88 (.36)	-.69 (.36)	-.03 (.10)	-.24 (.10)	-.18 (.10)
	Program Mean	-.07 (.15)	-.43 (.15)	-.28 (.15)	-.03 (.05)	-.16 (.05)	-.11 (.05)	.00 (.28)	-.56 (.29)	-.57 (.30)	-.00 (.11)	-.22 (.11)	-.23 (.11)
Information processing	Variable	-28 (21)	-72 (22)	16 (21)	-08 (06)	-21 (06)	05 (06)	.01 (.35)	-.79 (.36)	-.81 (.37)	.00 (.08)	-.19 (.08)	-.19 (.08)
	Site Mean	.05 (.60)	-1.56 (.67)	1.66 (.65)	.01 (.05)	-.13 (.05)	-.14 (.05)	.21 (.99)	-2.25 (1.19)	2.67 (1.06)	.02 (.10)	-.20 (.11)	-.24 (.09)
	Program Mean	-.03 (.48)	-1.12 (.50)	1.05 (.49)	.00 (.06)	-.14 (.06)	-.13 (.06)	-.35 (.79)	-2.09 (.82)	1.39 (.82)	-.05 (.10)	-.26 (.10)	-.17 (.10)
Social support	Variable	.13 (.07)	-.05 (.08)	.30 (.07)	.10 (.06)	-.03 (.06)	.23 (.06)	.11 (.17)	-.19 (.18)	-.42 (.17)	.07 (.11)	-.13 (.12)	-.27 (.11)
	Site Mean	.07 (.20)	-.43 (.22)	-.56 (.21)	.02 (.06)	-.12 (.06)	-.16 (.06)	.08 (.42)	-.73 (.45)	.88 (.45)	.03 (.11)	-.18 (.11)	-.24 (.12)
	Program Mean	.12 (.17)	-.26 (.16)	-.51 (.19)	.04 (.06)	-.10 (.06)	-.18 (.06)	.15 (.25)	-.43 (.27)	-.73 (.25)	.06 (.10)	-.15 (.10)	-.28 (.10)
Workload uncertainty	Variable	-85 (15)	-117 (15)	-54 (15)	-32 (06)	-43 (06)	-20 (06)	-.22 (.20)	-.72 (.23)	-.29 (.18)	-.08 (.07)	-.26 (.07)	-.10 (.07)
	Site Mean	.26 (.88)	-1.72 (.93)	2.24 (.91)	.02 (.06)	-.11 (.06)	-.15 (.06)	-.23 (.69)	-1.73 (.78)	1.30 (.69)	-.03 (.10)	-.23 (.10)	-.17 (.09)
	Program Mean	.42 (.37)	-.49 (.39)	1.32 (.38)	.06 (.05)	-.07 (.05)	-.19 (.05)	.46 (.36)	-.67 (.35)	1.57 (.40)	.08 (.06)	-.11 (.06)	-.27 (.06)
Schedule consistency	Variable	39 (08)	23 (09)	55 (08)	32 (07)	19 (07)	44 (07)	.23 (.13)	-.05 (.14)	.49 (.13)	.16 (.09)	-.03 (.10)	.36 (.09)
	Site Mean	-.48 (.29)	-1.08 (.29)	-.11 (.32)	-.11 (.07)	-.25 (.07)	-.02 (.07)	-.31 (.43)	-1.18 (.41)	.56 (.51)	-.09 (.11)	-.30 (.11)	-.12 (.11)
	Program Mean	-.18 (.14)	-.53 (.15)	-.16 (.14)	-.07 (.06)	-.21 (.06)	-.06 (.06)	-.16 (.23)	-.69 (.24)	-.38 (.23)	-.06 (.09)	-.27 (.09)	-.15 (.09)
Detachment	Variable	21 (10)	02 (10)	40 (11)	15 (07)	02 (07)	28 (07)	.19 (.18)	-.15 (.18)	-.53 (.20)	.11 (.11)	-.09 (.11)	.31 (.11)
	Site Mean	.06 (.23)	-.57 (.24)	-.68 (.26)	.01 (.05)	-.12 (.06)	-.14 (.05)	-.01 (.48)	-1.02 (.52)	-.99 (.58)	-.01 (.11)	-.22 (.11)	-.21 (.11)
	Program Mean	.24 (.20)	-.19 (.21)	.66 (.22)	.07 (.06)	-.06 (.06)	-.20 (.06)	.16 (.30)	-.47 (.31)	-.78 (.32)	.05 (.11)	-.16 (.11)	-.27 (.11)
Welfare	Variable	37 (12)	16 (12)	58 (13)	23 (07)	10 (07)	36 (07)	.27 (.23)	-.15 (.25)	.69 (.23)	.14 (.11)	-.07 (.12)	.34 (.11)
	Site Mean	-.17 (.24)	-.87 (.26)	-.53 (.34)	-.04 (.05)	-.17 (.05)	-.10 (.05)	.28 (.53)	-.82 (.57)	1.40 (.59)	.05 (.11)	-.15 (.11)	-.26 (.11)
	Program Mean	.08 (.17)	-.36 (.18)	-.52 (.19)	.03 (.06)	-.11 (.06)	-.16 (.06)	-.12 (.36)	-.86 (.35)	.63 (.39)	-.04 (.10)	-.25 (.10)	-.18 (.10)
Efficiency	Variable	-35 (15)	-57 (16)	-13 (15)	-20 (08)	-33 (08)	-07 (08)	-.10 (.18)	-.46 (.18)	.27 (.19)	-.05 (.09)	-.24 (.09)	-.14 (.10)
	Site Mean	.31 (.38)	-.53 (.38)	1.15 (.42)	.05 (.06)	-.09 (.06)	-.18 (.06)	-.24 (.58)	-1.42 (.68)	.93 (.63)	-.05 (.11)	-.26 (.12)	-.17 (.12)
	Program Mean	.13 (.23)	-.37 (.25)	-.64 (.23)	.04 (.06)	-.10 (.07)	-.17 (.06)	.20 (.32)	-.59 (.33)	.98 (.35)	.05 (.09)	-.15 (.09)	-.26 (.09)
Pressure to produce	Variable	-45 (08)	-62 (08)	-28 (09)	-33 (06)	-46 (06)	-21 (07)	-.09 (.20)	-.43 (.21)	.25 (.21)	-.05 (.12)	-.25 (.12)	-.15 (.12)
	Site Mean	.25 (.25)	-.50 (.30)	1.00 (.25)	.05 (.05)	-.08 (.05)	-.18 (.05)	.16 (.38)	-.81 (.43)	1.13 (.45)	.04 (.09)	-.17 (.09)	-.25 (.09)
	Program Mean	.08 (.14)	-.27 (.14)	.44 (.14)	.03 (.05)	-.10 (.05)	-.16 (.05)	.00 (.23)	-.64 (.25)	-.64 (.23)	.00 (.07)	-.21 (.08)	-.21 (.07)
Tenure	Variable	.00 (.00)	.00 (.00)	.00 (.00)	-.03 (.05)	-.16 (.05)	-.11 (.05)	.00 (.00)	.00 (.00)	.00 (.00)	-.12 (.08)	-.32 (.08)	-.07 (.08)
	Site Mean	.00 (.00)	.00 (.00)	.01 (.00)	.03 (.06)	-.11 (.06)	-.18 (.06)	.00 (.00)	-.01 (.00)	.00 (.00)	-.07 (.08)	-.30 (.09)	-.15 (.09)
	Program Mean	.00 (.00)	.00 (.00)	.01 (.00)	.07 (.06)	-.08 (.06)	-.21 (.06)	.00 (.00)	.00 (.00)	.01 (.00)	22 (09)	01 (09)	43 (09)
Hours	Variable	-45 (10)	-77 (10)	-13 (10)	-21 (04)	-35 (04)	-06 (05)	-.18 (.18)	-.65 (.20)	-.28 (.18)	-.09 (.09)	-.32 (.09)	-.14 (.09)
	Site Mean	.16 (.34)	-.82 (.32)	1.13 (.43)	.02 (.05)	-.12 (.05)	-.16 (.06)	-.08 (.30)	-.94 (.31)	-.78 (.33)	-.02 (.08)	-.23 (.08)	-.18 (.08)
	Program Mean	-.03 (.19)	-.56 (.20)	-.50 (.19)	-.01 (.05)	-.16 (.06)	-.14 (.05)	.10 (.25)	-.55 (.25)	-.76 (.28)	.04 (.09)	-.19 (.09)	-.27 (.09)
Night Shift	Variable	-.11 (.04)	-.21 (.05)	.00 (.04)	-13 (05)	-26 (05)	-01 (05)	.04 (.07)	-.15 (.07)	.23 (.07)	.04 (.07)	-.14 (.07)	.23 (.07)
	Site Mean	.08 (.15)	-.35 (.15)	-.52 (.17)	.03 (.05)	-.12 (.06)	-.17 (.05)	-.17 (.23)	-.67 (.23)	-.35 (.25)	-.07 (.10)	-.28 (.10)	-.13 (.10)
	Program Mean	.07 (.10)	-.17 (.10)	.32 (.11)	.04 (.06)	-.10 (.06)	-.18 (.06)	-.09 (.17)	-.54 (.17)	-.36 (.17)	-.04 (.07)	-.23 (.07)	-.15 (.08)

Note. Values outside of parentheses are regression coefficients of the predictors in the HLM and values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

*Old denotes scale used in Studies 1 and 2, and *New denotes scale composed solely of items introduced in Study 3.

*In this column, Variable, Program Mean, and Site Mean correspond to the raw predictor variable, learning site mean of the variable, and residency program mean of the variable, respectively.

^aFor Time 1 analysis, sample size was 289; number of programs 38; number of sites 19.

^bFor Time 2 analysis, sample size was 138; number of programs 35; number of sites 17.

Values in bold indicate that the 95% CI excluded zero.

Table 36. HLM coefficients of work context variables on sleep quantity (Study 3)

Predictor	Level*	Time 1 [‡]						Time 2 [‡]					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper
Communication (Site)	Variable	.02 (.01)	-.02 (.01)	.05 (.01)	.07 (.05)	-.06 (.05)	.20 (.05)	.04 (.02)	-.03 (.02)	.10 (.02)	.12 (.06)	-.09 (.06)	.33 (.06)
	Site Mean	.04 (.03)	-.08 (.03)	.16 (.03)	.05 (.03)	-.09 (.03)	.18 (.03)	-.02 (.04)	-.16 (.04)	.11 (.05)	-.03 (.05)	-.22 (.05)	.16 (.05)
	Program Mean	.03 (.02)	-.06 (.02)	.11 (.02)	.05 (.04)	-.11 (.04)	.21 (.04)	.02 (.03)	-.09 (.04)	.13 (.04)	.05 (.07)	-.17 (.07)	.27 (.07)
Communication (Program)	Variable	.00 (.01)	-.03 (.01)	.04 (.01)	.02 (.05)	-.11 (.05)	.14 (.05)	.02 (.02)	-.04 (.02)	.08 (.02)	.06 (.06)	-.15 (.06)	.27 (.06)
	Site Mean	.07 (.03)	-.03 (.03)	.17 (.03)	.09 (.03)	-.04 (.03)	.23 (.03)	-.03 (.05)	-.16 (.06)	.11 (.05)	-.04 (.07)	-.22 (.07)	.15 (.07)
	Program Mean	.06 (.02)	-.02 (.02)	.13 (.02)	.11 (.05)	-.05 (.05)	.26 (.04)	.08 (.03)	-.02 (.03)	.18 (.04)	.17 (.07)	-.05 (.07)	.39 (.07)
Positive features (Site)	Variable	.03 (.01)	.00 (.01)	.05 (.01)	.15 (.04)	.02 (.04)	.27 (.04)	.04 (.02)	-.01 (.02)	.09 (.02)	.17 (.07)	-.04 (.07)	.37 (.06)
	Site Mean	.01 (.02)	-.07 (.02)	.10 (.03)	.02 (.03)	-.11 (.03)	.15 (.03)	-.02 (.04)	-.13 (.05)	.09 (.04)	-.03 (.07)	-.22 (.07)	.15 (.07)
	Program Mean	.06 (.01)	.01 (.01)	.10 (.01)	.16 (.04)	.02 (.04)	.30 (.04)	.03 (.03)	-.05 (.03)	.12 (.03)	.09 (.08)	-.12 (.08)	.29 (.08)
Positive features (Program)	Variable	.03 (.01)	.01 (.01)	.05 (.01)	.16 (.04)	.04 (.04)	.29 (.04)	.02 (.01)	-.03 (.01)	.07 (.01)	.09 (.06)	-.11 (.06)	.29 (.06)
	Site Mean	.02 (.02)	-.05 (.02)	.09 (.02)	.03 (.03)	-.09 (.03)	.16 (.03)	-.02 (.04)	-.14 (.05)	.09 (.04)	-.04 (.06)	-.22 (.07)	.14 (.06)
	Program Mean	.06 (.01)	.01 (.01)	.10 (.01)	.16 (.04)	.02 (.04)	.30 (.03)	.08 (.03)	.00 (.03)	.17 (.03)	.20 (.07)	.00 (.07)	.41 (.07)
Negative features (Site)	Variable	-.06 (.01)	-.08 (.01)	-.04 (.01)	-.33 (.04)	-.45 (.04)	-.21 (.04)	-.07 (.02)	-.11 (.02)	-.02 (.02)	-.31 (.08)	-.52 (.08)	-.10 (.08)
	Site Mean	.01 (.01)	-.06 (.02)	.07 (.01)	.02 (.03)	-.11 (.02)	.14 (.03)	.05 (.03)	-.04 (.04)	.15 (.04)	.12 (.08)	-.08 (.08)	.32 (.08)
	Program Mean	-.06 (.01)	-.11 (.02)	-.01 (.01)	-.14 (.03)	-.27 (.03)	-.01 (.03)	-.02 (.03)	-.09 (.03)	.06 (.03)	-.05 (.09)	-.27 (.09)	.18 (.09)
Negative features (Program)	Variable	-.05 (.01)	-.07 (.01)	-.03 (.01)	-.32 (.04)	-.44 (.04)	-.20 (.04)	-.04 (.02)	-.09 (.02)	.00 (.02)	-.21 (.08)	-.43 (.08)	.01 (.08)
	Site Mean	-.01 (.01)	-.07 (.02)	.05 (.01)	-.02 (.03)	-.14 (.02)	.10 (.03)	.05 (.04)	-.04 (.04)	.15 (.04)	.11 (.08)	-.08 (.08)	.30 (.08)
	Program Mean	-.04 (.02)	-.09 (.02)	.00 (.02)	-.12 (.04)	-.26 (.04)	.01 (.05)	-.04 (.03)	-.12 (.03)	.03 (.03)	-.13 (.08)	-.36 (.08)	.10 (.09)
Communication (Site) Old	Variable	.02 (.02)	-.03 (.02)	.07 (.02)	.05 (.05)	-.09 (.05)	.18 (.05)	.03 (.03)	-.06 (.03)	.13 (.03)	.08 (.07)	-.14 (.07)	.30 (.07)
	Site Mean	.09 (.03)	-.07 (.04)	.25 (.04)	.07 (.03)	-.06 (.03)	.21 (.03)	-.06 (.06)	-.25 (.06)	.14 (.06)	-.06 (.06)	-.25 (.06)	.14 (.06)
	Program Mean	.04 (.03)	-.07 (.03)	.16 (.03)	.06 (.05)	-.10 (.05)	.22 (.04)	.03 (.06)	-.13 (.07)	.19 (.06)	.05 (.09)	-.18 (.09)	.27 (.09)
Communication (Program) Old	Variable	-.01 (.02)	-.06 (.02)	.03 (.02)	-.04 (.06)	-.17 (.06)	.09 (.06)	.01 (.03)	-.08 (.03)	.11 (.03)	.03 (.07)	-.17 (.07)	.24 (.07)
	Site Mean	.11 (.04)	-.04 (.03)	.25 (.04)	.10 (.03)	-.04 (.03)	.23 (.03)	-.06 (.08)	-.26 (.09)	.15 (.08)	-.05 (.08)	-.24 (.08)	.14 (.08)
	Program Mean	.10 (.03)	.00 (.03)	.20 (.03)	.16 (.05)	.00 (.05)	.31 (.05)	.11 (.07)	-.06 (.06)	.27 (.08)	.15 (.09)	-.07 (.09)	.36 (.09)
Positive features (Site) Old	Variable	.03 (.01)	-.01 (.01)	.06 (.01)	.10 (.04)	-.03 (.04)	.22 (.04)	.04 (.03)	-.03 (.03)	.11 (.03)	.11 (.07)	-.09 (.07)	.31 (.07)
	Site Mean	.03 (.03)	-.11 (.03)	.17 (.04)	.03 (.03)	-.11 (.03)	.16 (.03)	-.05 (.07)	-.23 (.07)	.13 (.07)	-.05 (.08)	-.24 (.08)	.14 (.07)
	Program Mean	.09 (.02)	.01 (.02)	.17 (.02)	.17 (.04)	.02 (.05)	.31 (.04)	.03 (.05)	-.10 (.06)	.17 (.06)	.05 (.09)	-.16 (.09)	.26 (.09)
Positive features (Program) Old	Variable	.04 (.01)	.01 (.01)	.08 (.01)	.16 (.04)	.03 (.04)	.28 (.04)	.01 (.03)	-.06 (.03)	.08 (.03)	.02 (.08)	-.19 (.08)	.23 (.08)
	Site Mean	.04 (.03)	-.08 (.03)	.16 (.04)	.04 (.03)	-.08 (.03)	.17 (.03)	-.03 (.06)	-.19 (.07)	.12 (.07)	-.04 (.07)	-.23 (.08)	.15 (.07)
	Program Mean	.08 (.02)	.00 (.02)	.16 (.02)	.14 (.04)	.00 (.04)	.28 (.03)	.11 (.04)	-.02 (.04)	.23 (.05)	.18 (.07)	-.02 (.07)	.39 (.07)
Negative features (Site) Old	Variable	-.11 (.02)	-.15 (.02)	-.07 (.02)	-.30 (.05)	-.42 (.05)	-.19 (.05)	-.07 (.03)	-.15 (.03)	.01 (.03)	-.19 (.08)	-.41 (.09)	.02 (.08)
	Site Mean	-.01 (.05)	-.15 (.06)	.14 (.05)	.00 (.05)	-.13 (.04)	.12 (.05)	.09 (.08)	-.08 (.08)	.25 (.09)	.10 (.09)	-.09 (.09)	.30 (.09)
	Program Mean	-.12 (.04)	-.24 (.05)	-.01 (.04)	-.14 (.04)	-.27 (.04)	-.01 (.04)	-.06 (.06)	-.20 (.06)	.08 (.06)	-.10 (.10)	-.32 (.10)	.13 (.10)
Negative features (Program) Old	Variable	-.11 (.02)	-.15 (.02)	-.06 (.02)	-.30 (.06)	-.42 (.06)	-.18 (.06)	-.06 (.03)	-.14 (.04)	.02 (.03)	-.16 (.08)	-.38 (.09)	.05 (.08)
	Site Mean	-.03 (.05)	-.18 (.06)	.12 (.05)	-.02 (.04)	-.14 (.04)	.10 (.04)	.10 (.07)	-.08 (.08)	.28 (.08)	.12 (.08)	-.07 (.08)	.31 (.08)
	Program Mean	-.09 (.05)	-.19 (.05)	.01 (.04)	-.12 (.05)	-.25 (.05)	.02 (.06)	-.09 (.05)	-.23 (.06)	.05 (.06)	-.15 (.09)	-.37 (.09)	.08 (.10)
Communication (Site) New	Variable	.04 (.03)	-.02 (.03)	.10 (.03)	.08 (.05)	-.05 (.05)	.20 (.05)	.06 (.04)	-.05 (.03)	.18 (.04)	.12 (.06)	-.08 (.06)	.32 (.06)
	Site Mean	-.03 (.08)	-.26 (.10)	.21 (.08)	-.01 (.05)	-.15 (.05)	.12 (.05)	.02 (.09)	-.25 (.10)	.29 (.10)	.01 (.06)	-.17 (.06)	.20 (.06)
	Program Mean	.01 (.06)	-.19 (.06)	.21 (.07)	.01 (.05)	-.16 (.05)	.17 (.05)	.05 (.10)	-.16 (.10)	.26 (.10)	.05 (.10)	-.16 (.10)	.26 (.10)
Communication (Program) New	Variable	.04 (.02)	-.02 (.02)	.10 (.02)	.08 (.05)	-.05 (.05)	.20 (.05)	.04 (.04)	-.07 (.04)	.14 (.05)	.07 (.08)	-.14 (.08)	.28 (.08)
	Site Mean	.06 (.06)	-.15 (.07)	.27 (.06)	.04 (.04)	-.10 (.04)	.18 (.04)	-.02 (.11)	-.27 (.13)	.24 (.12)	-.01 (.07)	-.19 (.07)	.17 (.07)
	Program Mean	-.01 (.06)	-.21 (.06)	.19 (.06)	-.01 (.05)	-.17 (.05)	.15 (.05)	.14 (.08)	-.05 (.08)	.32 (.09)	.16 (.09)	-.06 (.10)	.37 (.09)
Positive features (Site) New	Variable	.07 (.02)	.02 (.02)	.12 (.02)	.18 (.05)	.05 (.05)	.31 (.05)	.07 (.03)	-.01 (.03)	.16 (.04)	.17 (.08)	-.03 (.08)	.38 (.08)
	Site Mean	.01 (.05)	-.17 (.07)	.18 (.05)	.01 (.04)	-.12 (.04)	.14 (.04)	-.01 (.06)	-.20 (.08)	.19 (.07)	-.01 (.07)	-.19 (.07)	.18 (.07)
	Program Mean	.09 (.04)	-.02 (.04)	.20 (.04)	.12 (.05)	-.02 (.06)	.27 (.05)	.08 (.05)	-.07 (.06)	.23 (.05)	.11 (.07)	-.10 (.08)	.31 (.07)
Positive features (Program) New	Variable	.05 (.02)	.00 (.02)	.09 (.02)	.14 (.05)	.01 (.05)	.26 (.05)	.05 (.03)	-.03 (.03)	.14 (.03)	.13 (.07)	-.07 (.07)	.34 (.07)
	Site Mean	.02 (.05)	-.13 (.06)	.17 (.05)	.02 (.04)	-.11 (.04)	.15 (.04)	-.03 (.08)	-.24 (.08)	.18 (.09)	-.03 (.07)	-.21 (.07)	.15 (.07)
	Program Mean	.12 (.05)	.01 (.05)	.22 (.05)	.16 (.06)	.02 (.06)	.30 (.05)	.10 (.06)	-.05 (.07)	.25 (.06)	.14 (.09)	-.07 (.09)	.34 (.09)

Note. Values outside of parentheses are regression coefficients of the predictors in the HLM and values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

*Old denotes scale used in Studies 1 and 2, and *New denotes scale composed solely of items introduced in Study 3.

†In this column, Variable, Program Mean, and Site Mean correspond to the raw predictor variable, learning site mean of the variable, and residency program mean of the variable, respectively.

‡For Time 1 analysis, sample size was 289; number of programs 38; number of sites 19.

§For Time 2 analysis, sample size was 138; number of programs 35; number of sites 17.

Values in bold indicate that the 95% CI excluded zero.

Table 36. HLM coefficients of work context variables on sleep quantity (Study 3; continued)

Predictor	Level*	Time 1 ^a						Time 2 ^b					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper
Negative features (Site) New	Variable	-08 (.01)	-11 (.01)	-04 (.01)	-28 (.05)	-41 (.04)	-16 (.05)	-09 (.03)	-16 (.03)	-03 (.03)	-29 (.09)	-49 (.09)	-09 (.09)
	Site Mean	.00 (.02)	-.09 (.03)	.10 (.02)	.01 (.03)	-.12 (.03)	.13 (.03)	.05 (.05)	-.10 (.05)	.20 (.05)	.07 (.07)	-.12 (.07)	.27 (.08)
	Program Mean	-.08 (.02)	-.16 (.02)	.00 (.02)	-.13 (.04)	-.26 (.03)	.01 (.04)	-.01 (.05)	-.13 (.05)	.11 (.05)	-.01 (.09)	-.23 (.09)	.21 (.09)
Negative features (Program) New	Variable	-07 (.01)	-10 (.01)	-04 (.01)	-27 (.04)	-40 (.04)	-15 (.04)	-.05 (.03)	-.12 (.03)	.02 (.03)	-.16 (.09)	-.37 (.09)	.05 (.09)
	Site Mean	-.02 (.02)	-.11 (.02)	.08 (.02)	-.02 (.03)	-.15 (.03)	.11 (.03)	.05 (.05)	-.10 (.06)	.21 (.06)	.07 (.07)	-.12 (.07)	.26 (.07)
	Program Mean	-.07 (.03)	-.15 (.03)	.00 (.03)	-.13 (.04)	-.27 (.04)	.01 (.05)	-.06 (.04)	-.18 (.04)	.05 (.05)	-.13 (.09)	-.35 (.09)	.09 (.09)
Sleep motivation	Variable	.08 (.01)	.05 (.01)	.12 (.01)	.29 (.05)	.17 (.05)	.40 (.05)	.12 (.03)	.05 (.03)	.19 (.03)	.35 (.07)	.16 (.07)	.53 (.06)
	Site Mean	-.02 (.07)	-.19 (.08)	.14 (.07)	-.02 (.05)	-.15 (.05)	.11 (.05)	-.14 (.07)	-.31 (.07)	.04 (.07)	-.15 (.08)	-.33 (.08)	.02 (.08)
	Program Mean	.05 (.03)	-.06 (.04)	.15 (.03)	.06 (.04)	-.08 (.05)	.20 (.04)	.04 (.05)	-.09 (.05)	.17 (.05)	.06 (.08)	-.14 (.09)	.25 (.08)
PANAS (Positive)	Variable	.01 (.01)	-.02 (.01)	.05 (.01)	.05 (.04)	-.08 (.04)	.18 (.04)	.03 (.03)	-.04 (.03)	.11 (.03)	.09 (.08)	-.12 (.08)	.30 (.08)
	Site Mean	.02 (.03)	-.11 (.03)	.16 (.03)	.03 (.03)	-.11 (.03)	.16 (.03)	-.04 (.05)	-.19 (.05)	.10 (.06)	-.06 (.08)	-.26 (.08)	.14 (.08)
	Program Mean	.01 (.03)	-.08 (.03)	.10 (.03)	.01 (.05)	-.15 (.05)	.17 (.04)	.08 (.06)	-.05 (.06)	.21 (.06)	.13 (.10)	-.09 (.10)	.36 (.10)
PANAS (Negative)	Variable	-.02 (.01)	-.06 (.01)	.01 (.01)	-.10 (.04)	-.22 (.04)	.03 (.04)	-.05 (.02)	-.12 (.02)	.02 (.02)	-.17 (.07)	-.38 (.07)	.04 (.08)
	Site Mean	.01 (.03)	-.10 (.03)	.11 (.03)	.01 (.04)	-.13 (.04)	.15 (.04)	.10 (.06)	-.05 (.06)	.24 (.06)	-.14 (.08)	-.06 (.08)	.33 (.09)
	Program Mean	-.01 (.02)	-.10 (.02)	.07 (.02)	-.02 (.04)	-.18 (.04)	.14 (.04)	-.10 (.04)	-.21 (.04)	.02 (.04)	-.19 (.07)	-.41 (.07)	.03 (.07)
Information processing	Variable	-.05 (.03)	-.13 (.03)	.04 (.03)	-.07 (.04)	-.19 (.04)	.05 (.04)	-.12 (.06)	-.29 (.07)	.06 (.07)	-.13 (.08)	-.33 (.07)	.06 (.08)
	Site Mean	.03 (.10)	-.30 (.10)	.36 (.12)	.01 (.04)	-.12 (.04)	.14 (.04)	.28 (.16)	-.16 (.16)	.72 (.18)	.12 (.07)	-.07 (.07)	.31 (.07)
	Program Mean	.08 (.10)	-.17 (.11)	.34 (.11)	.05 (.06)	-.10 (.06)	.21 (.06)	.06 (.11)	-.30 (.12)	.42 (.12)	.04 (.07)	-.17 (.07)	.25 (.07)
Social support	Variable	.03 (.01)	.00 (.01)	.07 (.01)	.12 (.05)	-.01 (.05)	.24 (.05)	.04 (.03)	-.02 (.03)	.11 (.03)	.14 (.08)	-.06 (.08)	.35 (.08)
	Site Mean	.03 (.03)	-.08 (.02)	.13 (.03)	.03 (.03)	-.11 (.04)	.17 (.03)	-.12 (.05)	-.27 (.07)	.03 (.05)	-.15 (.06)	-.35 (.06)	.04 (.06)
	Program Mean	.01 (.02)	-.08 (.03)	.11 (.02)	.03 (.05)	-.14 (.05)	.19 (.04)	.08 (.04)	-.04 (.04)	.20 (.04)	.14 (.07)	-.07 (.07)	.36 (.08)
Workload uncertainty	Variable	-.09 (.01)	-.16 (.01)	-.03 (.01)	-.16 (.03)	-.28 (.02)	-.05 (.03)	-.04 (.02)	-.15 (.02)	.06 (.02)	-.08 (.04)	-.27 (.04)	.11 (.04)
	Site Mean	.34 (.10)	-.06 (.12)	.74 (.10)	.11 (.04)	-.02 (.04)	.24 (.03)	.01 (.04)	-.27 (.06)	.28 (.04)	.00 (.03)	-.18 (.03)	.18 (.03)
	Program Mean	-.21 (.04)	-.40 (.05)	-.02 (.05)	-.15 (.03)	-.29 (.03)	-.02 (.03)	-.21 (.04)	-.43 (.04)	.02 (.04)	-.18 (.03)	-.36 (.03)	.01 (.03)
Schedule consistency	Variable	.04 (.01)	.01 (.01)	.07 (.01)	.16 (.05)	.03 (.05)	.28 (.04)	.05 (.02)	-.01 (.02)	.10 (.02)	-.16 (.06)	-.04 (.06)	.36 (.06)
	Site Mean	-.11 (.04)	-.23 (.04)	.01 (.04)	-.12 (.04)	-.26 (.04)	.01 (.05)	-.03 (.05)	-.18 (.05)	.12 (.05)	-.04 (.06)	-.22 (.06)	.13 (.06)
	Program Mean	-.06 (.02)	-.01 (.02)	.14 (.02)	.13 (.04)	-.02 (.04)	.27 (.04)	.08 (.03)	-.03 (.04)	.19 (.03)	.16 (.06)	-.04 (.07)	.35 (.06)
Detachment	Variable	.06 (.02)	.02 (.02)	.09 (.02)	.19 (.07)	.07 (.07)	.32 (.07)	.07 (.03)	.00 (.03)	.14 (.03)	.20 (.08)	-.01 (.09)	.40 (.08)
	Site Mean	.01 (.04)	-.12 (.05)	.13 (.04)	.01 (.04)	-.13 (.05)	.14 (.04)	-.07 (.07)	-.26 (.08)	.10 (.07)	-.09 (.07)	-.27 (.07)	.10 (.07)
	Program Mean	.01 (.04)	-.09 (.04)	.12 (.04)	.02 (.05)	-.14 (.06)	.18 (.05)	.00 (.05)	-.13 (.05)	.13 (.05)	.00 (.08)	-.22 (.09)	.21 (.08)
Welfare	Variable	.04 (.02)	.00 (.02)	.09 (.02)	.13 (.06)	.00 (.06)	.26 (.06)	.02 (.04)	-.07 (.04)	.12 (.04)	.06 (.08)	-.16 (.09)	.27 (.08)
	Site Mean	.03 (.04)	-.12 (.04)	.17 (.06)	.02 (.04)	-.11 (.04)	.16 (.04)	.04 (.08)	-.16 (.08)	.25 (.09)	.05 (.08)	-.14 (.08)	.23 (.08)
	Program Mean	.03 (.03)	-.08 (.03)	.13 (.04)	.04 (.05)	-.12 (.05)	.19 (.05)	.06 (.06)	-.09 (.06)	.22 (.06)	.09 (.08)	-.13 (.09)	.30 (.08)
Efficiency	Variable	-.06 (.02)	-.10 (.02)	-.02 (.02)	-.17 (.06)	-.30 (.05)	-.05 (.06)	-.05 (.03)	-.13 (.03)	.03 (.03)	-.13 (.08)	-.32 (.08)	.07 (.09)
	Site Mean	.04 (.08)	-.13 (.08)	.22 (.09)	.03 (.06)	-.10 (.06)	.17 (.06)	.05 (.10)	-.16 (.11)	.26 (.10)	.05 (.09)	-.14 (.09)	.23 (.10)
	Program Mean	.01 (.04)	-.11 (.04)	.13 (.04)	.02 (.05)	-.14 (.05)	.18 (.06)	-.01 (.08)	-.17 (.08)	.15 (.09)	-.02 (.11)	-.22 (.11)	.19 (.11)
Pressure to produce	Variable	-.06 (.01)	-.09 (.01)	-.02 (.01)	-.21 (.05)	-.33 (.05)	-.08 (.05)	-.03 (.02)	-.10 (.03)	.04 (.03)	-.09 (.07)	-.30 (.07)	.12 (.07)
	Site Mean	.02 (.04)	-.14 (.05)	.17 (.04)	.02 (.04)	-.11 (.04)	.15 (.04)	-.05 (.07)	-.22 (.09)	.12 (.07)	-.05 (.08)	-.24 (.08)	.13 (.08)
	Program Mean	-.01 (.02)	-.10 (.02)	.07 (.02)	-.02 (.03)	-.17 (.03)	.13 (.04)	-.01 (.04)	-.14 (.05)	.12 (.05)	-.02 (.07)	-.22 (.07)	.19 (.07)
Tenure	Variable	.00 (.00)	.00 (.00)	.00 (.00)	-.05 (.03)	-.18 (.03)	.08 (.03)	.00 (.00)	.00 (.00)	.00 (.00)	-.02 (.04)	-.23 (.04)	.18 (.04)
	Site Mean	.00 (.00)	.00 (.00)	.00 (.00)	-.04 (.02)	-.18 (.02)	.11 (.02)	.00 (.00)	.00 (.00)	.00 (.00)	-.07 (.03)	-.28 (.04)	.14 (.03)
	Program Mean	.00 (.00)	.00 (.00)	.00 (.00)	.13 (.03)	-.04 (.04)	.31 (.03)	.00 (.00)	.00 (.00)	.00 (.00)	.01 (.03)	-.20 (.02)	.23 (.03)
Hours	Variable	-.16 (.01)	-.22 (.01)	-.10 (.01)	-.35 (.03)	-.49 (.03)	-.22 (.03)	-.19 (.03)	-.28 (.03)	-.09 (.03)	-.46 (.06)	-.68 (.06)	-.23 (.07)
	Site Mean	.02 (.03)	-.16 (.04)	.20 (.04)	.01 (.02)	-.11 (.02)	.14 (.03)	.08 (.02)	-.07 (.02)	.22 (.02)	.10 (.02)	-.08 (.02)	.27 (.02)
	Program Mean	-.04 (.02)	-.15 (.02)	.06 (.02)	-.06 (.03)	-.20 (.03)	.08 (.03)	.00 (.02)	-.13 (.02)	.12 (.02)	-.01 (.04)	-.22 (.04)	.21 (.04)
Night Shift	Variable	-.02 (.00)	-.04 (.00)	.00 (.00)	-.10 (.03)	-.22 (.03)	.02 (.03)	-.03 (.01)	-.07 (.01)	.01 (.01)	-.16 (.04)	-.35 (.04)	.03 (.04)
	Site Mean	.05 (.01)	-.04 (.02)	.14 (.02)	.09 (.02)	-.06 (.02)	.23 (.03)	.03 (.01)	-.06 (.02)	.12 (.01)	.07 (.03)	-.11 (.03)	.25 (.03)
	Program Mean	-.05 (.01)	-.10 (.01)	.01 (.01)	-.13 (.03)	-.28 (.03)	.03 (.03)	-.08 (.02)	-.17 (.02)	.01 (.02)	-.16 (.03)	-.35 (.03)	.02 (.04)

Note. Values outside of parentheses are regression coefficients of the predictors in the HLM and values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

*In this column, Variable, Program Mean, and Site Mean correspond to the raw predictor variable, learning site mean of the variable, and residency program mean of the variable, respectively.

^aFor Time 1 analysis, sample size was 289; number of programs 38; number of sites 19.

^bFor Time 2 analysis, sample size was 138; number of programs 35; number of sites 17.

Values in bold indicate that the 95% CI excluded zero.

Table 37. Relationship between Time 1 work context variables and Time 2 sleep (Study 3)

IV	DV					
	Unstandardized coefficient	T2 Sleep quality		Unstandardized coefficient	T2 Sleep quantity	
		95% CI lower (SD)	95% CI upper (SD)		95% CI lower (SD)	95% CI upper (SD)
Communication (Site)	.06 (.10)	-.14 (.11)	.27 (.11)	.04 (.01)	.00 (.01)	.08 (.01)
Communication (Program)	.02 (.10)	-.18 (.10)	.22 (.10)	.03 (.01)	-.01 (.01)	.08 (.01)
Positive features (Site)	.12 (.06)	-.01 (.06)	.25 (.06)	.04 (.00)	.01 (.01)	.07 (.01)
Positive features (Program)	.11 (.06)	-.03 (.06)	.24 (.06)	.04 (.00)	.01 (.00)	.07 (.00)
Negative features (Site)	-.15 (.06)	-.29 (.06)	-.02 (.06)	-.06 (.01)	-.09 (.01)	-.03 (.01)
Negative features (Program)	-.16 (.05)	-.29 (.05)	-.03 (.06)	-.05 (.01)	-.08 (.01)	-.03 (.01)
Communication (Site) Old	.14 (.16)	-.17 (.16)	.45 (.16)	.06 (.02)	.00 (.02)	.13 (.02)
Communication (Program) Old	.03 (.14)	-.27 (.15)	.33 (.15)	.05 (.02)	-.01 (.02)	.11 (.02)
Positive features (Site) Old	.17 (.10)	-.03 (.10)	.38 (.10)	.05 (.01)	.01 (.01)	.10 (.01)
Positive features (Program) Old	.14 (.09)	-.07 (.09)	.35 (.09)	.05 (.01)	.01 (.01)	.10 (.01)
Negative features (Site) Old	-.32 (.13)	-.60 (.13)	-.03 (.13)	-.11 (.01)	-.17 (.01)	-.05 (.01)
Negative features (Program) Old	-.31 (.12)	-.60 (.12)	-.02 (.14)	-.11 (.01)	-.17 (.01)	-.05 (.01)
Communication (Site) New	.01 (.19)	-.39 (.19)	.41 (.19)	.06 (.02)	-.03 (.03)	.14 (.02)
Communication (Program) New	.02 (.20)	-.37 (.20)	.40 (.21)	.04 (.02)	-.04 (.03)	.12 (.02)
Positive features (Site) New	.24 (.14)	-.05 (.14)	.53 (.14)	.09 (.02)	.03 (.02)	.15 (.02)
Positive features (Program) New	.22 (.12)	-.07 (.12)	.51 (.12)	.08 (.01)	.02 (.01)	.14 (.01)
Negative features (Site) New	-.20 (.10)	-.41 (.10)	.01 (.10)	-.09 (.01)	-.13 (.01)	-.04 (.01)
Negative features (Program) New	-.22 (.09)	-.42 (.09)	-.02 (.09)	-.07 (.01)	-.12 (.01)	-.03 (.01)
Sleep motivation	.23 (.08)	.01 (.08)	.45 (.08)	.08 (.02)	.04 (.02)	.13 (.02)
PANAS (Positive)	.32 (.09)	.09 (.10)	.53 (.08)	.03 (.01)	-.01 (.01)	.08 (.01)
PANAS (Negative)	-.19 (.08)	-.40 (.08)	.02 (.08)	-.05 (.01)	-.09 (.01)	.00 (.01)
Information processing	-.12 (.20)	-.69 (.23)	.46 (.20)	-.08 (.04)	-.21 (.04)	.04 (.04)
Social support	.06 (.12)	-.17 (.12)	.30 (.12)	.05 (.01)	.00 (.02)	.09 (.02)
Workload uncertainty	-.32 (.17)	-.77 (.18)	.15 (.17)	-.09 (.01)	-.19 (.01)	.01 (.01)
Schedule consistency	.10 (.08)	-.11 (.08)	.32 (.09)	.06 (.01)	.02 (.01)	.11 (.01)
Detachment	.16 (.10)	-.08 (.10)	.40 (.11)	.05 (.02)	.00 (.02)	.10 (.03)
Welfare	.19 (.12)	-.08 (.11)	.46 (.13)	.06 (.02)	.00 (.02)	.11 (.02)
Efficiency	-.12 (.13)	-.41 (.14)	.17 (.13)	-.05 (.02)	-.11 (.02)	.01 (.02)
Pressure to produce	-.22 (.11)	-.46 (.12)	.01 (.11)	-.05 (.01)	-.10 (.01)	.00 (.01)
Tenure at site	.00 (.00)	.00 (.00)	.00 (.00)	.00 (.00)	.00 (.00)	.00 (.00)
Average work hours per day	-.45 (.19)	-.90 (.19)	.00 (.19)	-.22 (.01)	-.31 (.01)	-.14 (.01)
Night shifts in the past month	-.04 (.05)	-.17 (.05)	.08 (.05)	-.04 (.01)	-.06 (.01)	-.01 (.01)

Note. Values outside of parentheses are HLM regression coefficients of the IV at Time 1 on DV at Time 2; values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

Sample size was 138; number of programs 35; number of sites 17.

Values in bold indicate that the 95% CI exclude zero.

Table 38. Indirect effects of molar climate on sleep (Study 3)

DV: Sleep quality

Predictor	Mediator	Time 1						Time 2					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Indirect Effect	Lower	Upper	Indirect Effect	Lower	Upper	Indirect Effect	Lower	Upper	Indirect Effect	Lower	Upper
Welfare	PANAS (Positive)	.095 (.042)	-.019 (.032)	.187 (.057)	.058 (.024)	-.012 (.019)	.115 (.033)	.050 (.038)	-.051 (.039)	.182 (.071)	.024 (.018)	-.025 (.019)	.089 (.033)
	PANAS (Negative)	.051 (.036)	-.019 (.038)	.132 (.045)	.032 (.022)	-.011 (.022)	.082 (.030)	.046 (.051)	-.056 (.062)	.175 (.083)	.022 (.024)	-.027 (.030)	.085 (.037)
	Total	.146 (.050)	-.040 (.043)	.266 (.064)	.091 (.032)	-.025 (.027)	.165 (.041)	.096 (.064)	-.054 (.072)	.279 (.089)	.047 (.029)	-.026 (.034)	.136 (.038)
Efficiency	PANAS (Positive)	-.047 (.020)	-.113 (.032)	.002 (.012)	-.027 (.012)	-.067 (.018)	.001 (.007)	-.035 (.044)	-.148 (.073)	.056 (.050)	-.018 (.023)	-.077 (.037)	.029 (.026)
	PANAS (Negative)	-.022 (.021)	-.074 (.032)	.018 (.021)	-.013 (.012)	-.044 (.019)	.010 (.012)	-.031 (.036)	-.131 (.068)	.049 (.034)	-.016 (.019)	-.068 (.034)	.026 (.018)
	Total	-.069 (.029)	-.151 (.040)	-.002 (.024)	-.041 (.017)	-.089 (.023)	-.001 (.014)	-.067 (.057)	-.216 (.085)	.059 (.057)	-.035 (.030)	-.112 (.043)	.031 (.030)
Pressure to Produce	PANAS (Positive)	-.056 (.022)	-.117 (.031)	-.010 (.014)	-.042 (.016)	-.086 (.023)	-.007 (.010)	-.021 (.033)	-.121 (.055)	.065 (.045)	-.012 (.019)	-.070 (.030)	.039 (.027)
	PANAS (Negative)	-.025 (.034)	-.089 (.040)	.033 (.037)	-.019 (.025)	-.065 (.030)	.024 (.026)	-.046 (.049)	-.159 (.075)	.043 (.055)	-.028 (.029)	-.094 (.045)	.025 (.030)
	Total	-.081 (.036)	-.168 (.043)	-.005 (.034)	-.060 (.027)	-.124 (.032)	-.004 (.025)	-.067 (.065)	-.217 (.084)	.061 (.069)	-.040 (.038)	-.127 (.048)	.036 (.040)

DV: Sleep quantity

Predictor	Mediator	Time 1						Time 2					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Indirect Effect	Lower	Upper									
Welfare	PANAS (Positive)	-.002 (.007)	-.017 (.008)	.014 (.009)	-.005 (.021)	-.052 (.025)	.041 (.027)	.003 (.005)	-.014 (.007)	.023 (.011)	.008 (.011)	-.032 (.017)	.055 (.025)
	PANAS (Negative)	.007 (.005)	-.007 (.006)	.023 (.006)	.021 (.014)	-.023 (.018)	.070 (.019)	.011 (.009)	-.010 (.007)	.038 (.015)	.025 (.021)	-.023 (.017)	.091 (.036)
	Total	.005 (.007)	-.016 (.008)	.028 (.009)	.016 (.019)	-.049 (.025)	.083 (.024)	.014 (.009)	-.013 (.009)	.048 (.015)	.033 (.022)	-.032 (.021)	.113 (.035)
Efficiency	PANAS (Positive)	.001 (.003)	-.007 (.004)	.009 (.005)	.002 (.008)	-.020 (.011)	.026 (.014)	-.002 (.005)	-.018 (.011)	.012 (.005)	-.006 (.012)	-.046 (.027)	.030 (.013)
	PANAS (Negative)	-.003 (.003)	-.013 (.005)	.004 (.002)	-.009 (.007)	-.037 (.013)	.012 (.008)	-.006 (.007)	-.026 (.013)	.010 (.007)	-.014 (.017)	-.064 (.031)	.025 (.018)
	Total	-.002 (.003)	-.015 (.004)	.009 (.004)	-.007 (.008)	-.042 (.012)	.025 (.012)	-.008 (.008)	-.034 (.013)	.013 (.007)	-.020 (.019)	-.085 (.032)	.033 (.018)
Pressure to Produce	PANAS (Positive)	.001 (.003)	-.008 (.004)	.010 (.004)	.002 (.011)	-.029 (.016)	.035 (.016)	-.002 (.004)	-.017 (.009)	.010 (.004)	-.006 (.010)	-.047 (.023)	.029 (.011)
	PANAS (Negative)	-.004 (.004)	-.017 (.005)	.009 (.005)	-.013 (.016)	-.061 (.019)	.031 (.018)	-.010 (.008)	-.033 (.014)	.008 (.006)	-.027 (.023)	-.093 (.040)	.022 (.018)
	Total	-.003 (.004)	-.019 (.005)	.012 (.005)	-.011 (.014)	-.068 (.016)	.044 (.018)	-.012 (.008)	-.039 (.014)	.010 (.006)	-.033 (.023)	-.110 (.037)	.029 (.018)

Note. Values in bold indicate that the 95% CI exclude zero.

Values in parentheses are SDs of the estimate across 50 imputed datasets.

Table 39. Indirect effects of sleep climate on sleep quality (Study 3)

Predictor	Mediator	Time 1						Time 2					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Indirect effect	Lower	Upper	Indirect effect	Lower	Upper	Indirect Effect	Lower	Upper	Indirect Effect	Lower	Upper
Communication (Site)	PANAS (Positive)	.065 (.024)	.012 (.020)	.132 (.031)	.050 (.018)	.009 (.015)	.101 (.023)	.038 (.040)	-.040 (.035)	.134 (.071)	.027 (.027)	-.029 (.025)	.095 (.046)
	PANAS (Negative)	.024 (.020)	-.008 (.016)	.067 (.030)	.019 (.015)	-.006 (.012)	.051 (.023)	.019 (.031)	-.044 (.032)	.092 (.057)	.013 (.021)	-.031 (.021)	.065 (.038)
	Sleep Motivation	.023 (.020)	-.028 (.019)	.078 (.028)	.017 (.015)	-.021 (.015)	.060 (.022)	.023 (.035)	-.043 (.039)	.105 (.057)	.016 (.023)	-.031 (.028)	.074 (.036)
	Total	.112 (.031)	-.028 (.028)	.207 (.037)	.086 (.024)	-.021 (.021)	.159 (.029)	.080 (.067)	-.046 (.060)	.225 (.093)	.056 (.042)	-.033 (.040)	.158 (.054)
Communication (Program)	PANAS (Positive)	.063 (.025)	.013 (.019)	.126 (.034)	.052 (.021)	.011 (.016)	.104 (.028)	.039 (.050)	-.032 (.044)	.129 (.079)	.029 (.035)	-.024 (.032)	.095 (.053)
	PANAS (Negative)	.017 (.013)	-.010 (.010)	.052 (.022)	.014 (.011)	-.008 (.008)	.043 (.019)	.019 (.036)	-.045 (.038)	.095 (.061)	.014 (.027)	-.034 (.029)	.070 (.045)
	Sleep Motivation	.011 (.018)	-.036 (.020)	.061 (.026)	.010 (.015)	-.030 (.017)	.050 (.021)	.021 (.035)	-.040 (.032)	.095 (.061)	.015 (.025)	-.030 (.025)	.070 (.042)
	Total	.091 (.030)	.014 (.028)	.177 (.036)	.076 (.026)	.012 (.024)	.147 (.030)	.080 (.066)	-.041 (.055)	.218 (.094)	.058 (.047)	-.031 (.042)	.161 (.063)
Positive features (Site)	PANAS (Positive)	.036 (.015)	.001 (.015)	.078 (.018)	.043 (.018)	.001 (.017)	.092 (.022)	.024 (.023)	-.028 (.022)	.092 (.042)	.022 (.020)	-.026 (.020)	.082 (.035)
	PANAS (Negative)	.018 (.013)	-.005 (.012)	.048 (.019)	.022 (.016)	-.006 (.015)	.058 (.022)	.018 (.022)	-.028 (.025)	.078 (.040)	.017 (.020)	-.025 (.022)	.070 (.036)
	Sleep Motivation	.017 (.013)	-.016 (.010)	.052 (.020)	.020 (.015)	-.019 (.013)	.062 (.023)	.009 (.014)	-.034 (.021)	.061 (.027)	.008 (.012)	-.031 (.019)	.055 (.022)
	Total	.071 (.018)	.015 (.017)	.132 (.021)	.084 (.021)	.018 (.020)	.157 (.024)	.052 (.030)	-.035 (.029)	.154 (.045)	.047 (.026)	-.032 (.027)	.138 (.037)
Positive features (Program)	PANAS (Positive)	.036 (.016)	.001 (.015)	.078 (.020)	.044 (.019)	.001 (.018)	.094 (.024)	.019 (.021)	-.031 (.023)	.081 (.039)	.017 (.018)	-.028 (.020)	.073 (.033)
	PANAS (Negative)	.020 (.014)	-.005 (.013)	.050 (.019)	.024 (.017)	-.005 (.016)	.061 (.023)	.014 (.022)	-.032 (.023)	.069 (.039)	.013 (.019)	-.029 (.020)	.062 (.035)
	Sleep Motivation	.014 (.011)	-.018 (.010)	.048 (.017)	.016 (.013)	-.022 (.013)	.058 (.020)	.004 (.014)	-.039 (.022)	.051 (.025)	.004 (.013)	-.036 (.020)	.047 (.022)
	Total	.069 (.019)	.014 (.019)	.130 (.021)	.084 (.023)	.017 (.023)	.158 (.026)	.037 (.035)	-.047 (.033)	.130 (.051)	.033 (.031)	-.043 (.029)	.118 (.044)
Negative features (Site)	PANAS (Positive)	-.041 (.022)	-.092 (.026)	.005 (.022)	-.049 (.026)	-.109 (.031)	.006 (.026)	-.021 (.022)	-.085 (.037)	.030 (.023)	-.020 (.021)	-.084 (.034)	.030 (.024)
	PANAS (Negative)	-.025 (.025)	-.070 (.028)	.016 (.026)	-.030 (.029)	-.084 (.033)	.018 (.030)	-.025 (.027)	-.092 (.041)	.029 (.032)	-.025 (.027)	-.092 (.041)	.028 (.031)
	Sleep Motivation	-.033 (.016)	-.071 (.023)	-.001 (.013)	-.039 (.019)	-.084 (.027)	-.001 (.015)	-.010 (.018)	-.061 (.029)	.033 (.023)	-.010 (.017)	-.060 (.028)	.033 (.022)
	Total	-.099 (.027)	-.176 (.030)	-.028 (.028)	-.118 (.033)	-.209 (.036)	-.033 (.033)	-.055 (.038)	-.159 (.050)	.035 (.040)	-.055 (.037)	-.157 (.049)	.034 (.038)
Negative features (Program)	PANAS (Positive)	-.040 (.022)	-.090 (.026)	.005 (.022)	-.049 (.026)	-.109 (.030)	.006 (.026)	-.029 (.020)	-.098 (.038)	.023 (.018)	-.028 (.019)	-.096 (.036)	.022 (.018)
	PANAS (Negative)	-.024 (.024)	-.067 (.027)	.015 (.025)	-.030 (.029)	-.082 (.034)	.017 (.030)	-.019 (.024)	-.083 (.040)	.033 (.027)	-.019 (.024)	-.082 (.040)	.032 (.025)
	Sleep Motivation	-.037 (.019)	-.075 (.026)	-.006 (.014)	-.045 (.022)	-.091 (.030)	-.007 (.017)	-.009 (.016)	-.061 (.030)	.036 (.021)	-.009 (.015)	-.060 (.028)	.035 (.020)
	Total	-.102 (.030)	-.176 (.032)	-.032 (.029)	-.124 (.036)	-.214 (.039)	-.039 (.036)	-.057 (.032)	-.161 (.046)	.034 (.032)	-.056 (.032)	-.160 (.044)	.033 (.031)
Communication (Site) Old	PANAS (Positive)	.095 (.035)	.016 (.029)	.194 (.048)	.049 (.018)	.008 (.015)	.101 (.024)	.048 (.066)	-.070 (.060)	.188 (.112)	.023 (.031)	-.033 (.028)	.090 (.053)
	PANAS (Negative)	.029 (.026)	-.017 (.021)	.088 (.043)	.015 (.013)	-.009 (.011)	.046 (.022)	.016 (.054)	-.085 (.069)	.126 (.083)	.008 (.026)	-.040 (.030)	.059 (.040)
	Sleep Motivation	.040 (.031)	-.037 (.032)	.125 (.044)	.021 (.016)	-.020 (.017)	.065 (.032)	.012 (.048)	-.082 (.062)	.117 (.076)	.005 (.022)	-.040 (.030)	.055 (.034)
	Total	.163 (.050)	.037 (.045)	.304 (.060)	.085 (.026)	.020 (.024)	.159 (.032)	.077 (.092)	-.112 (.090)	.284 (.124)	.037 (.044)	-.053 (.042)	.135 (.059)
Communication (Program) Old	PANAS (Positive)	.093 (.035)	.019 (.026)	.186 (.048)	.053 (.020)	.011 (.015)	.106 (.028)	.058 (.076)	-.051 (.070)	.195 (.119)	.028 (.035)	-.025 (.033)	.093 (.054)
	PANAS (Negative)	.026 (.020)	-.015 (.016)	.080 (.035)	.015 (.011)	-.008 (.009)	.045 (.019)	.022 (.058)	-.077 (.060)	.131 (.096)	.010 (.028)	-.037 (.029)	.062 (.046)
	Sleep Motivation	-.001 (.032)	-.074 (.039)	.072 (.039)	-.001 (.018)	-.042 (.022)	.041 (.022)	.020 (.046)	-.071 (.052)	.125 (.081)	.010 (.021)	-.034 (.024)	.059 (.037)
	Total	.118 (.052)	.001 (.050)	.246 (.060)	.067 (.029)	.001 (.029)	.140 (.034)	.100 (.098)	-.082 (.088)	.305 (.137)	.048 (.047)	-.040 (.043)	.145 (.064)
Positive features (Site) Old	PANAS (Positive)	.050 (.020)	.002 (.020)	.110 (.026)	.039 (.016)	.002 (.015)	.085 (.020)	.035 (.038)	-.044 (.040)	.135 (.064)	.021 (.022)	-.026 (.023)	.080 (.036)
	PANAS (Negative)	.025 (.019)	-.008 (.016)	.069 (.028)	.020 (.014)	-.006 (.012)	.053 (.021)	.030 (.035)	-.045 (.042)	.125 (.061)	.018 (.021)	-.026 (.025)	.074 (.034)
	Sleep Motivation	.018 (.019)	-.031 (.017)	.072 (.029)	.014 (.015)	-.024 (.013)	.055 (.022)	.010 (.020)	-.055 (.034)	.085 (.037)	.006 (.012)	-.033 (.019)	.050 (.021)
	Total	.094 (.025)	.013 (.025)	.183 (.030)	.073 (.020)	.011 (.020)	.142 (.023)	.075 (.046)	-.058 (.049)	.229 (.066)	.044 (.026)	-.035 (.029)	.136 (.035)
Positive features (Program) Old	PANAS (Positive)	.051 (.023)	.001 (.023)	.112 (.030)	.039 (.018)	.001 (.017)	.087 (.023)	.018 (.028)	-.055 (.036)	.103 (.049)	.011 (.018)	-.034 (.022)	.065 (.031)
	PANAS (Negative)	.029 (.021)	-.008 (.020)	.076 (.030)	.023 (.017)	-.006 (.015)	.059 (.023)	.015 (.030)	-.054 (.034)	.093 (.052)	.010 (.019)	-.034 (.022)	.059 (.034)
	Sleep Motivation	.016 (.017)	-.034 (.018)	.070 (.025)	.012 (.013)	-.027 (.014)	.054 (.019)	-.005 (.024)	-.074 (.042)	.059 (.036)	-.003 (.015)	-.046 (.026)	.038 (.023)
	Total	.096 (.027)	.012 (.029)	.188 (.030)	.074 (.022)	.009 (.023)	.145 (.024)	.028 (.049)	-.097 (.052)	.160 (.067)	.018 (.032)	-.061 (.033)	.101 (.045)
Negative features (Site) Old	PANAS (Positive)	-.081 (.041)	-.178 (.051)	.003 (.039)	-.047 (.024)	-.102 (.029)	.002 (.022)	-.021 (.043)	-.128 (.064)	.068 (.058)	-.011 (.023)	-.070 (.032)	.037 (.032)
	PANAS (Negative)	-.051 (.046)	-.134 (.053)	.023 (.049)	-.029 (.025)	-.077 (.030)	.013 (.027)	-.035 (.044)	-.141 (.079)	.052 (.044)	-.019 (.024)	-.078 (.042)	.028 (.024)
	Sleep Motivation	-.071 (.032)	-.148 (.047)	-.006 (.021)	-.040 (.017)	-.084 (.026)	-.004 (.012)	-.008 (.030)	-.092 (.051)	.070 (.043)	-.004 (.016)	-.050 (.027)	.038 (.024)
	Total	-.203 (.050)	-.349 (.056)	-.068 (.051)	-.116 (.029)	-.200 (.032)	-.039 (.030)	-.064 (.078)	-.234 (.105)	.088 (.083)	-.035 (.042)	-.128 (.054)	.048 (.045)
Negative features (Program) Old	PANAS (Positive)	-.079 (.043)	-.173 (.054)	.002 (.041)	-.044 (.023)	-.096 (.028)	.001 (.023)	-.042 (.040)	-.161 (.070)	.052 (.045)	-.023 (.021)	-.087 (.036)	.028 (.024)
	PANAS (Negative)	-.048 (.044)	-.129 (.052)	.022 (.048)	-.027 (.025)	-.073 (.029)	.012 (.025)	-.037 (.048)	-.148 (.085)	.054 (.045)	-.020 (.024)	-.079 (.042)	.029 (.024)
	Sleep Motivation	-.082 (.038)	-.164 (.054)	-.014 (.026)	-.046 (.021)	-.092 (.030)	-.008 (.015)	-.013 (.029)	-.105 (.051)	.068 (.044)	-.007 (.016)	-.057 (.028)	.037 (.022)
	Total	-.209 (.055)	-.355 (.063)	-.076 (.054)	-.117 (.030)	-.199 (.032)	-.043 (.031)	-.092 (.072)	-.276 (.103)	.069 (.071)	-.050 (.037)	-.149 (.050)	.037 (.038)
Communication (Site) New	PANAS (Positive)	.087 (.038)	.010 (.025)	.192 (.056)	.034 (.015)	.004 (.010)	.076 (.021)	.048 (.062)	-.080 (.067)	.201 (.101)	.018 (.023)	-.030 (.025)	.076 (.037)
	PANAS (Negative)	.043 (.035)	-.014 (.028)	.121 (.056)	.017 (.013)	-.006 (.011)	.048 (.021)	.033 (.053)	-.078 (.056)	.164 (.095)	.012 (.019)	-.030 (.020)	.062 (.034)
	Sleep Motivation	.021 (.039)	-.076 (.038)	.122 (.058)	.008 (.015)	-.030 (.016)	.048 (.022)	.050 (.056)	-.072 (.056)	.203 (.104)	.019 (.021)	-.027 (.022)	.077 (.037)
	Total	.152 (.060)	.007 (.050)	.313 (.078)	.060 (.023)	.002 (.020)	.124 (.028)	.131 (.111)	-.089 (.098)	.379 (.154)	.049 (.039)	-.034 (.036)	.144 (.053)
Communication (Program) New	PANAS (Positive)	.079 (.039)	.008 (.025)	.175 (.058)	.034 (.017)	.003 (.011)	.074 (.024)	.045 (.066)	-.077 (.064)	.191 (.114)	.018 (.025)	-.031 (.025)	.077 (.043)
	PANAS (Negative)	.020 (.022)	-.027 (.020)	.080 (.041)	.009 (.009)	-.011 (.008)	.034 (.017)	.031 (.056)	-.080 (.065)	.162 (.093)	.013 (.022)	-.032 (.025)	.066 (.037)
	Sleep Motivation	.042 (.035)	-.047 (.029)	.140 (.056)	.018 (.015)	-.020 (.012)	.059 (.022)	.034 (.051)	-.073 (.054)	.167 (.089)	.013 (.020)	-.031 (.024)	.067 (.033)
	Total	.142 (.055)	.011 (.046)	.289 (.072)	.060 (.023)	.005 (.020)	.122 (.029)	.110 (.104)	-.097 (.093)	.345 (.149)	.044 (.040)	-.040 (.038)	.139 (.054)
Positive features (Site) New	PANAS (Positive)	.074 (.029)	.003 (.027)	.161 (.039)	.040 (.016)	.002 (.014)	.088 (.021)	.032 (.041)	-.060 (.043)	.146 (.071)	.016 (.020)	-.031 (.023)	.072 (.033)
	PANAS (Negative)	.036 (.029)	-.013 (.026)	.099 (.041)	.020 (.016)	-.007 (.015)	.055 (.024)	.022 (.037)	-.060 (.037)	.116 (.071)	.011 (.018)	-.029 (.017)	.058 (.034)
	Sleep Motivation	.042 (.032)	-.028 (.026)	.121 (.047)	.023 (.017)	-.016 (.015)	.066 (.025)	.015 (.030)	-.064 (.041)	.108 (.054)	.008 (.015)	-.032 (.021)	.054 (.026)
	Total	.152 (.041)	.035 (.037)	.283 (.050)	.083 (.023)	.019 (.020)	.155 (.028)	.069 (.064)	-.083 (.060)	.241 (.095)	.034 (.032)	-.042 (.031)	.120 (.044)
Positive features (Program) New	PANAS (Positive)	.076 (.031)	.007 (.027)	.161 (.042)	.043 (.017)	.004 (.015)	.092 (.023)	.037 (.044)	-.054 (.042)	.149 (.077)	.018 (.021)	-.027 (.021)	.075 (.037)
	PANAS (Negative)	.035 (.026)	-.012 (.024)	.095 (.036)	.020 (.015)	-.006 (.014)	.055 (.022)	.022 (.036)	-.057 (.038)	.117 (.070)	.011 (.017)	-.029 (.018)	.059 (.033)
	Sleep Motivation	.033 (.026)	-.034 (.023)	.107 (.040)	.019 (.015)	-.020 (.014)	.061 (.022)	.019 (.030)	-.060 (.041)	.116 (.052)	.010 (.015)		

Table 40. Indirect effects of sleep climate on sleep quantity (Study 3)

Predictor	Mediator	Time 1						Time 2					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Indirect effect	Lower	Upper	Indirect effect	Lower	Upper	Indirect Effect	Lower	Upper	Indirect Effect	Lower	Upper
Communication (Site)	PANAS (Positive)	-.004 (.005)	-.016 (.006)	.007 (.006)	-.015 (.019)	-.059 (.022)	.025 (.022)	.001 (.006)	-.013 (.010)	.014 (.009)	.002 (.019)	-.043 (.033)	.049 (.030)
	PANAS (Negative)	.003 (.002)	-.003 (.002)	.011 (.004)	.012 (.008)	-.010 (.008)	.042 (.015)	.002 (.004)	-.010 (.005)	.015 (.008)	.006 (.012)	-.033 (.017)	.052 (.024)
	Sleep Motivation	.005 (.004)	-.006 (.004)	.016 (.006)	.018 (.016)	-.021 (.014)	.060 (.022)	.015 (.011)	-.006 (.010)	.041 (.016)	.051 (.038)	-.021 (.036)	.139 (.053)
	Total	.004 (.006)	-.013 (.006)	.021 (.006)	.015 (.021)	-.049 (.022)	.080 (.024)	.017 (.013)	-.011 (.012)	.049 (.017)	.059 (.043)	-.038 (.043)	.168 (.056)
Communication (Program)	PANAS (Positive)	-.003 (.005)	-.014 (.006)	.007 (.005)	-.012 (.018)	-.055 (.023)	.029 (.021)	.000 (.004)	-.013 (.007)	.013 (.008)	.001 (.014)	-.045 (.024)	.047 (.027)
	PANAS (Negative)	.002 (.002)	-.002 (.001)	.009 (.003)	.010 (.007)	-.009 (.005)	.036 (.014)	.003 (.004)	-.008 (.005)	.017 (.009)	.012 (.015)	-.030 (.019)	.062 (.031)
	Sleep Motivation	.002 (.004)	-.007 (.004)	.013 (.005)	.010 (.015)	-.029 (.015)	.051 (.020)	.012 (.013)	-.008 (.012)	.036 (.018)	.043 (.046)	-.030 (.044)	.129 (.063)
	Total	.002 (.005)	-.013 (.006)	.017 (.006)	.008 (.021)	-.054 (.024)	.071 (.023)	.015 (.015)	-.012 (.014)	.046 (.019)	.055 (.053)	-.043 (.051)	.164 (.067)
Positive features (Site)	PANAS (Positive)	-.003 (.003)	-.011 (.004)	.004 (.004)	-.020 (.018)	-.066 (.021)	.021 (.020)	.000 (.004)	-.009 (.006)	.010 (.006)	.001 (.017)	-.039 (.024)	.043 (.027)
	PANAS (Negative)	.002 (.002)	-.002 (.002)	.008 (.003)	.014 (.009)	-.012 (.009)	.047 (.015)	.002 (.003)	-.006 (.004)	.013 (.006)	.011 (.014)	-.028 (.018)	.059 (.025)
	Sleep Motivation	.003 (.003)	-.003 (.002)	.011 (.004)	.019 (.015)	-.019 (.013)	.061 (.020)	.005 (.008)	-.011 (.009)	.023 (.010)	.022 (.034)	-.047 (.040)	.099 (.042)
	Total	.002 (.003)	-.009 (.003)	.014 (.004)	.013 (.019)	-.052 (.020)	.080 (.021)	.008 (.009)	-.013 (.010)	.030 (.012)	.034 (.041)	-.056 (.043)	.132 (.051)
Positive features (Program)	PANAS (Positive)	-.004 (.003)	-.012 (.003)	.003 (.003)	-.022 (.018)	-.070 (.020)	.020 (.020)	.001 (.003)	-.007 (.004)	.009 (.006)	.004 (.013)	-.030 (.016)	.041 (.024)
	PANAS (Negative)	.002 (.002)	-.002 (.002)	.008 (.002)	.014 (.009)	-.014 (.011)	.049 (.014)	.002 (.003)	-.007 (.004)	.012 (.005)	.008 (.013)	-.029 (.016)	.052 (.023)
	Sleep Motivation	.003 (.002)	-.004 (.002)	.010 (.003)	.017 (.013)	-.022 (.012)	.058 (.019)	.003 (.006)	-.013 (.008)	.020 (.008)	.013 (.028)	-.056 (.034)	.088 (.037)
	Total	.002 (.003)	-.010 (.003)	.013 (.003)	.009 (.018)	-.059 (.020)	.077 (.020)	.006 (.007)	-.014 (.008)	.027 (.009)	.025 (.034)	-.062 (.036)	.118 (.043)
Negative features (Site)	PANAS (Positive)	.009 (.004)	-.001 (.004)	.019 (.005)	.050 (.024)	-.004 (.024)	.110 (.028)	.000 (.003)	-.009 (.004)	.009 (.005)	.000 (.013)	-.041 (.022)	.041 (.023)
	PANAS (Negative)	-.001 (.003)	-.009 (.004)	.007 (.003)	-.005 (.017)	-.055 (.020)	.043 (.019)	-.003 (.004)	-.015 (.006)	.007 (.005)	-.014 (.019)	-.072 (.029)	.035 (.025)
	Sleep Motivation	-.007 (.003)	-.014 (.004)	.000 (.003)	-.038 (.018)	-.081 (.024)	.001 (.015)	-.007 (.006)	-.024 (.008)	.007 (.007)	-.034 (.030)	-.116 (.041)	.034 (.033)
	Total	.001 (.005)	-.013 (.005)	.016 (.005)	.007 (.027)	-.078 (.028)	.093 (.029)	-.010 (.008)	-.032 (.009)	.010 (.008)	-.048 (.037)	-.154 (.047)	.048 (.040)
Negative features (Program)	PANAS (Positive)	.008 (.004)	-.001 (.004)	.018 (.005)	.047 (.024)	-.007 (.023)	.106 (.028)	.000 (.003)	-.010 (.004)	.010 (.006)	.001 (.014)	-.046 (.021)	.047 (.027)
	PANAS (Negative)	-.001 (.003)	-.010 (.003)	.007 (.003)	-.008 (.018)	-.058 (.020)	.039 (.021)	-.003 (.004)	-.015 (.007)	.006 (.004)	-.016 (.018)	-.073 (.034)	.028 (.019)
	Sleep Motivation	-.007 (.004)	-.015 (.005)	-.001 (.003)	-.044 (.021)	-.089 (.028)	-.007 (.017)	-.007 (.007)	-.024 (.010)	.009 (.007)	-.031 (.033)	-.115 (.047)	.041 (.034)
	Total	-.001 (.005)	-.015 (.005)	.013 (.005)	-.006 (.030)	-.091 (.031)	.080 (.032)	-.010 (.009)	-.033 (.012)	.011 (.008)	-.047 (.042)	-.156 (.056)	.052 (.041)
Communication (Site) Old	PANAS (Positive)	-.005 (.007)	-.022 (.009)	.010 (.008)	-.013 (.019)	-.057 (.024)	.026 (.021)	.000 (.008)	-.019 (.014)	.020 (.012)	.001 (.018)	-.044 (.033)	.046 (.030)
	PANAS (Negative)	.004 (.003)	-.004 (.003)	.015 (.006)	.011 (.009)	-.010 (.007)	.039 (.016)	.001 (.007)	-.019 (.011)	.021 (.011)	.001 (.017)	-.043 (.027)	.047 (.026)
	Sleep Motivation	.008 (.007)	-.007 (.006)	.026 (.009)	.022 (.018)	-.019 (.016)	.066 (.024)	.010 (.020)	-.023 (.022)	.047 (.026)	.023 (.046)	-.054 (.052)	.107 (.057)
	Total	.007 (.009)	-.018 (.010)	.033 (.010)	.019 (.023)	-.045 (.024)	.084 (.026)	.011 (.023)	-.033 (.024)	.057 (.028)	.025 (.052)	-.077 (.056)	.131 (.063)
Communication (Program) Old	PANAS (Positive)	-.003 (.007)	-.019 (.008)	.012 (.008)	-.008 (.019)	-.051 (.023)	.032 (.022)	.000 (.007)	-.019 (.010)	.019 (.013)	.007 (.016)	-.044 (.023)	.045 (.029)
	PANAS (Negative)	.004 (.003)	-.003 (.002)	.014 (.006)	.011 (.008)	-.009 (.006)	.038 (.015)	.003 (.007)	-.015 (.010)	.024 (.012)	.001 (.015)	-.035 (.023)	.055 (.029)
	Sleep Motivation	.000 (.007)	-.015 (.007)	.015 (.009)	.001 (.018)	-.041 (.019)	.042 (.023)	.011 (.022)	-.021 (.023)	.047 (.028)	.027 (.049)	-.047 (.050)	.109 (.064)
	Total	.001 (.009)	-.022 (.009)	.024 (.010)	.003 (.024)	-.061 (.027)	.067 (.027)	.015 (.025)	-.028 (.026)	.060 (.030)	.035 (.055)	-.063 (.056)	.139 (.067)
Positive features (Site) Old	PANAS (Positive)	-.004 (.004)	-.015 (.005)	.006 (.005)	-.015 (.017)	-.056 (.020)	.022 (.019)	.001 (.005)	-.012 (.007)	.015 (.010)	.003 (.016)	-.034 (.020)	.043 (.028)
	PANAS (Negative)	.004 (.002)	-.003 (.002)	.012 (.004)	.013 (.008)	-.011 (.009)	.044 (.014)	.004 (.005)	-.010 (.005)	.022 (.009)	.013 (.013)	-.028 (.015)	.064 (.026)
	Sleep Motivation	.004 (.004)	-.006 (.004)	.014 (.005)	.014 (.014)	-.025 (.014)	.055 (.019)	.004 (.012)	-.020 (.014)	.030 (.015)	.012 (.035)	-.057 (.042)	.087 (.042)
	Total	.003 (.005)	-.013 (.005)	.020 (.005)	.012 (.018)	-.049 (.021)	.075 (.019)	.010 (.014)	-.021 (.015)	.044 (.018)	.029 (.043)	-.062 (.045)	.126 (.052)
Positive features (Program) Old	PANAS (Positive)	-.005 (.004)	-.017 (.005)	.005 (.005)	-.019 (.016)	-.063 (.019)	.019 (.019)	.001 (.003)	-.009 (.004)	.013 (.007)	.004 (.010)	-.028 (.012)	.039 (.022)
	PANAS (Negative)	.004 (.002)	-.004 (.003)	.012 (.004)	.013 (.009)	-.014 (.010)	.047 (.014)	.002 (.004)	-.010 (.006)	.016 (.007)	.006 (.013)	-.031 (.018)	.050 (.023)
	Sleep Motivation	.003 (.004)	-.007 (.004)	.014 (.005)	.013 (.013)	-.026 (.014)	.054 (.018)	-.002 (.01)	-.027 (.014)	.021 (.012)	-.006 (.032)	-.082 (.041)	.066 (.040)
	Total	.002 (.005)	-.015 (.006)	.019 (.005)	.007 (.018)	-.058 (.021)	.072 (.019)	.001 (.012)	-.029 (.014)	.031 (.014)	.003 (.037)	-.087 (.042)	.095 (.045)
Negative features (Site) Old	PANAS (Positive)	.014 (.008)	-.003 (.007)	.034 (.010)	.040 (.022)	-.007 (.021)	.094 (.026)	.000 (.004)	-.014 (.007)	.014 (.007)	.000 (.010)	-.037 (.019)	.038 (.019)
	PANAS (Negative)	-.003 (.006)	-.019 (.007)	.012 (.007)	-.009 (.015)	-.053 (.018)	.033 (.018)	-.005 (.006)	-.025 (.013)	.011 (.007)	-.013 (.017)	-.065 (.033)	.028 (.019)
	Sleep Motivation	-.014 (.006)	-.029 (.008)	-.001 (.005)	-.038 (.016)	-.081 (.022)	-.003 (.013)	-.007 (.014)	-.037 (.017)	.020 (.016)	-.018 (.036)	-.098 (.044)	.054 (.045)
	Total	-.003 (.009)	-.030 (.010)	.025 (.010)	-.007 (.024)	-.085 (.025)	.070 (.027)	-.012 (.017)	-.050 (.021)	.023 (.018)	-.031 (.044)	-.132 (.052)	.062 (.050)
Negative features (Program) Old	PANAS (Positive)	.011 (.006)	-.005 (.007)	.030 (.008)	.031 (.017)	-.013 (.020)	.082 (.021)	.000 (.006)	-.017 (.010)	.016 (.010)	-.001 (.015)	-.044 (.026)	.042 (.024)
	PANAS (Negative)	-.004 (.005)	-.019 (.006)	.010 (.007)	-.011 (.014)	-.053 (.017)	.028 (.018)	-.005 (.007)	-.026 (.014)	.011 (.007)	-.014 (.018)	-.068 (.034)	.030 (.019)
	Sleep Motivation	-.016 (.007)	-.032 (.010)	-.003 (.005)	-.044 (.019)	-.088 (.025)	-.007 (.014)	-.010 (.014)	-.042 (.020)	.017 (.015)	-.026 (.036)	-.108 (.048)	.046 (.041)
	Total	-.009 (.009)	-.036 (.011)	.019 (.009)	-.023 (.024)	-.099 (.026)	.051 (.025)	-.016 (.019)	-.056 (.026)	.021 (.019)	-.041 (.050)	-.147 (.062)	.056 (.051)
Communication (Site) New	PANAS (Positive)	-.005 (.006)	-.023 (.009)	.009 (.008)	-.010 (.012)	-.044 (.016)	.018 (.015)	.002 (.006)	-.019 (.011)	.024 (.013)	.003 (.012)	-.034 (.020)	.044 (.023)
	PANAS (Negative)	.006 (.004)	-.005 (.004)	.020 (.007)	.011 (.007)	-.010 (.007)	.038 (.012)	.005 (.006)	-.015 (.008)	.029 (.013)	.008 (.011)	-.028 (.015)	.053 (.022)
	Sleep Motivation	.004 (.008)	-.016 (.008)	.025 (.011)	.008 (.015)	-.030 (.015)	.048 (.020)	.031 (.021)	-.006 (.017)	.077 (.030)	.058 (.041)	-.010 (.033)	.143 (.057)
	Total	.004 (.008)	-.024 (.009)	.034 (.010)	.009 (.015)	-.047 (.017)	.065 (.019)	.037 (.021)	-.011 (.018)	.093 (.029)	.069 (.041)	-.019 (.035)	.172 (.055)
Communication (Program) New	PANAS (Positive)	-.005 (.006)	-.021 (.009)	.008 (.007)	-.011 (.013)	-.044 (.018)	.017 (.015)	.000 (.005)	-.020 (.011)	.020 (.011)	.000 (.009)	-.039 (.020)	.040 (.020)
	PANAS (Negative)	.003 (.003)	-.005 (.003)	.013 (.005)	.006 (.006)	-.011 (.006)	.027 (.011)	.006 (.008)	-.014 (.008)	.030 (.015)	.011 (.015)	-.028 (.015)	.059 (.030)
	Sleep Motivation	.008 (.007)	-.010 (.006)	.028 (.009)	.018 (.014)	-.020 (.013)	.059 (.019)	.021 (.020)	-.014 (.019)	.064 (.027)	.042 (.040)	-.028 (.040)	.127 (.054)
	Total	.006 (.007)	-.020 (.009)	.032 (.008)	.012 (.014)	-.041 (.017)	.066 (.017)	.027 (.022)	-.019 (.022)	.080 (.029)	.054 (.045)	-.038 (.044)	.157 (.057)
Positive features (Site) New	PANAS (Positive)	-.008 (.006)	-.024 (.008)	.006 (.007)	-.021 (.017)	-.064 (.021)	.017 (.017)	.000 (.006)	-.016 (.010)	.016 (.009)	.000 (.014)	-.038 (.024)	.037 (.021)
	PANAS (Negative)	.005 (.003)	-.005 (.003)	.016 (.006)	.013 (.009)	-.012 (.008)	.044 (.017)	.002 (.005)	-.013 (.007)	.019 (.010)	.005 (.012)	-.031 (.015)	.046 (.023)
	Sleep Motivation	.009 (.006)	-.006 (.006)	.025 (.009)	.022 (.017)	-.016 (.015)	.065 (.022)	.010 (.013)	-.018 (.015)	.042 (.017)	.025 (.031)	-.044 (.036)	.103 (.041)
	Total	.006 (.007)	-.018 (.007)	.030 (.009)	.015 (.019)	-.049 (.019)	.079 (.022)	.012 (.015)	-.024 (.016)	.051 (.019)	.030 (.037)	-.058 (.037)	.124 (.047)
Positive features (Program) New	PANAS (Positive)	-.006 (.006)	-.022 (.007)	.008 (.007)	-.017 (.017)	-.061 (.021)	.022 (.020)	.001 (.005)	-.013 (.007)	.016 (.010)	.003 (.012)	-.032 (.017)	.041 (.023)
	PANAS (Negative)	.005 (.003)	-.004 (.003)	.016 (.005)	.013 (.009)	-.012 (.009)	.045 (.016)	.003 (.005)	-.011 (.006)	.020 (.011)	.007 (.013)	-.028 (.014)	.049 (.025)
	Sleep Motivation	.007 (.005)	-.007 (.005)	.022 (.007)	.019 (.015)	-.020 (.013)	.061 (.020)	.013 (.012)	-.015 (.014)	.045 (.017)	.031 (.030)	-.036 (.034)	.110 (.041)
	Total	.005 (.006)	-.018 (.007)	.029 (.007)	.014 (.018)	-.050 (.020)	.080 (.021)	.017 (.015)	-.018 (.015)	.055 (.020)	.041 (.036)	-.044 (.036)	.136 (.047)
Negative features (Site) New	PANAS (Positive)	.010 (.006)	-.003 (.006)	.025 (.008)	.037 (.023)	-.012 (.022)	.091 (.027)	.000 (.003)	-.013 (.006)	.012 (.006)	-.001 (.011)	-.040 (.020)	.038 (.018)
	PANAS (Negative)	-.003 (.004)	-.016 (.005)	.009 (.005)	-.011 (.016)	-.058 (.019)	.034 (.017)	-.004 (.005)	-.020 (.008)	.010 (.006)	-.011 (.015)	-.064 (.026)	.032 (.019)
	Sleep Motivation	-.008 (.005)	-.020 (.007)	.002 (.005)	-.030 (.019)	-.074 (.025)	.007 (.018)	-.011 (.009)	-.036 (.013)	.011 (.010)	-.035 (.029)		

Table 41. Indirect effects of job characteristics on sleep (Study 3)

DV: Sleep Quality

Predictor	Mediator	Time 1						Time 2					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Indirect Effect	Lower	Upper	Indirect Effect	Lower	Upper	Indirect Effect	Lower	Upper	Indirect Effect	Lower	Upper
Social Support	PANAS (Positive)	.110 (.038)	.038 (.031)	.196 (.050)	.084 (.029)	.029 (.023)	.150 (.037)	.056 (.043)	-.023 (.037)	.163 (.068)	.038 (.030)	-.015 (.026)	.109 (.046)
	PANAS (Negative)	.058 (.035)	-.004 (.035)	.129 (.042)	.044 (.027)	-.003 (.027)	.099 (.032)	.046 (.049)	-.036 (.048)	.149 (.075)	.031 (.032)	-.023 (.032)	.100 (.049)
	Total	.168 (.043)	.070 (.040)	.278 (.052)	.129 (.034)	.054 (.031)	.212 (.040)	.102 (.058)	-.017 (.052)	.249 (.081)	.068 (.039)	-.011 (.036)	.167 (.053)
Schedule Consistency	PANAS (Positive)	.053 (.020)	.010 (.014)	.110 (.028)	.043 (.015)	.008 (.011)	.089 (.021)	.055 (.039)	-.018 (.032)	.154 (.065)	.040 (.028)	-.013 (.023)	.111 (.046)
	PANAS (Negative)	.025 (.028)	-.020 (.031)	.076 (.033)	.020 (.022)	-.016 (.024)	.062 (.027)	.018 (.026)	-.043 (.032)	.092 (.044)	.014 (.018)	-.030 (.021)	.067 (.031)
	Total	.078 (.029)	.013 (.028)	.153 (.035)	.063 (.023)	.011 (.022)	.124 (.028)	.074 (.043)	-.026 (.039)	.196 (.063)	.053 (.031)	-.018 (.027)	.141 (.044)
Workload Uncertainty	PANAS (Positive)	-.102 (.037)	-.215 (.052)	-.018 (.026)	-.038 (.013)	-.079 (.018)	-.006 (.009)	-.067 (.047)	-.224 (.088)	.049 (.036)	-.025 (.017)	-.084 (.032)	.019 (.014)
	PANAS (Negative)	-.051 (.050)	-.153 (.061)	.035 (.055)	-.019 (.018)	-.057 (.023)	.013 (.019)	-.045 (.055)	-.187 (.088)	.068 (.063)	-.017 (.020)	-.070 (.032)	.025 (.023)
	Total	-.154 (.046)	-.302 (.056)	-.028 (.046)	-.057 (.017)	-.112 (.020)	-.010 (.017)	-.112 (.071)	-.320 (.103)	.058 (.065)	-.042 (.026)	-.120 (.037)	.021 (.024)
Information Processing	Detachment	-.018 (.043)	-.100 (.064)	.054 (.049)	-.005 (.012)	-.029 (.018)	.016 (.014)	.005 (.055)	-.164 (.088)	.179 (.095)	.001 (.013)	-.039 (.022)	.043 (.023)

DV: Sleep Quantity

Predictor	Mediator	Time 1						Time 2					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Indirect Effect	Lower	Upper									
Social Support	PANAS (Positive)	-.002 (.007)	-.017 (.008)	.013 (.009)	-.007 (.026)	-.063 (.029)	.048 (.031)	.003 (.007)	-.012 (.008)	.019 (.011)	.009 (.021)	-.039 (.026)	.063 (.035)
	PANAS (Negative)	.006 (.004)	-.006 (.005)	.020 (.005)	.024 (.016)	-.022 (.018)	.075 (.019)	.008 (.008)	-.007 (.009)	.029 (.013)	.028 (.026)	-.023 (.025)	.095 (.043)
	Total	.005 (.007)	-.015 (.007)	.025 (.008)	.017 (.024)	-.056 (.027)	.092 (.028)	.011 (.009)	-.011 (.010)	.037 (.013)	.037 (.030)	-.036 (.030)	.122 (.045)
Schedule Consistency	PANAS (Positive)	.000 (.003)	-.009 (.004)	.009 (.004)	.000 (.013)	-.034 (.017)	.034 (.016)	.002 (.006)	-.013 (.009)	.018 (.009)	.007 (.020)	-.044 (.032)	.063 (.031)
	PANAS (Negative)	.004 (.003)	-.005 (.004)	.015 (.005)	.016 (.013)	-.021 (.014)	.057 (.019)	.005 (.004)	-.007 (.004)	.020 (.008)	.016 (.014)	-.023 (.013)	.068 (.027)
	Total	.004 (.004)	-.009 (.004)	.018 (.004)	.016 (.014)	-.035 (.016)	.069 (.018)	.007 (.006)	-.012 (.009)	.029 (.008)	.023 (.022)	-.043 (.032)	.100 (.028)
Workload Uncertainty	PANAS (Positive)	.003 (.007)	-.014 (.008)	.021 (.009)	.005 (.012)	-.026 (.015)	.038 (.016)	-.004 (.007)	-.027 (.014)	.015 (.007)	-.007 (.012)	-.050 (.024)	.028 (.013)
	PANAS (Negative)	-.009 (.007)	-.030 (.009)	.010 (.008)	-.016 (.012)	-.054 (.016)	.017 (.013)	-.010 (.007)	-.040 (.014)	.011 (.006)	-.019 (.013)	-.073 (.026)	.019 (.010)
	Total	-.006 (.006)	-.033 (.007)	.020 (.007)	-.011 (.010)	-.059 (.012)	.036 (.012)	-.015 (.008)	-.052 (.014)	.015 (.007)	-.026 (.014)	-.094 (.025)	.027 (.012)
Information Processing	Detachment	-.005 (.008)	-.024 (.012)	.013 (.010)	-.007 (.011)	-.035 (.017)	.019 (.014)	.005 (.020)	-.039 (.023)	.051 (.033)	.006 (.023)	-.045 (.027)	.058 (.037)

Note. Values in bold indicate that the 95% CI exclude zero.

Values in parentheses are SDs of the estimate across 50 imputed datasets.

Table 42. Stability of variables across time (Study 3)

Variable*	Predictor*	Estimate	Lower	Upper
Communication (Site)	T1 Variable	.35 (.07)	.15 (.07)	.54 (.09)
	Location	-1.19 (1.24)	-4.19 (1.16)	3.85 (1.49)
	T1 x Location	-.04 (.09)	-.31 (.10)	.24 (.08)
Communication (Program)	T1 Variable	.33 (.09)	.14 (.09)	.52 (.10)
	Location	-1.98 (1.61)	-6.08 (1.71)	2.15 (1.62)
	T1 x Location	.09 (.10)	-.18 (.10)	.36 (.10)
Positive features (Site)	T1 Variable	.40 (.05)	.26 (.05)	.53 (.06)
	Location	.04 (1.27)	-4.38 (1.45)	4.4 (1.42)
	T1 x Location	-.02 (.06)	-.23 (.07)	.19 (.07)
Positive features (Program)	T1 Variable	.38 (.05)	.25 (.05)	.51 (.06)
	Location	-2.45 (2.3)	-7.03 (2.34)	2.2 (2.36)
	T1 x Location	.09 (.10)	-.12 (.10)	.30 (.09)
Negative features (Site)	T1 Variable	.45 (.06)	.29 (.06)	.60 (.07)
	Location	.74 (1.76)	-4.33 (1.81)	5.81 (1.87)
	T1 x Location	-.05 (.08)	-.28 (.08)	.17 (.08)
Negative features (Program)	T1 Variable	.44 (.06)	.30 (.06)	.58 (.06)
	Location	.41 (1.83)	-4.34 (1.9)	5.18 (1.84)
	T1 x Location	-.03 (.08)	-.24 (.08)	.18 (.08)
Communication (Site) Old	T1 Variable	.29 (.09)	.08 (.09)	.50 (.10)
	Location	.41 (1.02)	-2.16 (1.06)	2.98 (1.05)
	T1 x Location	-.09 (.12)	-.38 (.12)	.20 (.12)
Communication (Program) Old	T1 Variable	.26 (.10)	.06 (.09)	.46 (.10)
	Location	-.51 (.98)	-3.07 (1.03)	2.00 (1.04)
	T1 x Location	.02 (.10)	-.25 (.11)	.29 (.11)
Positive features (Site) Old	T1 Variable	.33 (.06)	.18 (.06)	.47 (.07)
	Location	-.03 (.72)	-2.62 (.76)	2.58 (.74)
	T1 x Location	-.02 (.07)	-.25 (.07)	.21 (.07)
Positive features (Program) Old	T1 Variable	.33 (.06)	.18 (.06)	.48 (.06)
	Location	-1.73 (1.04)	-4.7 (1.07)	1.23 (1.04)
	T1 x Location	.11 (.08)	-.13 (.08)	.36 (.08)
Negative features (Site) Old	T1 Variable	.34 (.07)	.16 (.08)	.54 (.08)
	Location	.65 (1.00)	-2.38 (1.13)	3.72 (1.13)
	T1 x Location	-.08 (.11)	-.39 (.11)	.22 (.12)
Negative features (Program) Old	T1 Variable	.36 (.10)	.17 (.11)	.55 (.10)
	Location	-.07 (1.15)	-3.06 (1.25)	2.94 (1.22)
	T1 x Location	.00 (.12)	-.29 (.12)	.29 (.13)
Communication (Site) New	T1 Variable	.19 (.12)	-.02 (.11)	.40 (.13)
	Location	-.53 (.62)	-2.32 (.72)	1.25 (.64)
	T1 x Location	.04 (.12)	-.27 (.12)	.35 (.12)
Communication (Program) New	T1 Variable	.19 (.12)	-.02 (.12)	.40 (.13)
	Location	-.95 (.85)	-2.88 (.99)	.97 (.82)
	T1 x Location	.12 (.14)	-.20 (.15)	.43 (.15)
Positive features (Site) New	T1 Variable	.37 (.08)	.19 (.07)	.55 (.08)
	Location	.20 (1.04)	-2.45 (1.18)	2.88 (1.06)
	T1 x Location	-.05 (.11)	-.33 (.11)	.24 (.12)
Positive features (Program) New	T1 Variable	.36 (.09)	.18 (.09)	.53 (.09)
	Location	.08 (1.39)	-2.66 (1.56)	2.81 (1.32)
	T1 x Location	-.02 (.13)	-.30 (.13)	.26 (.15)
Negative features (Site) New	T1 Variable	.40 (.07)	.23 (.07)	.57 (.08)
	Location	.35 (1.07)	-2.79 (1.08)	3.50 (1.20)
	T1 x Location	-.06 (.09)	-.30 (.10)	.19 (.09)

Note. *Time 2 variable entered in the models as the DV.

*T1 Variables are Time 1 variables corresponding to the DV, Location is a dummy variable representing location change between Times 1 and 2 (0: no change; 1: change).

Values outside of parentheses are regression coefficients of the Predictor variables as IVs; values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

Table 42. Stability of variables across time (Study 3; continued)

Variable	Predictor	Estimate	Lower	Upper
Negative features (Program) New	T1 Variable	.38 (.07)	.22 (.08)	.54 (.07)
	Location	.33 (1.19)	-2.59 (1.29)	3.24 (1.2)
	T1 x Location	-.05 (.10)	-.28 (.09)	.18 (.11)
Sleep quality	T1 Variable	.38 (.11)	.17 (.10)	.60 (.12)
	Location	1.77 (2.97)	-5.68 (2.98)	9.18 (3.31)
	T1 x Location	-.07 (.12)	-.39 (.13)	.25 (.12)
Sleep quantity	T1 Variable	.87 (.01)	.69 (.02)	1.05 (.02)
	Location	.88 (.13)	-.70 (.15)	2.45 (.19)
	T1 x Location	-.13 (.02)	-.36 (.03)	.10 (.02)
Sleep motivation	T1 Variable	.28 (.08)	.11 (.08)	.45 (.09)
	Location	-1.41 (1.75)	-5.85 (1.65)	3.01 (1.91)
	T1 x Location	.08 (.09)	-.16 (.10)	.33 (.09)
PANAS (Positive)	T1 Variable	.29 (.07)	.12 (.07)	.46 (.07)
	Location	-1.27 (1.74)	-5.33 (1.78)	2.79 (1.75)
	T1 x Location	.06 (.11)	-.19 (.11)	.30 (.11)
PANAS (Negative)	T1 Variable	.43 (.06)	.27 (.06)	.59 (.06)
	Location	.93 (1.00)	-1.84 (.98)	3.66 (1.13)
	T1 x Location	-.06 (.09)	-.30 (.09)	.18 (.09)
Information processing	T1 Variable	.11 (.08)	-.08 (.08)	.30 (.08)
	Location	-1.06 (2.11)	-6.23 (2.04)	4.07 (2.34)
	T1 x Location	.04 (.11)	-.23 (.12)	.31 (.11)
Social support	T1 Variable	.35 (.10)	.15 (.10)	.56 (.11)
	Location	.81 (3.19)	-6.2 (3.47)	8.01 (3.37)
	T1 x Location	-.05 (.13)	-.34 (.14)	.24 (.14)
Workload uncertainty	T1 Variable	.81 (.07)	.61 (.08)	1.00 (.06)
	Location	2.31 (.67)	.09 (.81)	4.46 (.53)
	T1 x Location	-.27 (.09)	-.55 (.08)	.01 (.11)
Schedule consistency	T1 Variable	.40 (.08)	.21 (.08)	.59 (.09)
	Location	-.54 (1.3)	-3.79 (1.39)	2.69 (1.36)
	T1 x Location	.05 (.11)	-.22 (.11)	.32 (.11)
Detachment	T1 Variable	.21 (.08)	.01 (.09)	.41 (.08)
	Location	-.05 (1.44)	-3.35 (1.55)	3.22 (1.54)
	T1 x Location	.02 (.12)	-.26 (.12)	.30 (.13)
Welfare	T1 Variable	.25 (.09)	.07 (.09)	.44 (.11)
	Location	-1.24 (1.67)	-4.95 (1.79)	2.44 (1.84)
	T1 x Location	.08 (.11)	-.17 (.12)	.34 (.12)
Efficiency	T1 Variable	.24 (.09)	.03 (.09)	.46 (.09)
	Location	-.84 (1.96)	-5.13 (2.11)	3.48 (2.03)
	T1 x Location	.05 (.13)	-.25 (.14)	.34 (.14)
Pressure to produce	T1 Variable	.24 (.10)	.04 (.10)	.44 (.11)
	Location	-2.14 (1.88)	-7.03 (2.04)	2.70 (2.03)
	T1 x Location	.13 (.10)	-.13 (.10)	.39 (.10)
Tenure at site	T1 Variable	.75 (.03)	.60 (.05)	.91 (.03)
	Location	86.59 (9.68)	-1.90 (15.34)	184.16 (18.61)
	T1 x Location	-.06 (.02)	-.28 (.03)	.16 (.04)
Average work hours per day	T1 Variable	.54 (.03)	.26 (.04)	.81 (.05)
	Location	-1.09 (.53)	-5.2 (.64)	3.02 (.71)
	T1 x Location	.10 (.05)	-.28 (.07)	.48 (.06)
Night shifts in the past month	T1 Variable	.16 (.04)	.00 (.04)	.31 (.05)
	Location	.19 (.16)	-1.61 (.21)	1.99 (.22)
	T1 x Location	-.01 (.05)	-.27 (.06)	.25 (.04)

Note. *Time 2 variable entered in the models as the DV.

*T1 Variables are Time 1 variables corresponding to the DV, Location is a dummy variable representing location change between Times 1 and 2 (0: no change; 1: change).

Values outside of parentheses are regression coefficients of the Predictor variables as IVs; values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

Figure 1. The Mechanism of Work Context Characteristics' Effect on Sleep

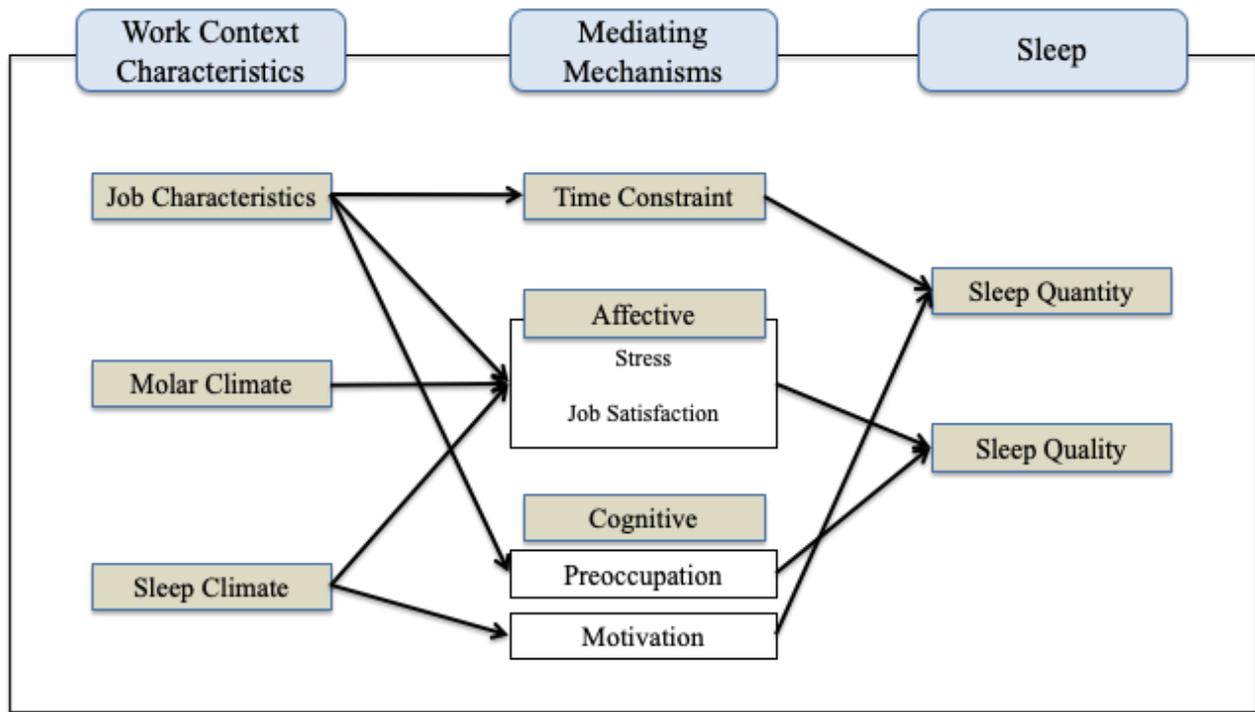


Figure 2. The cross-sectional mediation model of sleep climate, sleep knowledge, and sleep motivation (Study 2)

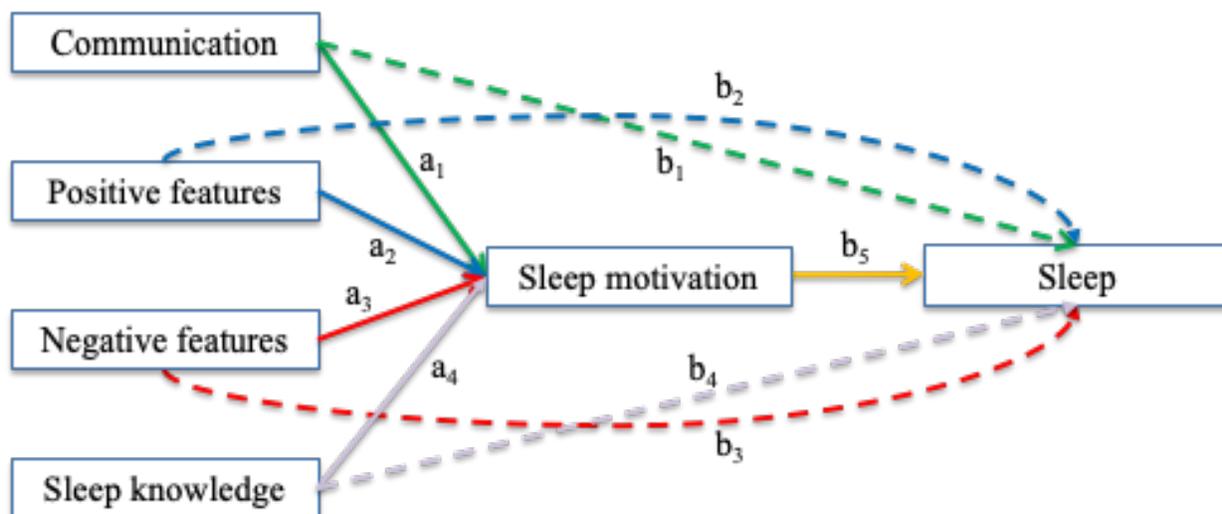


Figure 3. The cross-sectional mediation model of sleep climate and negative affect (Study 2)

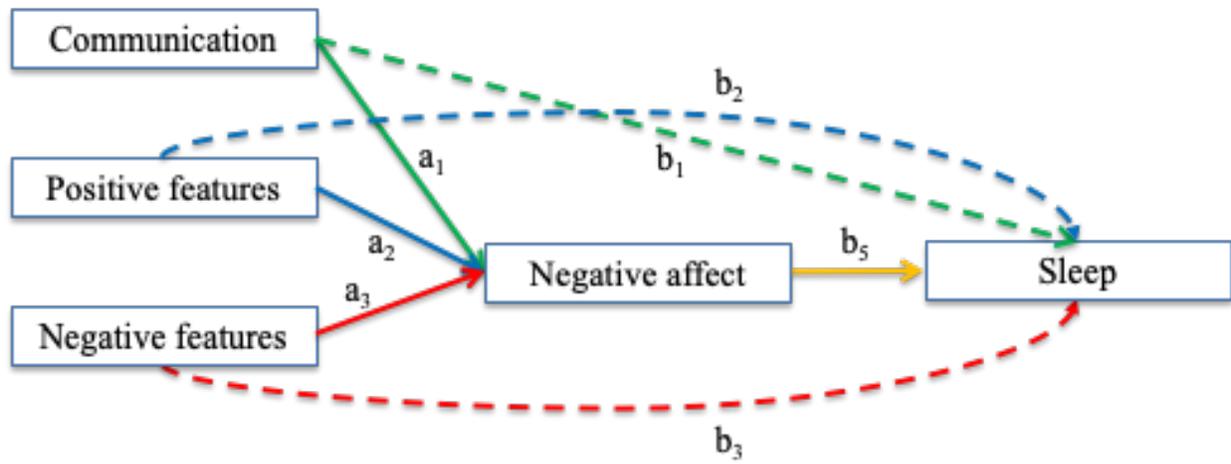
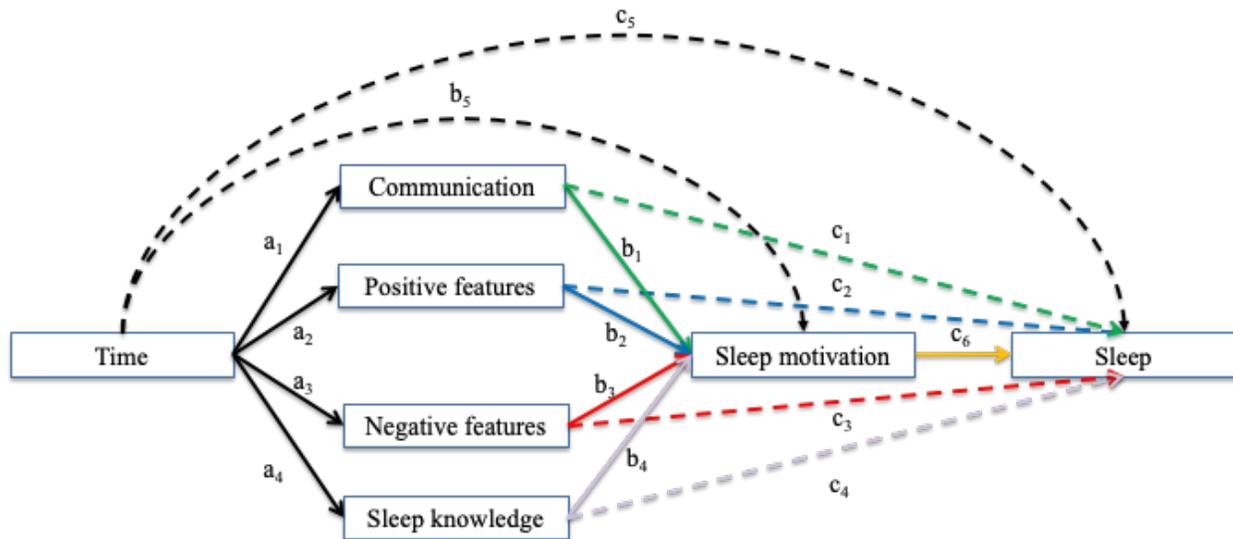


Figure 4. The within-person mediation model of sleep climate, sleep knowledge, and sleep motivation (Study 2)



Appendix

APPENDIX A. Job Content Questionnaire Dimensions (Karasek, et al., 1998)

1a. Skill Discretion

“learn new things”; “repetitive work”; “requires creativity”; “high skill level”; “variety”;
“develop own abilities”

1b. Decision Authority

“allows own decisions”; “little decision freedom”; “a lot of say”

1c. Skill Utilization

“education required by job” (also requires education)

1. Decision Latitude = a weighted sum of 1a and 1b

2. Psychological Job Demands

“work fast”; “work hard”; “no excessive work”; “enough time”; “conflicting demands”; “intense concentration”; “tasks interrupted”; “hectic job”; “wait on others”

3a. Supervisor Social Support

“supervisor concerned”; “supervisor pays attention”; “hostile supervisor”; “helpful supervisor”;
“supervisor good organizer”

3b. Coworker Social Support

“coworkers competent”; “coworkers interested in me”; “hostile coworkers”; “friendly coworkers”; “coworkers work together”; “coworkers helpful”

4. Physical Job Demands

“much physical effort”; “lift heavy loads”; “rapid physical activity”; “awkward body position”; “awkward arm position”

5. Job Insecurity

“steady work”; “job security”; “recent layoff”; “future layoff”; “career possibilities”; “skills valuable”

APPENDIX B. Organizational Climate Measure (Patterson et al., 2005; used in Studies 1 and 3)

1. Management let people make their own decisions much of the time
2. Management trust people to take work-related decisions without getting permission first
3. People at the top tightly control the work of those below them
4. Management keep too tight a reign on the way things are done around here
5. It's important to check things first with the boss before taking a decision
6. Supervisors here are really good at understanding peoples' problems
7. Supervisors show that they have confidence in those they manage
8. Supervisors here are friendly and easy to approach
9. Supervisors can be relied upon to give good guidance to people
10. Supervisors show an understanding of the people who work for them
11. Mostly false must be chosen for this item
12. This company pays little attention to the interests of employees
13. This company tries to look after its employees
14. This company cares about its employees
15. This company tries to be fair in its actions towards employees
16. It is considered extremely important here to follow the rules
17. People can ignore formal procedures and rules if it helps get the job done
18. Everything has to be done by the book
19. Its not necessary to follow procedures to the letter around here
20. Nobody gets too upset if people break the rules around here

21. Senior management like to keep to established, traditional ways of doing things
22. The way this organization does things has never changed very much
23. Management are not interested in trying out new ideas
24. Changes in the way things are done here happen very slowly
25. New ideas are readily accepted here
26. This company is quick to respond when changes need to be made
27. Management here are quick to spot the need to do things differently
28. This organization is very flexible; it can quickly change procedures to meet new conditions and solve problems as they arise
29. Assistance in developing new ideas is readily available
30. People in this organization are always searching for new ways of looking at problems
31. This organization is quite inward looking; it does not concern itself with what is happening in the market place
32. Ways of improving service to the customer are not given much thought
33. Please choose Definitely false for this item
34. Customer needs are not considered top priority here
35. This company is slow to respond to the needs of the customer
36. This organization is continually looking for new opportunities in the market place
37. In this organization, the way people work together is readily changed in order to improve performance
38. The methods used by this organization to get the job done are often discussed
39. There are regular discussions as to whether people in the organization are working effectively together

40. In this organization, objectives are modified in light of changing circumstances
41. In this organization, time is taken to review organizational objectives
42. Time and money could be saved if work were better organized
43. Things could be done much more efficiently, if people stopped to think
44. Poor scheduling and planning often result in targets not being met
45. Productivity could be improved if jobs were organized and planned better
46. People here always want to perform to the best of their ability
47. People are enthusiastic about their work
48. People here get by with doing as little as possible
49. People are prepared to make a special effort to do a good job
50. People here don't put more effort into their work than they have to
51. People are expected to do too much in a day
52. In general, peoples' workloads are not particularly demanding
53. Management require people to work extremely hard
54. People here are under pressure to meet targets
55. Please choose Mostly true for this item
56. The pace of work here is pretty relaxed
57. This company is always looking to achieve the highest standards of quality
58. Quality is taken very seriously here
59. People believe the company's success depends on high-quality work
60. This company does not have much of a reputation for top-quality products

APPENDIX C. Work Design Questionnaire (Morgeson & Humphrey, 2006) and other job characteristics items (used in Studies 1 and 3)

1. The job allows me to make my own decisions about how to schedule my work.
2. The job allows me to decide on the order in which things are done on the job.
3. The job allows me to plan how I do my work.
4. The job gives me a chance to use my personal initiative or judgment in carrying out the work.
5. The job allows me to make a lot of decisions on my own.
6. The job provides me with significant autonomy in making decisions.
7. The job allows me to make decisions about what methods I use to complete my work.
8. The job gives me considerable opportunity for independence and freedom in how I do the work.
9. The job allows me to decide on my own how to go about doing my work.
10. The job involves a great deal of task variety.
11. The job involves doing a number of different things.
12. To get this attention check correct, select Somewhat agree.
13. The job requires the performance of a wide range of tasks.
14. The job involves performing a variety of tasks.
15. The results of my work are likely to significantly affect the lives of other people.
16. The job itself is very significant and important in the broader scheme of things.
17. The job has a large impact on people outside the organization.

18. The work performed on the job has a significant impact on people outside the organization.
19. The job involves completing a piece of work that has an obvious beginning and end.
20. The job is arranged so that I can do an entire piece of work from beginning to end.
21. The job provides me the chance to completely finish the pieces of work I begin.
22. The job allows me to complete work I start.
23. The work activities themselves provide direct and clear information about the effectiveness (e.g., quality and quantity) of my job performance.
24. The job itself provides feedback on my performance.
25. The job itself provides me with information about my performance.
26. The job requires that I only do one task or activity at a time (reverse scored).
27. The tasks on the job are simple and uncomplicated (reverse scored).
28. The job comprises relatively uncomplicated tasks (reverse scored).
29. The job involves performing relatively simple tasks (reverse scored).
30. The job requires me to monitor a great deal of information.
31. The job requires that I engage in a large amount of thinking.
32. The job requires me to keep track of more than one thing at a time.
33. The job requires me to analyze a lot of information.
34. The job involves solving problems that have no obvious correct answer.
35. This item requires that you choose Neither agree nor disagree.
36. The job requires me to be creative.
37. The job often involves dealing with problems that I have not met before.
38. The job requires unique ideas or solutions to problems.

39. The job requires a variety of skills.
40. The job requires me to utilize a variety of different skills in order to complete the work.
41. The job requires me to use a number of complex or high-level skills.
42. The job requires the use of a number of skills.
43. The job is highly specialized in terms of purpose, tasks, or activities.
44. The tools, procedures, materials, and so forth used on this job are highly specialized in terms of purpose.
45. The job requires very specialized knowledge and skills.
46. The job requires a depth of knowledge and expertise.
47. I have the opportunity to develop close friendships in my job.
48. I have the chance in my job to get to know other people.
49. I have the opportunity to meet with others in my work.
50. My supervisor is concerned about the welfare of the people that work for him/her.
51. People I work with take a personal interest in me.
52. People I work with are friendly.
53. The job requires me to accomplish my job before others complete their job.
54. Other jobs depend directly on my job.
55. Unless my job gets done, other jobs cannot be completed.
56. The job activities are greatly affected by the work of other people.
57. Please choose Agree for this item.
58. The job depends on the work of many different people for its completion.
59. My job cannot be done unless others do their work.
60. The job requires spending a great deal of time with people outside my organization.

61. The job involves interaction with people who are not members of my organization.
62. On the job, I frequently communicate with people who do not work for the same organization as I do.
63. The job involves a great deal of interaction with people outside my organization.
64. I receive a great deal of information from my manager and coworkers about my job performance.
65. Other people in the organization, such as managers and coworkers, provide information about the effectiveness (e.g., quality and quantity) of my job performance.
66. I receive feedback on my performance from other people in my organization (such as my manager or coworkers).
67. The seating arrangements on the job are adequate (e.g., ample opportunities to sit, comfortable chairs, good postural support).
68. The work place allows for all size differences between people in terms of clearance, reach, eye height, leg room, etc.
69. The job involves excessive reaching (reverse scored).
70. The job requires a great deal of muscular endurance.
71. The job requires a great deal of muscular strength.
72. The job requires a lot of physical effort.
73. The work place is free from excessive noise.
74. The climate at the work place is comfortable in terms of temperature and humidity.
75. The job has a low risk of accident.
76. The job takes place in an environment free from health hazards (e.g., chemicals, fumes, etc.).

77. The job occurs in a clean environment.
78. The job involves the use of a variety of different equipment.
79. The job involves the use of complex equipment or technology.
80. Agree must be selected to get this attention check correct.
81. A lot of time was required to learn the equipment used on the job.
82. I am often tasked with unexpected work.
83. I often encounter unexpected events and situations at work.
84. I have demanding clients and customers.
85. My clients and customers are friendly.
86. My work schedule differs from day to day.
87. My work schedule is consistent.
88. Start and end times of work are the same every day.
89. I am often on call.
90. There are days I am unexpectedly asked to leave early or stay late.

Commute

- How long is the one-way commute to your workplace (in minutes)?
- How often do you get stuck during your commute to or from work? Examples include your car being stuck in traffic or the train being delayed due to an accident.

Work hours

- On average, how long do you work for in a day? Please exclude time you use for your lunch/dinner break.

- At what time does your work usually start? Please respond to the nearest quarter hour.
Please enter midnight as 12:00 a.m. and noon as 12:00 p.m.
- At what time does your work usually end? Please respond to the nearest quarter hour.
Please enter midnight as 12:00 a.m. and noon as 12:00 p.m.

Work pace

1. How long does it take for your work to reach your customers, clients, or intended audience?
2. How long does it take to complete your primary task?
3. How soon do the work activities themselves provide information about how well you are performing?
4. How long does it take before a piece of your work holds up the work of your colleagues?
5. How long does it take before your coworkers' piece of work holds up your work?
6. How long does it take to receive feedback from others on the job about how well you are performing?

APPENDIX D. Health Behavior Climate Measure (Sonnetag & Pundt, 2016; used in Study 1)

Healthy eating - Values and expectations

- Management in this organization shows an interest in healthy nutrition.
- In this organization, it is common to eat healthily.
- Management in this organization considers healthy food to be important.

Healthy eating - Organizational practices

- If you are interested in eating healthier, you will get support from this organization.
- Where I work, there is ample information about healthy nutrition.
- In this organization there are brochures and information on the Internet about healthy nutrition.

Healthy eating - Communication

- Here we openly discuss healthy and unhealthy eating behavior.
- Here we talk openly about how to eat healthily.
- Here there are many opportunities to talk about healthy eating.

Exercise - Values and expectations

- Exercise and physical activity for employees are considered by the management to be important in this organization.
- Here, it is expected that you will be physically active on a regular basis.

- Management in this organization puts great emphasis on employees' regular physical exercise.

Exercise - Organizational practices

- In this organization, there are training and information events about upright posture.
- From time to time, teams from this organization participate in sport events and competitions (e.g., a local running event).
- In this organization, there are posters featuring exercise and physical activity.

Exercise - Communication

- Here there are plenty of opportunities to talk about exercise and physical activities.
- Here one talks openly with colleagues about how to stay healthy by exercising.
- Here one likes to exchange ideas about exercising and physical activity.

APPENDIX E. Sleep Quality Measure (adapted from Jenkins et al., 1988; used in Studies 1, 2, and 3)

How often in the past month did you:

1. Have trouble falling asleep?
2. Wake up several times per night?
3. Have trouble staying asleep (including waking far too early)?
4. Wake up after your usual amount of sleep feeling tired and worn out?
5. Feel like you had a good night's sleep?
6. Wake up feeling like you had slept well?

APPENDIX F. Sleep Knowledge Check Items (used in Study 2)

1. If one of your peers is having trouble falling asleep at night but also have trouble waking up in the morning (e.g., need to use an alarm clock, often hitting snooze), what is the likely cause of their falling asleep? Check all that apply.
2. Which of the following is NOT helpful in diagnosing Restless Leg Syndrome? Check all that apply.
3. Which of the following strategies is an evidence-based intervention for the treatment of an insomnia stemming from an overactive brain (psychophysiological insomnia)? Check all that apply.
4. Which of the following is a consequence of untreated sleep apnea? Check all that apply.
5. Patient does not tolerate CPAP therapy for Obstructed Sleep Apnea. What else can be done? Check all that apply.
6. What are some evidence-based strategies to help a physician adjust to overnight shift work? Check all that apply.

For the purpose of this discussion please consider a shift that runs from 9pm to 7am and an individual who would like to go home and sleep starting at about 9am.

APPENDIX G. Sleep Motivation Items (used in Studies 2 and 3)

1. I felt confident in sleeping well.
2. I was committed to sleeping well.
3. I placed value on healthy sleep.
4. I had the intention to sleep well.
5. I prioritized sleep over other activities.

APPENDIX H. HLM coefficients of work context variables on sleep quality only grouped by residency program (Study 3)

Predictor	Level*	Time 1 ^a						Time 2 ^b					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper
Communication (Site)	Variable	.07 (.08)	-10 (.08)	.24 (.08)	.05 (.06)	-.08 (.06)	.18 (.06)	-.02 (.20)	-.32 (.21)	.27 (.21)	-.02 (.15)	-.22 (.15)	.18 (.15)
	Program Mean	.18 (.16)	-.19 (.16)	.55 (.17)	.07 (.06)	-.07 (.06)	.20 (.06)	.02 (.20)	-.49 (.20)	.53 (.22)	.01 (.09)	-.21 (.09)	.23 (.09)
Communication (Program)	Variable	.02 (.07)	-.14 (.07)	.18 (.07)	.02 (.06)	-.11 (.06)	.15 (.06)	-.11 (.19)	-.38 (.19)	.17 (.19)	-.08 (.14)	-.28 (.14)	.12 (.14)
	Program Mean	.19 (.13)	-.15 (.13)	.53 (.14)	.08 (.05)	-.06 (.05)	.21 (.05)	.07 (.21)	-.42 (.22)	.56 (.22)	.03 (.09)	-.19 (.10)	.25 (.09)
Positive features (Site)	Variable	.15 (.04)	.04 (.04)	.26 (.05)	.17 (.05)	.04 (.05)	.30 (.05)	.16 (.14)	-.06 (.14)	.37 (.15)	.14 (.12)	-.05 (.13)	.33 (.12)
	Program Mean	.08 (.07)	-.14 (.07)	.31 (.08)	.05 (.04)	-.08 (.04)	.18 (.04)	-.05 (.19)	-.46 (.21)	.37 (.20)	-.02 (.10)	-.23 (.10)	.19 (.10)
Positive features (Program)	Variable	.14 (.05)	.03 (.05)	.25 (.06)	.17 (.06)	.04 (.06)	.30 (.06)	.07 (.12)	-.15 (.13)	.29 (.12)	.06 (.11)	-.13 (.11)	.26 (.10)
	Program Mean	.09 (.08)	-.13 (.08)	.32 (.08)	.06 (.05)	-.08 (.05)	.19 (.05)	.02 (.18)	-.40 (.18)	.43 (.20)	.01 (.09)	-.20 (.09)	.22 (.09)
Negative features (Site)	Variable	-.24 (.06)	-.35 (.06)	-.14 (.06)	-.29 (.07)	-.41 (.07)	-.17 (.07)	-.14 (.11)	-.35 (.11)	.07 (.11)	-.14 (.11)	-.35 (.11)	.07 (.11)
	Program Mean	-.09 (.10)	-.33 (.11)	.15 (.10)	-.05 (.05)	-.17 (.05)	.08 (.05)	-.05 (.16)	-.42 (.16)	.31 (.16)	-.03 (.10)	-.26 (.10)	.19 (.10)
Negative features (Program)	Variable	-.25 (.05)	-.35 (.05)	-.15 (.05)	-.30 (.06)	-.43 (.06)	-.18 (.06)	-.15 (.12)	-.37 (.12)	.07 (.13)	-.15 (.12)	-.36 (.12)	.06 (.12)
	Program Mean	.00 (.09)	-.22 (.10)	.22 (.09)	.00 (.05)	-.13 (.06)	.13 (.05)	.01 (.15)	-.35 (.16)	.38 (.16)	.01 (.10)	-.23 (.10)	.24 (.11)
Communication (Site) Old	Variable	.08 (.13)	-.18 (.13)	.35 (.13)	.04 (.07)	-.09 (.07)	.18 (.07)	-.11 (.35)	-.55 (.37)	.33 (.36)	-.05 (.16)	-.25 (.16)	.15 (.17)
	Program Mean	.21 (.20)	-.29 (.21)	.71 (.21)	.06 (.06)	-.08 (.06)	.20 (.06)	.08 (.33)	-.69 (.35)	.83 (.35)	.02 (.14)	-.20 (.14)	.24 (.10)
Communication (Program) Old	Variable	-.03 (.10)	-.27 (.10)	.21 (.11)	-.02 (.06)	-.15 (.06)	.12 (.06)	-.23 (.35)	-.64 (.36)	.19 (.34)	-.11 (.16)	-.30 (.16)	.09 (.16)
	Program Mean	.24 (.19)	-.22 (.19)	.70 (.19)	.07 (.06)	-.07 (.06)	.22 (.06)	.19 (.33)	-.59 (.33)	.97 (.35)	.05 (.09)	-.16 (.09)	.27 (.09)
Positive features (Site) Old	Variable	.20 (.07)	.03 (.07)	.37 (.07)	.15 (.05)	.03 (.05)	.28 (.05)	.13 (.21)	-.20 (.21)	.46 (.21)	.08 (.12)	-.11 (.12)	.27 (.12)
	Program Mean	.09 (.13)	-.28 (.12)	.45 (.14)	.03 (.04)	-.10 (.04)	.17 (.05)	.04 (.29)	-.61 (.30)	.68 (.31)	.01 (.10)	-.20 (.10)	.23 (.10)
Positive features (Program) Old	Variable	.22 (.09)	.05 (.09)	.38 (.09)	.17 (.07)	.04 (.07)	.29 (.07)	.05 (.18)	-.26 (.19)	.36 (.18)	.03 (.11)	-.17 (.11)	.22 (.11)
	Program Mean	.10 (.14)	-.27 (.15)	.47 (.15)	.04 (.05)	-.10 (.05)	.17 (.05)	.06 (.25)	-.54 (.28)	.66 (.27)	.02 (.09)	-.19 (.09)	.24 (.10)
Negative features (Site) Old	Variable	-.44 (.11)	-.66 (.11)	-.23 (.11)	-.25 (.06)	-.37 (.06)	-.13 (.06)	-.19 (.22)	-.57 (.23)	.19 (.23)	-.10 (.12)	-.31 (.12)	.10 (.12)
	Program Mean	-.23 (.24)	-.77 (.29)	.31 (.21)	-.05 (.05)	-.18 (.05)	.07 (.05)	-.18 (.34)	-.84 (.35)	.49 (.35)	-.06 (.11)	-.28 (.11)	.16 (.11)
Negative features (Program) Old	Variable	-.48 (.11)	-.71 (.11)	-.26 (.11)	-.27 (.06)	-.40 (.06)	-.15 (.06)	-.18 (.23)	-.56 (.24)	.21 (.25)	-.10 (.12)	-.30 (.12)	.11 (.13)
	Program Mean	.03 (.21)	-.47 (.24)	.53 (.19)	.01 (.06)	-.12 (.06)	.14 (.05)	-.08 (.32)	-.74 (.34)	.60 (.31)	-.03 (.11)	-.25 (.11)	.20 (.11)
Communication (Site) New	Variable	.12 (.15)	-.20 (.15)	.44 (.15)	.05 (.06)	-.08 (.06)	.17 (.06)	.06 (.38)	-.46 (.38)	.56 (.37)	.02 (.14)	-.17 (.15)	.21 (.14)
	Program Mean	.32 (.43)	-.52 (.39)	1.15 (.52)	.05 (.06)	-.09 (.06)	.18 (.07)	-.01 (.39)	-.10 (.42)	1.02 (.41)	.00 (.08)	-.21 (.08)	.21 (.08)
Communication (Program) New	Variable	.12 (.16)	-.17 (.16)	.41 (.16)	.05 (.06)	-.07 (.06)	.17 (.06)	-.03 (.29)	-.52 (.29)	.46 (.30)	-.01 (.12)	-.21 (.12)	.18 (.12)
	Program Mean	.40 (.37)	-.42 (.34)	1.22 (.43)	.06 (.06)	-.07 (.06)	.20 (.06)	-.04 (.44)	-.97 (.45)	.86 (.46)	-.01 (.10)	-.23 (.10)	.21 (.10)
Positive features (Site) New	Variable	.29 (.11)	.05 (.11)	.53 (.11)	.16 (.06)	.03 (.06)	.29 (.06)	.32 (.24)	-.07 (.25)	.71 (.25)	.16 (.11)	-.03 (.12)	.35 (.11)
	Program Mean	.24 (.17)	-.25 (.17)	.72 (.19)	.07 (.05)	-.07 (.05)	.20 (.05)	-.17 (.31)	-.94 (.34)	.57 (.31)	-.05 (.09)	-.26 (.08)	.16 (.09)
Positive features (Program) New	Variable	.23 (.10)	.00 (.10)	.46 (.10)	.13 (.06)	.00 (.06)	.26 (.06)	.17 (.23)	-.22 (.23)	.55 (.24)	.08 (.11)	-.11 (.11)	.27 (.11)
	Program Mean	.26 (.17)	-.22 (.17)	.74 (.19)	.07 (.05)	-.06 (.05)	.21 (.05)	-.08 (.33)	-.83 (.36)	.68 (.33)	-.02 (.10)	-.24 (.10)	.19 (.10)
Negative features (Site) New	Variable	-.35 (.10)	-.52 (.10)	-.19 (.10)	-.26 (.07)	-.39 (.07)	-.14 (.07)	-.18 (.16)	-.50 (.18)	.13 (.17)	-.12 (.11)	-.32 (.11)	.08 (.11)
	Program Mean	-.12 (.15)	-.49 (.16)	.25 (.15)	-.04 (.05)	-.17 (.05)	.09 (.05)	-.05 (.22)	-.62 (.23)	.52 (.22)	-.02 (.09)	-.24 (.09)	.20 (.09)
Negative features (Program) New	Variable	-.35 (.09)	-.51 (.09)	-.18 (.09)	-.27 (.07)	-.39 (.07)	-.14 (.07)	-.19 (.17)	-.51 (.19)	.12 (.17)	-.12 (.11)	-.33 (.11)	.08 (.12)
	Program Mean	-.05 (.15)	-.40 (.16)	.30 (.15)	-.02 (.06)	-.15 (.06)	.11 (.05)	.01 (.24)	-.55 (.24)	.57 (.25)	.00 (.10)	-.22 (.10)	.23 (.10)
Sleep motivation	Variable	.46 (.10)	.29 (.10)	.62 (.10)	.33 (.07)	.21 (.07)	.44 (.07)	.24 (.17)	-.08 (.17)	.55 (.18)	.14 (.10)	-.05 (.10)	.33 (.10)
	Program Mean	-.17 (.20)	-.65 (.21)	.31 (.23)	-.05 (.06)	-.18 (.06)	.08 (.06)	.18 (.29)	-.49 (.30)	.85 (.30)	.06 (.09)	-.15 (.09)	.26 (.09)
PANAS (Positive)	Variable	.38 (.07)	.21 (.07)	.54 (.07)	.29 (.05)	.16 (.06)	.41 (.05)	.39 (.16)	.07 (.15)	.73 (.17)	.24 (.09)	.04 (.10)	.43 (.09)
	Program Mean	.04 (.16)	-.33 (.16)	.41 (.16)	.01 (.06)	-.12 (.06)	.14 (.06)	-.03 (.19)	-.63 (.19)	.57 (.21)	-.01 (.07)	-.22 (.07)	.20 (.07)
PANAS (Negative)	Variable	-.29 (.08)	-.44 (.08)	-.14 (.09)	-.24 (.07)	-.36 (.07)	-.12 (.08)	-.29 (.19)	-.60 (.19)	.02 (.20)	-.19 (.12)	-.39 (.12)	.01 (.12)
	Program Mean	-.04 (.14)	-.40 (.15)	.32 (.14)	-.01 (.05)	-.15 (.05)	.12 (.05)	-.04 (.28)	-.59 (.28)	.51 (.30)	-.02 (.11)	-.24 (.11)	.20 (.11)
Information processing	Variable	-.30 (.21)	-.73 (.22)	.14 (.20)	-.09 (.06)	-.21 (.06)	.04 (.06)	.02 (.35)	-.78 (.36)	.82 (.36)	.00 (.08)	-.18 (.09)	.19 (.09)
	Program Mean	.04 (.49)	-1.07 (.53)	1.14 (.49)	.01 (.06)	-.13 (.06)	.14 (.06)	-.32 (.78)	-2.00 (.78)	1.37 (.83)	-.04 (.09)	-.25 (.10)	.17 (.10)
Social support	Variable	.12 (.07)	-.05 (.08)	.29 (.07)	.10 (.06)	-.03 (.06)	.23 (.06)	.12 (.16)	-.18 (.16)	.42 (.17)	.08 (.11)	-.12 (.11)	.27 (.10)
	Program Mean	.17 (.16)	-.20 (.15)	.55 (.18)	.06 (.05)	-.07 (.05)	.20 (.05)	.20 (.25)	-.37 (.26)	.76 (.26)	.08 (.10)	-.14 (.10)	.29 (.10)
Workload uncertainty	Variable	-.85 (.15)	-.117 (.15)	-.53 (.15)	-.31 (.06)	-.43 (.05)	-.20 (.06)	-.23 (.18)	-.71 (.19)	.25 (.17)	-.09 (.06)	-.26 (.06)	.09 (.06)
	Program Mean	.48 (.37)	-.43 (.41)	1.40 (.38)	.07 (.05)	-.06 (.05)	.20 (.05)	.48 (.37)	-.67 (.38)	1.62 (.39)	.08 (.06)	-.11 (.06)	.28 (.06)
Schedule consistency	Variable	.36 (.08)	.20 (.08)	.52 (.08)	.29 (.07)	.16 (.07)	.42 (.07)	.18 (.12)	-.09 (.13)	.45 (.12)	.13 (.09)	-.06 (.09)	.32 (.08)
	Program Mean	-.24 (.14)	-.59 (.15)	.12 (.15)	-.10 (.06)	-.23 (.06)	.04 (.06)	-.16 (.23)	-.70 (.25)	.39 (.23)	-.06 (.09)	-.27 (.09)	.15 (.09)
Detachment	Variable	.21 (.10)	.02 (.10)	.39 (.11)	.14 (.07)	.02 (.07)	.27 (.07)	.17 (.19)	-.17 (.18)	.51 (.21)	.10 (.11)	-.10 (.11)	.30 (.11)
	Program Mean	.27 (.20)	-.15 (.20)	.70 (.22)	.08 (.06)	-.05 (.06)	.21 (.06)	.21 (.31)	-.42 (.31)	.83 (.34)	.07 (.11)	-.14 (.11)	.28 (.11)
Welfare	Variable	.35 (.13)	.14 (.12)	.56 (.13)	.22 (.07)	.09 (.07)	.34 (.07)	.29 (.24)	-.13 (.25)	.69 (.23)	.14 (.11)	-.06 (.12)	.34 (.11)
	Program Mean	.10 (.17)	-.35 (.18)	.54 (.19)	.03 (.05)	-.11 (.06)	.16 (.06)	-.06 (.35)	-.83 (.36)	.69 (.37)	-.02 (.10)	-.24 (.10)	.20 (.10)
Efficiency	Variable	-.32 (.15)	-.54 (.16)	-.11 (.15)	-.19 (.08)	-.32 (.08)	-.06 (.08)	-.10 (.18)	-.47 (.17)	.26 (.19)	-.06 (.09)	-.24 (.09)	.13 (.10)
	Program Mean	.12 (.23)	-.40 (.26)	.63 (.22)	.04 (.06)	-.10 (.07)	.17 (.06)	.12 (.31)	-.66 (.34)	.90 (.32)	.03 (.09)	-.18 (.09)	.24 (.09)
Pressure to produce	Variable	-.44 (.08)	-.61 (.08)	-.26 (.09)	-.32 (.06)	-.45 (.06)	-.20 (.07)	-.06 (.19)	-.39 (.20)	.27 (.20)	-.03 (.11)	-.23 (.11)	.16 (.11)
	Program Mean	.09 (.14)	-.28 (.14)	.45 (.14)	.03 (.05)	-.10 (.05)	.17 (.05)	.01 (.22)	-.64 (.23)	.67 (.24)	.00 (.07)	-.21 (.07)	.22 (.07)
Tenure	Variable	.00 (.00)	.00 (.00)	.00 (.00)	-.03 (.05)	-.16 (.05)	.11 (.05)	.00 (.00)	.00 (.00)	.00 (.00)	-.15 (.08)	-.34 (.08)	.04 (.08)
	Program Mean	.00 (.00)	.00 (.00)	.01 (.00)	.08 (.05)	-.06 (.05)	.22 (.05)	.00 (.00)	.00 (.00)	.01 (.00)	.22 (.08)	.01 (.09)	.42 (.08)
Hours	Variable	-.46 (.10)	-.77 (.10)	-.15 (.10)	-.21 (.04)	-.35 (.04)	-.07 (.05)	-.21 (.18)	-.65 (.19)	.24 (.19)	-.10 (.09)	-.33 (.09)	.12 (.09)
	Program Mean	.00 (.18)	-.53 (.19)	.54 (.18)	.00 (.05)	-.15 (.06)	.15 (.05)	.12 (.26)	-.55 (.26)	.78 (.28)	.04 (.09)	-.19 (.09)	.27 (.09)
Night Shift	Variable	-.11 (.04)	-.21 (.04)	.00 (.04)	-.13 (.05)	-.26 (.05)	.00 (.05)	.01 (.07)	-.17 (.07)	.19 (.07)	.01 (.07)	-.17 (.07)	.18 (.07)
	Program Mean	.10 (.10)	-.15 (.09)	.35 (.11)	.06 (.05)	-.08 (.05)	.19 (.06)	-.07 (.16)	-.55 (.17)	.39 (.18)	-.03 (.07)	-.23 (.07)	.16 (.07)

Note. Values outside of parentheses are regression coefficients of the predictors in the HLM and values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

Old denotes scale used in Studies 1 and 2, and *New* denotes scale composed solely of items introduced in Study 3.

^aIn this column, Variable, Program Mean, and Site Mean correspond to the raw predictor variable, learning site mean of the variable, and residency program mean of the variable, respectively.

^bFor Time 1 analysis, sample size was 289; number of programs 38; number of sites 19.

^cFor Time 2 analysis, sample size was 138; number of programs 35; number of sites 17.

Values in bold indicate that the 95% CI excluded zero.

APPENDIX I. HLM coefficients of work context variables on sleep quantity only grouped by residency program (Study 3)

Predictor	Level*	Time 1 ^a						Time 2 ^b					
		Unstandardized			Standardized			Unstandardized			Standardized		
		Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper
Communication (Site)	Variable	.02 (.01)	-.01 (.01)	.05 (.01)	.08 (.05)	-.05 (.05)	.20 (.05)	.03 (.02)	-.03 (.02)	.09 (.02)	.11 (.06)	-.10 (.06)	.32 (.06)
	Program Mean	.04 (.02)	-.05 (.02)	.12 (.02)	.07 (.04)	-.08 (.04)	.23 (.04)	.02 (.03)	-.09 (.04)	.12 (.04)	.04 (.07)	-.17 (.07)	.25 (.07)
Communication (Program)	Variable	.01 (.01)	-.02 (.01)	.04 (.01)	.03 (.04)	-.09 (.04)	.16 (.04)	.01 (.02)	-.04 (.02)	.07 (.02)	.05 (.06)	-.15 (.06)	.26 (.07)
	Program Mean	.07 (.02)	-.01 (.02)	.15 (.02)	.14 (.04)	-.02 (.04)	.29 (.04)	.07 (.03)	-.03 (.03)	.17 (.03)	.16 (.06)	-.05 (.07)	.37 (.06)
Positive features (Site)	Variable	.03 (.01)	.00 (.01)	.05 (.01)	.15 (.04)	.02 (.04)	.27 (.03)	.04 (.01)	-.01 (.02)	.08 (.02)	.16 (.06)	-.04 (.07)	.35 (.06)
	Program Mean	.06 (.01)	.01 (.01)	.11 (.01)	.17 (.04)	.03 (.04)	.31 (.04)	.03 (.03)	-.05 (.03)	.11 (.03)	.08 (.07)	-.13 (.08)	.28 (.07)
Positive features (Program)	Variable	.03 (.01)	.01 (.01)	.05 (.01)	.17 (.03)	.04 (.03)	.29 (.03)	.02 (.01)	-.03 (.01)	.06 (.01)	.07 (.06)	-.12 (.06)	.27 (.06)
	Program Mean	.06 (.01)	.01 (.01)	.11 (.01)	.17 (.03)	.03 (.04)	.31 (.03)	.08 (.03)	.00 (.03)	.16 (.03)	.20 (.06)	.00 (.07)	.40 (.06)
Negative features (Site)	Variable	-.06 (.01)	-.08 (.01)	-.04 (.01)	-.33 (.04)	-.44 (.04)	-.22 (.04)	-.06 (.02)	-.10 (.02)	-.02 (.02)	-.29 (.08)	-.49 (.08)	-.08 (.08)
	Program Mean	-.05 (.01)	-.10 (.02)	.00 (.01)	-.13 (.03)	-.27 (.03)	.00 (.03)	.00 (.03)	-.07 (.03)	.07 (.03)	.00 (.09)	-.21 (.09)	.22 (.09)
Negative features (Program)	Variable	-.06 (.01)	-.08 (.01)	-.04 (.01)	-.33 (.04)	-.45 (.04)	-.21 (.05)	-.04 (.02)	-.08 (.02)	.01 (.02)	-.18 (.08)	-.40 (.08)	.03 (.08)
	Program Mean	-.04 (.02)	-.09 (.02)	.00 (.02)	-.12 (.04)	-.25 (.04)	.01 (.05)	-.03 (.02)	-.10 (.02)	.04 (.02)	-.10 (.08)	-.32 (.08)	.13 (.08)
Communication (Site) Old	Variable	.02 (.02)	-.03 (.02)	.08 (.02)	.06 (.05)	-.07 (.05)	.19 (.05)	.03 (.03)	-.07 (.03)	.12 (.04)	.06 (.07)	-.15 (.07)	.27 (.07)
	Program Mean	.06 (.03)	-.05 (.03)	.17 (.03)	.09 (.04)	-.07 (.05)	.24 (.04)	.02 (.06)	-.14 (.07)	.18 (.06)	.03 (.08)	-.19 (.08)	.25 (.08)
Communication (Program) Old	Variable	-.01 (.02)	-.06 (.02)	.04 (.02)	-.02 (.06)	-.15 (.06)	.11 (.06)	.01 (.03)	-.08 (.03)	.10 (.03)	.02 (.07)	-.18 (.07)	.22 (.07)
	Program Mean	.12 (.03)	.02 (.03)	.22 (.03)	.19 (.04)	.04 (.05)	.34 (.04)	.10 (.06)	-.06 (.06)	.26 (.06)	.13 (.08)	-.08 (.08)	.34 (.07)
Positive features (Site) Old	Variable	.03 (.01)	-.01 (.01)	.06 (.01)	.10 (.04)	-.03 (.04)	.22 (.04)	.03 (.02)	-.03 (.03)	.10 (.02)	.10 (.07)	-.10 (.07)	.29 (.07)
	Program Mean	.09 (.02)	.01 (.02)	.17 (.02)	.18 (.04)	.03 (.04)	.31 (.04)	.02 (.05)	-.11 (.05)	.15 (.05)	.04 (.08)	-.17 (.08)	.24 (.08)
Positive features (Program) Old	Variable	.04 (.01)	.01 (.01)	.08 (.01)	.16 (.03)	.04 (.03)	.29 (.03)	.00 (.02)	-.06 (.02)	.07 (.02)	.01 (.07)	-.19 (.07)	.21 (.07)
	Program Mean	.08 (.02)	.00 (.02)	.16 (.02)	.15 (.04)	.01 (.04)	.29 (.03)	.10 (.04)	-.02 (.04)	.22 (.04)	.18 (.07)	-.03 (.07)	.38 (.06)
Negative features (Site) Old	Variable	-.11 (.02)	-.15 (.02)	-.07 (.02)	-.31 (.05)	-.42 (.05)	-.19 (.05)	-.06 (.03)	-.14 (.03)	.01 (.03)	-.17 (.07)	-.37 (.08)	.04 (.07)
	Program Mean	-.12 (.04)	-.24 (.05)	.00 (.04)	-.14 (.04)	-.27 (.04)	.00 (.04)	-.04 (.05)	-.17 (.05)	.10 (.06)	-.06 (.09)	-.28 (.09)	.16 (.09)
Negative features (Program) Old	Variable	-.11 (.02)	-.16 (.02)	-.07 (.02)	-.31 (.06)	-.43 (.06)	-.19 (.06)	-.05 (.03)	-.13 (.04)	.03 (.03)	-.14 (.09)	-.35 (.09)	.07 (.09)
	Program Mean	-.09 (.05)	-.19 (.05)	.02 (.04)	-.11 (.05)	-.25 (.05)	.02 (.06)	-.06 (.05)	-.20 (.05)	.07 (.06)	-.11 (.09)	-.32 (.09)	.11 (.09)
Communication (Site) New	Variable	.04 (.03)	-.03 (.02)	.10 (.03)	.07 (.05)	-.05 (.05)	.19 (.05)	.07 (.04)	-.04 (.03)	.17 (.04)	.12 (.06)	-.08 (.06)	.31 (.06)
	Program Mean	.01 (.06)	-.19 (.06)	.22 (.07)	.01 (.05)	-.15 (.05)	.17 (.05)	.05 (.09)	-.15 (.09)	.25 (.09)	.06 (.09)	-.15 (.09)	.26 (.09)
Communication (Program) New	Variable	.04 (.02)	-.02 (.02)	.10 (.02)	.08 (.04)	-.04 (.04)	.20 (.04)	.03 (.04)	-.07 (.04)	.14 (.05)	.07 (.08)	-.13 (.08)	.27 (.08)
	Program Mean	.00 (.06)	-.20 (.06)	.21 (.06)	.00 (.05)	-.16 (.05)	.16 (.05)	.13 (.08)	-.04 (.08)	.32 (.09)	.16 (.08)	-.05 (.09)	.36 (.08)
Positive features (Site) New	Variable	.07 (.02)	.02 (.02)	.12 (.02)	.18 (.05)	.06 (.05)	.31 (.05)	.07 (.03)	-.01 (.03)	.15 (.04)	.17 (.08)	-.02 (.08)	.37 (.08)
	Program Mean	.09 (.04)	-.02 (.04)	.20 (.04)	.12 (.05)	-.02 (.05)	.27 (.05)	.08 (.05)	-.07 (.05)	.23 (.05)	.10 (.07)	-.10 (.08)	.31 (.07)
Positive features (Program) New	Variable	.05 (.02)	.00 (.02)	.09 (.02)	.14 (.05)	.01 (.05)	.26 (.05)	.05 (.03)	-.03 (.03)	.13 (.03)	.12 (.07)	-.07 (.07)	.32 (.07)
	Program Mean	.12 (.05)	.02 (.05)	.22 (.05)	.16 (.05)	.02 (.06)	.30 (.05)	.10 (.06)	-.05 (.06)	.25 (.06)	.14 (.09)	-.07 (.09)	.34 (.08)
Negative features (Site) New	Variable	-.08 (.01)	-.11 (.01)	-.05 (.01)	-.29 (.04)	-.40 (.04)	-.17 (.04)	-.09 (.03)	-.15 (.03)	-.02 (.03)	.27 (.09)	-.47 (.09)	-.07 (.09)
	Program Mean	-.07 (.02)	-.15 (.03)	.01 (.02)	-.12 (.04)	-.26 (.04)	.01 (.04)	.01 (.04)	-.11 (.04)	.12 (.05)	.02 (.09)	-.19 (.09)	.23 (.09)
Negative features (Program) New	Variable	-.07 (.01)	-.10 (.01)	-.04 (.01)	-.28 (.04)	-.40 (.04)	-.16 (.04)	-.04 (.03)	-.11 (.03)	.02 (.03)	-.14 (.09)	-.35 (.09)	.07 (.09)
	Program Mean	-.07 (.03)	-.15 (.03)	.00 (.03)	-.13 (.04)	-.27 (.04)	.00 (.05)	-.05 (.04)	-.17 (.04)	.06 (.04)	-.11 (.08)	-.32 (.08)	.11 (.09)
Sleep motivation	Variable	.08 (.01)	.05 (.01)	.11 (.01)	.28 (.05)	.17 (.05)	.39 (.04)	.11 (.03)	.04 (.02)	.17 (.03)	.30 (.07)	.12 (.07)	.48 (.07)
	Program Mean	.05 (.03)	-.06 (.04)	.15 (.03)	.06 (.04)	-.08 (.05)	.20 (.04)	.03 (.05)	-.11 (.06)	.16 (.05)	.04 (.08)	-.16 (.09)	.23 (.08)
PANAS (Positive)	Variable	.01 (.01)	-.02 (.01)	.05 (.01)	.05 (.04)	-.07 (.04)	.18 (.04)	.02 (.03)	-.05 (.03)	.10 (.03)	.07 (.08)	-.13 (.08)	.27 (.08)
	Program Mean	.01 (.03)	-.08 (.03)	.10 (.03)	.02 (.05)	-.13 (.05)	.18 (.04)	.06 (.05)	-.06 (.05)	.19 (.05)	.11 (.09)	-.10 (.09)	.32 (.08)
PANAS (Negative)	Variable	-.02 (.01)	-.05 (.01)	.01 (.01)	-.10 (.04)	-.22 (.04)	.02 (.04)	-.04 (.02)	-.11 (.02)	.02 (.03)	-.14 (.08)	-.34 (.07)	.07 (.08)
	Program Mean	-.01 (.02)	-.10 (.02)	.08 (.02)	-.02 (.03)	-.17 (.03)	.14 (.03)	-.07 (.03)	-.18 (.04)	.04 (.03)	-.14 (.06)	-.35 (.06)	.08 (.06)
Information processing	Variable	-.05 (.03)	-.13 (.03)	.04 (.03)	-.07 (.04)	-.19 (.04)	.05 (.04)	-.09 (.06)	-.26 (.06)	.08 (.07)	-.10 (.08)	-.30 (.07)	.09 (.08)
	Program Mean	-.10 (.10)	-.16 (.10)	.36 (.10)	.06 (.06)	-.10 (.06)	.22 (.06)	.12 (.10)	-.23 (.10)	.46 (.11)	.07 (.06)	-.13 (.07)	.28 (.06)
Social support	Variable	.03 (.01)	.00 (.01)	.06 (.01)	.12 (.05)	-.01 (.05)	.24 (.05)	.03 (.02)	-.03 (.02)	.09 (.03)	.10 (.08)	-.10 (.08)	.30 (.08)
	Program Mean	.03 (.02)	-.06 (.03)	.12 (.02)	.05 (.04)	-.11 (.05)	.21 (.04)	.06 (.04)	-.06 (.04)	.17 (.04)	.10 (.06)	-.11 (.07)	.32 (.07)
Workload uncertainty	Variable	-.09 (.01)	-.15 (.01)	-.02 (.02)	-.15 (.03)	-.27 (.02)	-.04 (.03)	-.04 (.02)	-.15 (.02)	.06 (.02)	-.08 (.04)	-.26 (.04)	.10 (.04)
	Program Mean	-.17 (.04)	-.37 (.04)	.04 (.04)	-.12 (.03)	-.26 (.03)	.03 (.03)	-.20 (.03)	-.42 (.04)	.02 (.03)	-.17 (.03)	-.36 (.03)	.01 (.03)
Schedule consistency	Variable	.03 (.01)	.00 (.01)	.07 (.01)	.13 (.04)	.00 (.04)	.26 (.04)	.04 (.02)	-.01 (.02)	.10 (.02)	.14 (.07)	-.05 (.07)	.34 (.06)
	Program Mean	.05 (.02)	-.03 (.02)	.13 (.02)	.09 (.04)	-.06 (.04)	.25 (.04)	.08 (.03)	-.03 (.04)	.18 (.03)	.15 (.06)	-.05 (.07)	.35 (.06)
Detachment	Variable	.06 (.02)	.02 (.02)	.09 (.02)	.19 (.07)	.07 (.07)	.31 (.07)	.06 (.03)	-.01 (.03)	.13 (.03)	.17 (.08)	-.03 (.09)	.37 (.08)
	Program Mean	.03 (.03)	-.08 (.04)	.13 (.04)	.04 (.05)	-.12 (.06)	.19 (.05)	-.01 (.05)	-.14 (.05)	.12 (.05)	-.02 (.08)	-.23 (.09)	.19 (.08)
Welfare	Variable	.04 (.02)	.00 (.02)	.09 (.02)	.13 (.06)	.01 (.06)	.26 (.06)	.03 (.03)	-.06 (.04)	.12 (.04)	.07 (.08)	-.13 (.08)	.28 (.08)
	Program Mean	.03 (.03)	-.07 (.03)	.14 (.04)	.05 (.05)	-.11 (.05)	.20 (.05)	.07 (.06)	-.08 (.06)	.22 (.06)	.09 (.08)	-.12 (.09)	.31 (.08)
Efficiency	Variable	-.06 (.02)	-.10 (.02)	-.02 (.02)	-.16 (.06)	-.29 (.06)	-.04 (.06)	-.04 (.03)	-.12 (.03)	.03 (.03)	-.11 (.08)	-.30 (.08)	.08 (.08)
	Program Mean	.00 (.04)	-.12 (.04)	.13 (.04)	.01 (.05)	-.15 (.05)	.17 (.06)	.00 (.08)	-.16 (.08)	.15 (.08)	-.01 (.10)	-.21 (.11)	.20 (.10)
Pressure to produce	Variable	-.06 (.01)	-.09 (.01)	-.02 (.01)	-.20 (.05)	-.33 (.04)	-.08 (.05)	-.04 (.03)	-.11 (.02)	.03 (.03)	-.11 (.07)	-.30 (.07)	.09 (.07)
	Program Mean	-.01 (.02)	-.10 (.02)	.08 (.02)	-.02 (.03)	-.17 (.03)	.14 (.03)	-.01 (.04)	-.14 (.04)	.12 (.05)	-.02 (.07)	-.23 (.07)	.19 (.07)
Tenure	Variable	.00 (.00)	.00 (.00)	.00 (.00)	-.06 (.03)	-.19 (.03)	.07 (.03)	.00 (.00)	.00 (.00)	.00 (.00)	-.05 (.04)	-.24 (.04)	.15 (.04)
	Program Mean	.00 (.00)	.00 (.00)	.00 (.00)	.13 (.03)	-.04 (.04)	.30 (.03)	.00 (.00)	.00 (.00)	.00 (.00)	-.01 (.02)	-.22 (.02)	.20 (.03)
Hours	Variable	-.16 (.01)	-.22 (.01)	-.10 (.01)	-.36 (.03)	-.49 (.03)	-.23 (.03)	-.17 (.03)	-.26 (.03)	-.08 (.02)	-.41 (.06)	-.63 (.06)	-.20 (.06)
	Program Mean	-.03 (.02)	-.14 (.02)	.07 (.02)	-.05 (.03)	-.19 (.03)	.09 (.03)	.01 (.02)	-.12 (.02)	.13 (.02)	.01 (.03)	-.21 (.04)	.22 (.03)
Night Shift	Variable	-.02 (.00)	-.04 (.00)	.00 (.00)	-.09 (.03)	-.22 (.03)	.03 (.03)	-.03 (.01)	-.07 (.01)	.01 (.01)	-.13 (.04)	-.31 (.04)	.04 (.04)
	Program Mean	-.03 (.01)	-.09 (.01)	.02 (.01)	-.10 (.03)	-.25 (.03)	.06 (.03)	-.08 (.02)	-.17 (.02)	.01 (.02)	-.16 (.03)	-.34 (.03)	.02 (.03)

Note. Values outside of parentheses are regression coefficients of the predictors in the HLM and values in parentheses are SDs of the estimate across 50 imputed datasets.

(Site) and (Program) denote referent of the sleep climate items.

Old denotes scale used in Studies 1 and 2, and *New* denotes scale composed solely of items introduced in Study 3.

*In this column, Variable, Program Mean, and Site Mean correspond to the raw predictor variable, learning site mean of the variable, and residency program mean of the variable, respectively.

^aFor Time 1 analysis, sample size was 289; number of programs 38; number of sites 19.

^bFor Time 2 analysis, sample size was 138; number of programs 35; number of sites 17.

Values in bold indicate that the 95% CI excluded zero.

Appendix J. Descriptive statistics of study variables at Times 1 and 2, matched for individuals (Study 3)

Variable	Time 1		Time 2	
	Mean* (SD**)	SD* (SD**)	Mean* (SD**)	SD* (SD**)
1. Communication (Site) [*]	2.81 (.11)	.71 (.02)	2.92 (.09)	.63 (.05)
2. Communication (Program)	2.98 (.12)	.74 (.02)	3.04 (.10)	.66 (.06)
3. Positive features (Site)	2.79 (.11)	.78 (.03)	2.75 (.07)	.57 (.04)
4. Positive features (Program)	2.98 (.10)	.78 (.03)	2.95 (.09)	.57 (.04)
5. Negative features (Site)	3.13 (.13)	.77 (.03)	3.12 (.10)	.62 (.03)
6. Negative features (Program)	3.16 (.12)	.80 (.03)	3.16 (.09)	.62 (.03)
7. Communication (Site) Old	2.87 (.04)	.79 (.03)	2.94 (.13)	.70 (.06)
8. Communication (Program) Old	3.02 (.04)	.84 (.03)	3.05 (.13)	.71 (.07)
9. Positive features (Site) Old	2.67 (.03)	.89 (.02)	2.68 (.10)	.65 (.05)
10. Positive features (Program) Old	2.91 (.03)	.86 (.02)	2.77 (.13)	.70 (.05)
11. Negative features (Site) Old	3.22 (.23)	.83 (.04)	3.25 (.15)	.81 (.06)
12. Negative features (Program) Old	3.32 (.21)	.83 (.05)	3.24 (.13)	.80 (.06)
13. Communication (Site) New	2.72 (.27)	.89 (.04)	2.90 (.14)	.84 (.07)
14. Communication (Program) New	2.93 (.28)	.93 (.05)	3.03 (.14)	.90 (.07)
15. Positive features (Site) New	2.93 (.24)	.82 (.05)	2.85 (.09)	.74 (.05)
16. Positive features (Program) New	3.09 (.24)	.85 (.05)	3.18 (.11)	.75 (.06)
17. Negative features (Site) New	3.07 (.16)	.86 (.03)	3.02 (.12)	.71 (.05)
18. Negative features (Program) New	3.04 (.15)	.90 (.04)	3.10 (.10)	.72 (.05)
19. Sleep quality	3.82 (.20)	.72 (.05)	3.91 (.14)	.73 (.05)
20. Sleep quantity	6.76 (.00)	.87 (.00)	6.78 (.01)	.91 (.01)
21. Sleep motivation	3.51 (.15)	.64 (.03)	3.45 (.08)	.52 (.03)
22. PANAS (Positive)	3.21 (.02)	.65 (.03)	3.13 (.09)	.53 (.04)
23. PANAS (Negative)	2.15 (.11)	.69 (.03)	2.17 (.11)	.58 (.03)
24. Information processing	4.68 (.09)	.31 (.02)	4.68 (.05)	.26 (.02)
25. Social support	4.03 (.15)	.53 (.03)	3.92 (.08)	.49 (.04)
26. Workload uncertainty	3.82 (.00)	.77 (.00)	3.84 (.04)	.82 (.03)
27. Schedule consistency	2.29 (.09)	.70 (.03)	2.37 (.11)	.63 (.04)
28. Detachment	2.83 (.26)	.77 (.06)	2.93 (.15)	.66 (.06)
29. Welfare	3.59 (.26)	.68 (.06)	3.64 (.10)	.54 (.05)
30. Efficiency ⁺	3.52 (.24)	.62 (.04)	3.48 (.13)	.57 (.04)
31. Pressure to produce	3.69 (.09)	.63 (.02)	3.60 (.09)	.52 (.03)
32. Tenure at site	231.54 (.00)	359.14 (.00)	230.43 (8.07)	361.67 (12.41)
33. Average work hours per day	10.64 (.00)	1.67 (.00)	10.48 (.06)	2.23 (.03)
34. Night shifts in the past month	3.90 (.00)	5.69 (.00)	3.46 (.13)	4.36 (.08)

Note. Values are adjusted by the number of items in the scale.

*Mean estimate across the 50 imputed datasets.

**Standard deviations of the estimate across the 50 imputed datasets.

^{*}Variables 1 through 18 are sleep climate dimensions. Word in parentheses denotes the referent of sleep climate (i.e., residency program or learning site).

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

Variables 1 ~ 18, 21 ~ 31 are on a 5-point scale; variable 20 is on a 6-point scale.

⁺Reverse-coded. Higher value represents lower efficiency

Appendix K. Correlation matrix of study variables, matched for individuals (Study 3)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1. Communication (Site)		.60	.47	.39	-.12	-.11	.87	.52	.40	.33	-.05	-.06	.79	.49	.38	.29	-.14	-.12	-.01	.13	.09	.19	-.14	-.02	.15	-.11	.06	-.01	.20	-.11	-.07	.10	-.09	.04
2. Communication (Program)	.82		.37	.50	-.11	-.18	.55	.87	.32	.44	-.07	-.12	.44	.81	.29	.34	-.12	-.17	-.07	.15	.10	.15	-.11	-.02	.21	-.14	.13	.00	.19	-.12	-.09	.04	-.13	-.05
3. Positive features (Site)	.60	.56		.54	-.19	-.19	.42	.32	.86	.45	-.13	-.14	.36	.31	.79	.41	-.18	-.17	.13	.20	.10	.20	-.19	.02	.18	-.10	.08	.02	.25	-.14	-.13	.03	-.18	-.09
4. Positive features (Program)	.60	.67	.84		-.18	-.24	.34	.41	.44	.84	-.12	-.17	.30	.43	.45	.75	-.18	-.22	.07	.18	.09	.15	-.13	-.01	.21	-.15	.14	.02	.23	-.17	-.12	-.03	-.20	-.11
5. Negative features (Site)	-.32	-.33	-.39	-.40		.75	-.08	-.12	-.11	-.10	.80	.60	-.13	-.07	-.21	-.20	.86	.63	-.16	-.28	-.15	-.26	.31	.13	-.24	.28	-.18	-.12	-.24	.08	.32	-.11	.33	.18
6. Negative features (Program)	-.33	-.33	-.40	-.42	.87		-.09	-.17	-.12	-.15	.62	.79	-.10	-.13	-.20	-.25	.63	.86	-.14	-.25	-.14	-.25	.25	.14	-.24	.31	-.21	-.09	-.20	.08	.31	-.08	.27	.16
7. Communication (Site) Old	.90	.77	.59	.59	-.35	-.36		.55	.36	.30	-.03	-.05	.38	.36	.32	.23	-.09	-.09	-.04	.08	.03	.14	-.12	.02	.11	-.09	.00	-.04	.16	-.07	-.03	.13	-.06	.01
8. Communication (Program) Old	.73	.89	.56	.66	-.35	-.35	.82		.29	.38	-.07	-.13	.29	.42	.23	.26	-.11	-.15	-.08	.10	.08	.14	-.09	.01	.17	-.12	.06	-.01	.17	-.09	-.07	.09	-.10	-.08
9. Positive features (Site) Old	.61	.55	.94	.79	-.31	-.32	.58	.54		.43	-.07	-.08	.30	.24	.36	.25	-.11	-.12	.09	.11	.07	.13	-.13	.02	.14	-.06	.05	.04	.20	-.10	-.08	.04	-.11	-.08
10. Positive features (Program) Old	.60	.65	.80	.94	-.31	-.33	.58	.64	.82		-.06	-.09	.23	.36	.29	.27	-.10	-.14	.04	.11	.03	.08	-.06	-.02	.13	-.12	.11	.00	.17	-.11	-.08	-.04	-.13	-.12
11. Negative features (Site) Old	-.23	-.24	-.30	-.32	.87	.77	-.27	-.27	-.23	-.24		.72	-.06	-.03	-.15	-.14	.37	.34	-.14	-.20	-.10	-.20	.24	.10	-.20	.19	-.16	-.10	-.16	.04	.24	-.08	.24	.11
12. Negative features (Program) Old	-.24	-.23	-.31	-.33	.76	.87	-.29	-.27	-.24	-.25	.84		-.05	-.07	-.16	-.19	.32	.36	-.12	-.20	-.13	-.20	.21	.10	-.19	.23	-.17	-.09	-.13	.06	.23	-.07	.19	.07
13. Communication (Site) New	.81	.61	.42	.42	-.17	-.18	.46	.37	.44	.43	-.09	-.10		.46	.29	.25	-.15	-.10	.01	.15	.13	.18	-.12	-.06	.14	-.10	.10	.03	.18	-.11	-.08	.02	-.09	.06
14. Communication (Program) New	.64	.79	.36	.44	-.19	-.18	.42	.42	.36	.43	-.11	-.10	.75		.27	.32	-.08	-.14	-.03	.16	.09	.11	-.09	-.04	.17	-.12	.15	.01	.15	-.11	-.08	-.02	-.12	-.01
15. Positive features (Site) New	.46	.46	.87	.73	-.42	-.42	.47	.47	.65	.60	-.33	-.35	.30	.28		.45	-.19	-.18	.13	.23	.10	.21	-.18	.02	.16	-.11	.10	-.01	.22	-.14	-.14	.01	-.20	-.07
16. Positive features (Program) New	.48	.56	.72	.88	-.43	-.45	.48	.56	.57	.65	-.35	-.37	.32	.37	.78		-.19	-.22	.07	.20	.12	.18	-.16	.01	.22	-.13	.12	.04	.20	-.16	-.12	-.01	-.19	-.05
17. Negative features (Site) New	-.33	-.34	-.39	-.39	.93	.81	-.35	-.35	-.32	-.31	.64	.58	-.20	-.21	-.41	-.42		.69	-.12	-.26	-.14	-.23	.27	.11	-.20	.26	-.14	-.10	-.23	.08	.30	-.10	.31	.19
18. Negative features (Program) New	-.33	-.35	-.39	-.42	.83	.94	-.35	-.36	-.33	-.33	.62	.66	-.20	-.21	-.41	-.44	.85		-.12	-.21	-.11	-.21	.20	.13	-.21	.28	-.18	-.07	-.19	.07	.28	-.06	.24	.18
19. Sleep quality	.13	.09	.19	.19	-.26	-.25	.13	.06	.18	.17	-.22	-.20	.09	.09	.17	.18	-.24	-.24		.16	.17	.23	-.19	-.02	.13	-.04	.10	.14	.13	-.04	-.03	-.03	-.08	-.01
20. Sleep quantity	.11	.10	.21	.23	-.38	-.37	.12	.11	.18	.21	-.36	-.35	.06	.05	.22	.21	-.33	-.34	.25		.31	.14	-.22	-.06	.15	-.16	.23	.16	.13	-.11	-.11	-.05	-.41	-.20
21. Sleep motivation	.08	.10	.17	.18	-.19	-.21	.10	.08	.13	.14	-.20	-.23	.04	.11	.18	.20	-.15	-.17	.33	.37		.16	-.15	-.09	.15	-.07	.13	.15	.12	-.10	-.08	.07	-.18	-.05
22. PANAS (Positive)	.27	.28	.28	.34	-.46	-.45	.32	.30	.20	.25	-.44	-.42	.12	.15	.33	.38	-.41	-.41	.34	.13	.31		-.29	.06	.27	-.13	.13	.05	.20	-.10	-.14	.04	-.17	-.04
23. PANAS (Negative)	-.24	-.22	-.25	-.27	.38	.35	-.30	-.26	-.19	-.20	.33	.31	-.08	-.08	-.29	-.30	.35	.32	-.24	-.11	-.13	-.46		-.07	-.28	.21	-.12	-.13	-.24	.11	.21	-.03	.24	.07
24. Information processing	.00	.06	-.10	-.03	-.05	-.05	-.02	.03	-.13	-.05	-.03	-.02	.03	.08	-.03	.00	-.06	-.07	-.06	-.09	-.04	.13	.09		.08	.16	-.14	-.03	.05	.00	.05	.05	.07	.10
25. Social support	.36	.40	.31	.39	-.32	-.33	.34	.35	.24	.33	-.26	-.29	.28	.32	.33	.39	-.31	-.31	.06	.12	.14	.38	-.34	.16		-.04	.07	.15	.24	-.14	-.12	.03	-.16	-.01
26. Workload uncertainty	-.11	-.09	-.20	-.21	.32	.34	-.04	-.03	-.20	-.21	.23	.26	-.17	-.13	-.15	-.16	.34	.35	-.30	-.21	-.28	-.17	.23	.11	-.09		-.39	.02	-.18	.14	.32	.00	.29	.11
27. Schedule consistency	.13	.09	.21	.18	-.30	-.33	.09	.08	.17	.15	-.22	-.30	.13	.08	.21	.17	-.31	-.31	.21	.17	.20	.07	-.16	-.02	.09	-.46		.04	.16	-.11	-.19	.03	-.17	-.06
28. Detachment	.14	.13	.22	.22	-.29	-.30	.15	.13	.21	.18	-.23	-.22	.09	.09	.19	.23	-.29	-.31	.19	.24	.19	.24	-.18	-.04	.17	-.21	.13		.14	.01	-.03	.08	-.01	.04
29. Welfare	.35	.32	.42	.43	-.39	-.35	.37	.33	.36	.38	-.31	-.32	.20	.41	.40	-.38	-.32	.21	.11	.18	.35	-.39	-.02	.35	-.19	.18	.21		-.13	-.22	.01	-.14	.01	
30. Efficiency	-.25	-.21	-.27	-.25	.14	.17	-.24	-.20	-.26	-.24	.12	.15	-.17	-.15	-.23	-.20	.14	.17	-.15	-.13	-.16	-.13	.13	.06	-.17	.21	-.08	-.04	-.28	.05	.07	-.01	.00	
31. Pressure to produce	-.27	-.21	-.37	-.31	.48	.46	-.28	-.21	-.33	-.26	.39	.40	-.17	-.14	-.34	-.32	.47	.44	-.30	-.15	-.20	-.31	.36	.11	-.24	.38	-.37	-.29	-.39	.22		.05	.19	.14
32. Tenure at site	.15	.14	.13	.15	-.16	-.15	.16	.14	.09	.10	-.14	-.13	.08	.09	.16	.18	-.14	-.14	.02	.02	-.04	.13	-.07	-.02	.13	-.04	.11	.05	.05	.00	-.06		-.02	.08
33. Average work hours per day	-.17	-.14	-.30	-.27	.44	.40	-.21	-.20	-.25	-.21	.34	.33	-.06	.00	-.30	-.28	.44	.39	-.20	-.47	-.20	-.22	.22	.08	-.07	.22	-.28	-.32	-.22	.02	.35	-.14		.33
34. Night shifts in the past month	-.11	-.10	-.20	-.17	.31	.27	-.08	-.12	-.17	-.14	.27	.22	-.11	-.04	-.21	-.18	.30	.27	-.14	-.24	-.11	-.11	.09	-.04	.06	-.25	-.08	-.05	-.04	-.16	-.02		.36	

Note. Values are the mean estimate across the 50 imputed datasets.

Variables 1 through 18 are sleep climate dimensions. Word in parentheses denotes the referent of sleep climate (i.e., residency program or learning site).

"Old" denotes scale used in Studies 1 and 2, and "New" denotes scale composed solely of items introduced in Study 3.

Correlations at Times 1 and 2 are displayed below and above the diagonal, respectively.