Daily microbreaks in a self-regulatory resources lens: Perceived health climate as a contextual moderator via microbreak autonomy.

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Abstract

Grounded in self-regulatory resources and conservation of resources theories, the current research examines poor self-regulatory capacity as a precursor to microbreaks and their possible outcomes at work. Full-time employees completed multiple online surveys for 10 (n_1 = 779 daily observations) and 5 workdays (n_2 = 1,024 daily observations). In Study 1, multilevel path analysis results showed that on days when employees had poorer recovery at home (i.e., poor sleep quality), they experienced higher fatigue in the next morning (low self-regulatory capacity) and thus took microbreaks more frequently at work. In turn, their engagement in microbreaks was related to higher work engagement during the day and lower end-of-work fatigue. Furthermore, perceived health climate was found to moderate the path from morning fatigue to microbreaks. In Study 2, we replicated and confirmed the serial mediation paths found in Study 1 (poor sleep quality → morning fatigue → microbreaks → work engagement and end-of-work fatigue). Building on Study 1, Study 2 also identified microbreak autonomy as a mechanism by which perceived health climate moderates the path between morning fatigue and microbreaks (i.e., mediated moderation effect). Exploratory analyses discovered intriguing patterns of socialization microbreaks versus other microbreaks, providing further implications for the theoretical perspective. Overall, the findings support the theoretical resource perspective of microbreaks as an effective energy management strategy while at work.

Keywords: fatigue, microbreaks, perceived health climate, recovery, self-regulatory resources

Daily Microbreaks in a Self-Regulatory Resources Lens: Perceived Health Climate as a Contextual Moderator via Microbreak Autonomy

According to recent national surveys, more than 60% of the American adults find work to be a significant source of life stress, and more than one-third of working individuals report feeling tense and stressed out during their workday (APA, 2017; Work and Well-Being Survey, 2017). Likewise, many employees today face a "human energy crisis," in which their heavy workloads and long hours of work outstrip their capacity and hinder their energy renewal (Schwartz, 2011). Accordingly, organizational scholars have paid increasing attention to employees' momentary recovery and energy management strategies in the form of short breaks while at work (Fritz, Lam, & Spreitzer, 2011; Trougakos & Hideg, 2009). Specifically, empirical studies have shown the benefits of within-day work breaks for employee well-being and job performance (e.g., Hunter & Wu, 2016; Kim, Park, & Headrick, 2018; Kim, Park, & Niu, 2017; Kühnel, Zacher, de Bloom, & Bledow, 2017; Sianoja, Syrek, de Bloom, Korpela, & Kinnunen, 2018; Trougakos, Beal, Green, & Weiss, 2008; Zacher, Brailsford, & Parker, 2014; Zhu, Kuykendall, & Zhang, 2019).

From a theoretical standpoint, employees are said to draw on their energy—which is often likened to self-regulatory resources—to perform job tasks that mostly require effortful regulation of their affect and cognition (Beal, Weiss, Barros, & MacDermid, 2005). Ego-depletion theory posits that any kind of volitional act that requires self-control, such as completing tasks, can deplete one's resources (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Muraven & Baumeister, 2000). This theory further suggests that one must stop regulatory acts and rest to renew the depleted resources before tackling the next set of self-regulation tasks. Prior research on work breaks has shown that taking breaks at work is associated with lower fatigue and higher performance (for reviews, see Sonnentag, Venz, & Casper, 2017; Trougakos & Hideg, 2009). Overall, this line of research has suggested that even short respite activities during breaks can be effective energy management strategies to reenergize employees while at work.

Nevertheless, important theoretical and empirical questions remain unanswered with regard to *when* and *why* employees take more or fewer breaks on some workdays but not on other days. For instance, what happens on those days when employees start their work with little energy because of their poor recovery in the previous night? Does their initial energy level in the morning affect how often they take breaks at work? Human energy is thought to be dynamic, fluctuating over time depending on cycles of resource consumption and renewal through work and rest (Halbesleben, Neveu, Paustian-Underdahl, & Westman, 2014; Quinn, Spreitzer, & Lam, 2012). Similarly, conservation of resources (COR) theory posits that when individuals' resources are running out, they avoid effortful acts but instead seek to conserve and acquire resources to prevent further resource losses (Halbesleben et al., 2014; Hobfoll, Halbesleben, Neveu, & Westman, 2018). According to this proposition, employees should pursue frequent breaks on days when they come to work with poor energy levels. In fact, Fritz et al. (2011) found break activities to be *positively* related to fatigue but *negatively* related to vitality in their cross-sectional data; this outcome led them to speculate that employees may seek out more frequent work breaks when their energy level is already low. In contrast, this pattern was reversed in the study by Zacher et al. (2014), who found that break activities positively predict vitality but negatively predict fatigue within individuals.

In the present study, using the combined perspective of self-regulatory resources theory (Baumeister, Muraven, & Tice, 2000; Muraven & Baumeister, 2000) and COR theory (Halbesleben et al., 2014; Hobfoll et al., 2018), we contend that both depleted self-regulatory resources and rest/breaks should be interrelated. In other words, individuals' preceding state of poor self-regulatory resources will trigger frequent breaks during the workday, which will then help replenish the self-regulatory resources. Thus, on days when employees take breaks as often as necessary (triggered by low self-regulatory capacity in the morning), they should be able to restore their depleted resources, and this state may then be manifested in less fatigue at the end of work and better work engagement during the day (see our conceptual model in Figure 1). Stated differently, work breaks are expected to serve as a mediating variable that connects morning self-regulation resource states with those after work. To our knowledge, research has not empirically tested these interrelationships, even though the theoretical self-regulatory resources perspective suggests they are likely to occur (Baumeister et al., 2000; Trougakos & Hideg, 2009). Thus, we test the interconnected relationships via work breaks to enhance our understanding of why employees take more or fewer breaks on some workdays, as well as how breaks play a role in employees' fluctuating self-regulatory capacity.

Importantly, we also consider a situational context that allows work breaks to be an intervening mechanism by which employees turn around their initially poor self-regulation capacity for the rest of their workday. Although ego-depletion theory itself does not offer specific organizational contextual variables, it is reasonable to assume that not all workplaces espouse the value of work breaks to the same degree. For example, in some workplaces, certain types of break activities, such as napping or watching a fun YouTube clip, may not be viewed as authentic resource-replenishing behaviors. By contrast, other workplaces, depending on their organizational climate, may support and accept those activities as part of health and well-being promotion. Accordingly, we introduce the concept of perceived health climate (Zweber, Henning, & Magley, 2016) and theorize why employees' perception of the health climate may moderate the indirect relationship between poor morning self-regulatory capacity and later outcomes at work mediated by work breaks. This moderation test contributes to the theory and informs evidence-based management practices by identifying a potential boundary condition of the self-regulatory perspective in the context of daily work breaks.

Theoretical Background and Hypotheses Development

Theoretical Perspective of Resources and Microbreaks

The theory of self-regulatory resources posits that individuals have a central pool of internal resources that determines their capacity to control and regulate emotions, mental states, and behaviors in any given situation (Baumeister et al., 2000; Muraven & Baumeister, 2000). Its fundamental premise is that the inner resources reservoir is finite and may become drained over time as individuals exert any type of self-control or self-regulatory efforts, such as resisting temptations and matching their behaviors to social norms and rules (Muraven & Baumeister, 2000). In the workplace, employees must routinely engage in various forms of self-regulation (e.g., suppressing and displaying emotions, allocating and redirecting cognitive attention) to perform their job tasks and successfully meet their career and social goals (Beal et al., 2005).

More importantly, as individuals continue their regulatory activities (e.g., concentrating on tasks, regulating emotions), their subsequent self-regulatory efforts are likely to diminish as their resource pool is drained (Muraven & Baumeister, 2000). That is, one's self-regulatory resources operate like a muscle or an engine that becomes fatigued and strained when used continuously and, therefore, functions less effectively. Accordingly, individuals need to manage their self-regulation resources by taking breaks/rests (Baumeister, Tice, & Vohs, 2018; Inzlicht, Schmeichel, & Macrae, 2014). According to this theoretical proposition, employees are likely to avoid further regulatory activity when they are fatigued but instead rest to restore their low energy (Beal et al., 2005; Meijman & Mulder, 1998; Trougakos & Hideg, 2009). This theoretical perspective nicely dovetails with COR theory's proposition: When individuals encounter resource loss, they are motivated to preserve and acquire resources and avoid resource spending (Hobfoll et al., 2018). That is, employees are likely to attempt to replenish personal resources and avoid further resource losses by taking short respites at work. In the context of our conceptual model, this suggests that when employees' resources are drained or not fully restored, they are more motivated to take microbreaks to facilitate their resource gains for work-related activities.

Empirical research has pointed to within-day work breaks as a way to cease continual resource consumption and renew energy (see Trougakos & Hideg, 2009, for a review). Among the various types of work breaks (e.g., lunch breaks, or formally structured work breaks), *microbreaks,* in particular, can conveniently serve as a resource-replenishing strategy as they refer to short respites that are taken informally and voluntarily when needed between task episodes (Kim et al., 2017, 2018). While the concept of microbreaks in organizational science was introduced as a brief, discretionary break that individuals take at work, the term is originated from and is used in the ergonomics literature as a purposeful respite that alleviates physical symptoms such as musculoskeletal discomfort (McLean et al., 2001). In ergonomics, microbreaks are defined as a scheduled rest that individuals take to prevent the onset or progression of physical discomforts and are often operationalized in the intervention contexts as having a specific length, frequency, and timing. Following the previous literature in organizational psychology (cf., Bennett, Gabriel, & Calderwood, 2019; Fritz et al., 2011; Kim et al., 2017; 2018; Zhu et al., 2019), the current study defines microbreaks as employees' unscheduled, brief respites that are voluntarily taken for momentary recovery at work. During these discretionary breaks, employees can engage in their preferred respite activities, including relaxation (e.g., stretching, a quick power nap), nutrition intake (e.g., having caffeinated or non-caffeinated beverages and snacks), socialization (e.g., calling significant others, chatting with coworkers about nonwork matters), and cognitive activities (e.g., reading a magazine for fun; Kim et al., 2017, 2018; cf. Fritz et al., 2011).

In regard to self-regulation resource cycles during workdays, prior research has mostly painted a partial picture—one which work breaks reenergize individuals, thereby resulting in higher well-being and performance and lower strains (e.g., Hunter & Wu, 2016; Kim et al., 2018; Trougakos et al., 2008; Zacher et al., 2014; Zhu et al., 2019). In this study, we assemble a more complete picture to better explain what makes employees take more or less frequent microbreaks and which subsequent experiences follow these respite periods. In essence, our prediction is grounded in the theoretical lens of resources: When individuals' self-regulatory resources are running low in the morning (resource loss), they will engage in more rest/breaks as a way to replenish their resource pool (Baumeister et al., 2000; Hobfoll et al., 2018; Inzlicht et al., 2014). This theoretical proposition is tested in the first part of the model in Figure 1, in which the previous night's poor recovery and its resultant morning states (low regulatory capacity) lead to frequent microbreaks. More specifically, we test the relationship between poor nightly sleep and morning fatigue as well as the relationship between morning fatigue and subsequent engagement in microbreaks while at work.

Previous Night's Poor Sleep Quality, Morning Fatigue, and Microbreaks at Work

Sleep is a primary method of daily human restoration, both psychological and physiological (Hursh et al., 2004). Importantly, sleep affects the executive function of the brain, which controls human emotions, cognition, and behaviors; thus, it is essential for individuals' self-regulation capacity (Baumeister et al., 2000; Hobson, 2005). Accordingly, research has assessed employees' sleep as an important recovery activity in the personal life domain, which could subsequently influence their self-regulatory resource level the following day. For example, prior research on sleep has found that employees' deprived sleep and poor quality sleep were associated with their lower positive affect (Barnes, Guarana, Nauman, & Kong, 2016; Sonnentag, Binnewies, & Mojza, 2008), higher negative affect (Sonnentag et al., 2008), and more depletion the following morning at work (Barnes et al., 2016; Lanaj, Johnson, & Barnes, Welsh, Ellis, Christian, & Mai, 2014). A recent meta-analysis also revealed that employees' feelings of sleepiness resulting from poor sleep quality were related with their affect, cognition, and behavior at work (Litwiller, Snyder, Taylor, & Steele, 2017). As shown in prior research, nightly sleep is a key process by which individuals rejuvenate their mind and body from the wear and tear of daily stress; thus, their report of sleep quality in the morning reflects how well they restored their self-regulatory resources at night (Barnes, 2012). That is, sleep is an important daily process of resource restoration that affects individuals' resource levels in the morning, such as morning fatigue.

Hypothesis 1: *Previous night's poor sleep quality (assessed in the morning) is positively related to the following day's morning fatigue.*

The *Merriam-Webster Online Dictionary* (2019) defines fatigue as a state of "weariness or exhaustion from labor, exertion, or stress." Conceptually, fatigue is inversely related to energy; that is, fatigue represents a state of impaired physical and cognitive functioning (Shen, Barbera, & Shapiro, 2006). As such, fatigue has been commonly assessed as an internal state indicator of "depleted ego" or "lack of self-regulatory resources" (e.g., Gross et al., 2011; Muraven, Tice, & Baumeister, 1998; Trougakos, Beal, Cheng, Hideg, & Zweig, 2015). Self-regulatory resources and COR theories suggest that individuals' poor regulatory capacity (lack of resources) shifts their volitional acts from self-regulatory activities (e.g., work, labor) to non-regulatory activities (e.g., rest, leisure) in an attempt to renew their depleted inner resources (Baumeister et al., 2000; Hobfoll et al., 2018; Inzlicht et al., 2014). In other words, the theoretical proposition predicts that employees will engage in microbreaks more frequently on days when they experience greater morning fatigue (low self-regulation capacity) to avoid complete resource depletion and restore their resources pool, compared to other workdays with less morning fatigue. Thus, we hypothesize the following:

Hypothesis 2: *Morning fatigue is positively related to frequent microbreaks.*

Serial Mediation to Predict Work Engagement and End-of-Work Fatigue

In the second part of the model in Figure 1, we propose that microbreaks will mediate the relationships between individuals' poor nightly sleep at home and low self-regulatory resource states at the start of work and their subsequent experiences at work—namely, a lower fatigue level at the end of work and higher work engagement during the day. The combined perspective of resources (Halbesleben et al., 2014; Hobfoll et al., 2018; Muraven & Baumeister, 2000) suggests that lack of resources (poor resource state) leads to actions to conserve and obtain resources (rest/breaks), and that once individuals' self-regulatory resources are replenished through rest, those persons become less strained and more capable of addressing work tasks with renewed strength. Likewise, empirical research has consistently linked microbreaks to lower strain and better work outcomes as microbreaks can provide momentary respites from effortful tasks to replenish resources (e.g., Kim et al., 2018; Zacher et al., 2014; Zhu et al., 2018). In short, microbreaks are expected to serve as a resource-replenishing mechanism connecting employees' initial resource states to their outcomes while at work. Thus, we expect that individuals' restored resources via microbreaks will be reflected in their low fatigue at the end of the work. From a conceptual perspective, microbreaks help to rejuvenate employees from their morning fatigue, such that they will be less fatigued at the end of workday (Gross et al., 2011; Sonnentag & Geurts, 2009). In essence, as employees' resource states undergo daily fluctuations, taking frequent microbreaks serves as an important mediator between their pre- and post-work fatigue. That is, on days when employees had poor sleep in the previous night and thus experience high morning fatigue, they will take more microbreaks based on their needs to conserve and restore their resources and, therefore, they will experience less fatigue at the end of work.

Hypothesis 3a (serial mediation): *Previous night's sleep quality has serial-mediated relationships with end-of-work fatigue via morning fatigue and microbreaks. In other words, when employees experience poor sleep quality in the previous night, they are likely to experience a higher level of fatigue in the next morning and thus take more frequent microbreaks at work; in turn, employees will experience less end-of-work fatigue.*

In addition, according to the resource theories (Hobfoll et al., 2018; Muraven & Baumeister, 2000), timely resource recovery through microbreaks will be beneficial not only for employees' fatigue at the end of work but also for their work-related experiences because employees can use their restored resources for conducting job tasks. Likewise, within-subjects research has found that taking work breaks is positively related to mental and affective resources, such as feeling motivated and energetic, and being able to concentrate (e.g., Hunter & Wu, 2016; Kim et al., 2018; Zacher et al., 2014; Zhu et al., 2019), which are all important to task conduct. Thus, we test *work engagement* as a positive work experience that captures a positive, fulfilling, and motivational state of work-related well-being (Bakker, Schaufeli, Leiter, & Taris, 2008;

Schaufeli, Bakker, & Salanova, 2006). In essence, work engagement represents the extent to which individuals experience their work as stimulating and energetic (vigor), meaningful and significant (dedication), and interesting and captivating (absorption) (Schaufeli et al., 2006). The theoretical resource perspective suggests that microbreaks may allow individuals' poor resource state to recover and thus support optimal work experiences in the next working periods. In other words, resource-depleted individuals, when given the opportunity to rest and relax, can subsequently perform well (cf. Hagger, Wood, Stiff, & Chatzisarantis, 2010). Thus, we hypothesize that microbreaks will have an intervening role in turning around one's poor self-regulatory resource state (i.e., morning fatigue due to poor nightly sleep) and thus allowing for more energetic, focused work experiences.

Hypothesis 3b (serial mediation): *Previous night's sleep quality has serial-mediated relationships with work engagement via morning fatigue and microbreaks. In other words, when employees experience poor sleep quality in the previous night, they are likely to experience a higher level of fatigue in the next morning and thus take more frequent microbreaks at work; in turn, employees will experience more work engagement.*

Perceived Health Climate as a Cross-Level Moderator

Employees' working conditions may differ in terms of whether they can freely engage in resource-replenishing activities between their task-focused endeavors when they have experienced resource loss. Indeed, we propose that not all employees are equally able to take microbreaks as frequently as they wish when their self-regulatory resources are running low. According to Hobfoll and colleagues (2018), individuals' dynamic resource conservation−acquirement processes are contingent upon supportive versus undermining environmental conditions. This suggests that supportive working conditions can serve as an important contextual resource for facilitating the within-person path from poor resource states to resource-gaining activities. Thus, as an important contextual factor, we introduce *organizational health climate,* defined as "employee perceptions of active support from coworkers, supervisor, and upper management for the physical and psychological well-being of employees" (Zweber et al., 2016, p. 250). This multifaceted construct captures employees' perceptions about how each of the three sources supports employee health and well-being. The workgroup factor addresses (1) how norms and expectations about health and health-related behaviors are communicated and encouraged while interacting with coworkers. Moreover, as workplace climate emerges through not only employee interactions but also organizational policies and procedures and supervisory practices (Schneider & Reichers, 1983), this construct includes (2) supervisory support and encouragement for employee health and (3) organizational resources for and responsiveness to employee health. Zweber et al. (2016) theorized that those three elements are critical to establishing a healthy workplace, and this health climate can be assessed as an overall latent construct. In this study, we focus on individuals' subjective perception of the organizational health climate and, therefore, use the term *perceived health climate*.

Generally, climate refers to how individuals in an organization make sense of their environment, including its norms, values, attitudes, and behaviors (Reichers & Schneider, 1990). The perceived health climate, depending on its levels, may either promote or inhibit the way employees replenish their self-regulatory resources in the workplace. Conceptually, under the high health climate condition, employees may view taking microbreaks as an appropriate and viable resource-replenishing strategy, especially when their self-regulation capacity is running low. For example, when employees perceive their colleagues, supervisor, and organization to be highly supportive of health and well-being, they are likely to feel safe in deciding whether or how often they take discretionary breaks in need for recovery. In contrast, in an unsupportive health climate, discretionary respite activities (e.g., napping, chatting about nonwork matters, enjoying social media) may be considered counterproductive and frowned upon. Employees working in such an unsupportive health climate are likely to refrain from taking microbreaks even when they need to repair their self-regulatory capacity for the rest of their workday. In sum, as health climate signals organizational members about (un)welcomed or (un)desirable behaviors related to well-being or resource management at work (Zweber et al., 2016), its perceptions will serve as a moderating factor in the path from morning resource states to microbreaks in our model.

Hypothesis 4: *Perceived health climate moderates the link between morning fatigue and microbreaks. The day-level relationships will be stronger (versus weaker) for employees who perceive a higher (versus lower) health climate.*

Combining the previous set of hypotheses (H1−H4), we further extend our prediction that the magnitude of the indirect effects of morning self-regulatory resources on the two outcomes via microbreaks will vary depending on the levels of perceived health climate. That is, when perceiving a high health climate, employees will feel liberated to take frequent microbreaks as needed to improve their initially poor morning states so as to manage resource levels and produce better work outcomes (low end-of-work fatigue, high work engagement). In contrast, for those who perceive a low health climate, microbreaks are less likely to serve as a mediator because they may feel discouraged from taking microbreaks, despite their need for resource restoration.

Hypothesis 5: *Perceived health climate moderates the serial indirect effects of poor sleep quality on (a) end-of-work fatigue and (b) work engagement via morning fatigue and microbreaks, such that the serial indirect effects will be stronger (versus weaker) for employees who perceive a higher (versus lower) health climate.*

Study 1

Method

Sample and procedure. We posted an online advertisement on several network and communities websites for about two weeks (e.g., professional group pages in Facebook, volunteer sections in Craigslist) to recruit participants who resided in the United States and worked full-time during standard daytime hours in offices. The advertisement contained information about eligibility for participation, the study procedure and compensation (i.e., $40 online gift card), and a web link to our initial survey (T0). Interested participants completed the initial survey, which assessed demographic information and the moderator (i.e., perceived health climate). A total of 203 eligible participants completed the initial survey. About two weeks after the initial survey, they answered two daily surveys for 10 workdays from Monday to Friday. Specifically, we emailed an online survey link every morning at 8:30 a.m. (T1) to assess morning fatigue and last night's sleep quality. The second email with another link was sent at the end of workday at 6 p.m. (T2) to measure daily microbreaks, work engagement, end-of-work fatigue, and control variables. To promote responses, friendly reminders were emailed. All of the survey links and reminders were sent according to participants' local time zone (i.e., Pacific, Mountain, Central, and Eastern Time).

As commonly occurs in daily diary research, 105 participants skipped some of the daily surveys (*n* = 27; e.g., completing only morning or end-of-work surveys) or did not complete any daily surveys after the first phase (n = 78). We removed them from the analysis, so our final sample included 98 participants (48% of 203 individuals). Multiple independent t-tests showed that the final sample did not significantly differ from those removed in terms of age, job tenure, and perceived health climate (p-values = .27−.72). The final sample provided 779 day-level data points out of 980 points possible (98 participants × 10 workdays), yielding a compliance rate of 79%. On average, participants completed the morning survey at 9:13 a.m. (*SD* = .47) and the end-of-work survey at 6:17 p.m. (*SD* = .83). The final sample consisted of 51% women and 49% men. On average, they were 35.42 years old (*SD* = 7.58) and had worked in their current job for 4.32 years (*SD* = 4.21). The majority of participants held a bachelor's or higher degree (88.8%). A wide variety of industries was represented, including manufacturing (38.8%), IT and technology (15.3%), health services (10.2%), sales (9.2%), hospitality (6.1%), farming/mining/fishing (5.1%), education (4.1%), and others (11.2%). The data reported in this article were part of a larger data collection (North Carolina State University #IRB-12686; Recovery processes, leisure, and well-being), some of which were reported in another published article (Cho & Kim, in press).

Daily measures.

Lastly night's poor sleep quality. The morning survey assessed the previous night's sleep quality with a single item from the Pittsburgh Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989): "How would you evaluate your previous night's sleep?" (1 = *Very poor* to 5 = *Very good*). This valid single-item measure is widely used in daily diary studies, as it is highly correlated with the full Pittsburgh Sleep Quality Index (Hahn, Binnewies, Sonnentag, & Mojza, 2011). We reverse-coded the responses to indicate poor sleep quality.

Fatigue. We assessed employees' fatigue level both in the morning as an independent variable and at the end of the workday as a dependent variable, using four items from McNair, Lorr, and Droppleman's (1971) scale. Participants rated their agreement with how well each item described their current state *in the morning* or *at the end of the work*. The descriptors included fatigued, tired, exhausted, and spent (1 = *Strongly disagree* to 5 = *Strongly agree*). Across observations, the average Cronbach's alpha was .96 for morning fatigue and .91 for end-of-workday fatigue.

Microbreaks. Daily microbreaks were assessed in the end-of-work survey with a formative measure developed by Kim et al. (2017, 2018), which was originally adapted from Fritz and colleagues' (2011) scale. The nine items included short descriptions of prototypical microbreaks activities: two items each for relaxation, nutrition-intake, and cognitive activities; and three items for social activities. In line with the definition of microbreaks, participants were instructed to recall their *short, informal breaks taken voluntarily during their work hours* and then rate how often they engaged in the four types of microbreaks (1 = *Never* to 5 = *Very frequently*). Sample items included "stretching, walking around the office, or physically relaxing for short minutes" for relaxation breaks; "drinking caffeinated beverage (e.g., coffee, energy drinks, or black tea)" for nutrition-intake breaks; "chatting with coworkers on nonwork related topics" for social breaks; and "reading book chapters, newspapers, or magazine for personal learning or entertainment" for cognitive breaks. Because microbreaks were defined by the combination of the activities as a formative measure, we did not calculate the coefficient alpha (Diamantopoulos & Siguaw, 2006).

Work engagement during the workday. We used the nine-item Utrecht Work Engagement Scale (Schaufeli et al., 2006) to assess work engagement during the workday as a dependent variable. Participants rated their agreement with each item describing their work engagement experiences during the workday (1 = *Strongly disagree* to 5 = *Strongly agree*). The scale measures three components of work engagement: vigor, dedication, and absorption. Example items included "Today, at work, I felt bursting with energy" (vigor), "Today at work, I was proud of the work that I did" (dedication), and "Today at work, I was immersed in my work" (absorption). The composite score was used to reflect an overall work engagement for each day, and the average Cronbach's alpha was .87 across times.

Control variables. We controlled for sleep quantity to focus on the effects of sleep quality on microbreaks. A single item was used to assess sleep hours: "How many hours did you sleep last night?" We also measured day-specific working hours and workload at the end of work as control variables because they could simultaneously influence employees' engagement in microbreaks (mediator) as well as end-of-work fatigue and work engagement (outcomes). A single item was used to assess work hours: "How many hours did you work today?" Three short items adapted from the Quantitative Workload Inventory (Spector & Jex, 1998) were used to assess workload (e.g., "Today, I had a lot of work to do"; 1 = *Strongly disagree* to 5 = *Strongly agree*). The average Cronbach's alpha for workload was .83 across observations. We also controlled for the potential effects of linear (day) and nonlinear trends (sine and cosine) in our model as there may be linear and cyclical trends in repeatedly measured affect, cognition, and behaviors (Beal & Weiss, 2003).

Between-person measure. *Perceived health climate* was measured in the initial survey with Zweber et al.'s (2016) fully validated 10-item scale of Multi-Faceted Organizational Health Climate Assessment. Participants indicated their agreement to statements that described three facets of the health climate (1 = *Strongly disagree* to 5 = *Strongly agree*). Example items were

"If my health were to decline, my coworkers would take steps to support my recovery" (workgroup facet), "My supervisor encourages healthy behaviors in my workgroup" (supervisor facet), and "My organization provides me with opportunities and resources to be healthy" (organization facet). The Cronbach's alpha was .83.

Construct validity. We performed a multilevel confirmatory factor analysis (MCFA) to evaluate the fit of the measurement model. The measurement model included day-specific workload, fatigue, and work engagement at the within-person level (three Level-1 factors), and organizational health climate at the between-person level (one Level-2 factor), but we did not include microbreak as its measure is a formative scale. Results revealed that the hypothesized measurement model with four factors fit to the data well ($\chi^2_{(df = 136)} = 214.61$, $p < .001$; CFI = .99; RMSEA = .03; and $SRMR_{within} = .03$; $SRMR_{between} = .06$). This model showed better fit than the alternative two-factor model which included one within-person level factor (all within-person factors combined) and one between-person level factor ($\chi^2_{(df = 139)} = 4750.26$, $p < .001$; CFI = .73; RMSEA = .21; and $SRMR_{within} = .21$; $SRMR_{between} = .07$). Thus, our four-factor model fit was superior to the two-factor model fit ($\Delta\chi^2 = 4535.65$; $\Delta df = 3$, $p < .001$). That is, our results provided construct validity evidence of the four latent constructs in the current data.

Analytical Approach

Because of the nested structure of our data (daily responses within individuals), we simultaneously estimated all path coefficients, using maximum likelihood estimation with robust standard errors (MLR), in the multilevel path analysis model (Figure 1). The path analyses were conducted with Mplus 7.4 (Muthén & Muthén, 2007). The day-level predictors (i.e., morning fatigue, sleep quality) and control variables (i.e., sleep quantity, work hour, and workload) were centered at each person's mean scores to remove between-person variances in these variables, so that the within-person relations in our model were not confounded by individual differences (Ilies et al., 2007). The moderator, perceived health climate, was modeled as a person-level variable, representing differences across participants. We centered the moderator variable at the grand mean so that our cross-level moderation estimates could strictly reflect the effects of between-person differences.

One-way random-factor ANOVA results and variance decomposition at Level-1 and Level-2 showed that it was appropriate to use multilevel modeling for the current data analyses: employees' poor sleep quality [ICC(1) = .70, $F(97, 778) = 8.13$, $p < .001$], morning fatigue [ICC(1) = .47, $F(97, 778) = 12.19$, $p < .001$], microbreaks [ICC(1) = .67, $F(97, 778) = 36.78$, $p < .001$], end-of-work fatigue [ICC(1) = .47, $F(97, 778) = 8.51$, $p < .001$], and work engagement [ICC(1) = .75, $F(97, 778) = 12.79$, $p < .001$]. Thus, substantial variability was due to within-person fluctuations in poor sleep quality (30.3%), morning fatigue (52.7%), microbreaks (32.7%), end-of-work fatigue (53.3%), and work engagement (24.8%; see Table 1). To test our mediation hypotheses, we used the bootstrapping method for multilevel mediation at Level 1-1-1 to obtain bias-corrected 95% confidence intervals (CIs) around the observed values of indirect effects, as indirect effects are typically not normally distributed (Bauer, Preacher, & Gil, 2006). For this analysis, we used the open-source software R to analyze the fixed-effect indirect effects of morning resources on outcome variables via microbreaks, found at http://www.quantpsy.org/medmc/medmc.htm.

Results

Preliminary analyses. Table 2 presents means, standard deviations, reliability estimates, and intercorrelations of the study variables. As expected, at the within-person level, previous night's poor sleep quality was significantly related to morning fatigue ($r = .32$, p

< .001). Morning fatigue was also positively related to both microbreaks ($r = .35$, $p < .001$) and fatigue at the end of work ($r = .14$, $p < .001$), but negatively related to work engagement during the workday ($r = –.14$, $p < .001$). Microbreaks were positively associated with employees' end-of-work fatigue ($r = –.19$, $p < .001$) and work engagement ($r = .21$, $p < .001$).

Hypotheses testing. Table 3 displays the results from the multilevel path analysis.[1] We used Snijders and Bosker's (1999) formulas to calculate pseudo-R^2 for the effect sizes in predicting the strain outcome. Predictors in the current model accounted for 40% of the total variance in work engagement and 58% of the variance in end-of-work fatigue, suggesting that the model explained a sizable portion of the variation in the outcome variable. Hypothesis 1 predicted a positive relationship between previous night's poor sleep quality and morning fatigue. After controlling for sleep quantity and temporal variables, the results showed that previous night's poor sleep quality was positively associated with the following day's morning fatigue ($\gamma = .32$, $p < .001$), supporting Hypothesis 1. The results suggested that on days when employees had poorer sleep in the previous night, they tended to experience higher level of fatigue the next morning. Hypothesis 2 predicted a positive relationship between morning fatigue and microbreaks. Our results showed that morning fatigue was positively associated with microbreaks ($\gamma = .13$, $p < .001$) after controlling for daily work hours, workload, and temporal variables, which supported Hypothesis 2. Thus, on days when employees experienced higher fatigue in the morning, they tended to take more frequent microbreaks at work.

Hypothesis 3 predicted the serial mediation effect: poor sleep quality → morning fatigue → microbreaks → (a) end-of-work fatigue and (b) work engagement. Our bootstrapping results

[1] The results presented here are based on the model without demographic variables (i.e., sex, job tenure, industry, age). We did not include them because they did not affect the significance of our hypothesis testing results when included in the model (cf. Becker, 2005).

showed that the indirect effect of previous night's poor sleep quality on end-of-work fatigue via morning fatigue and microbreaks was –.008, with a 95% bias-corrected bootstrap CI from –.017 to –.003. The indirect effect of poor sleep quality on work engagement via morning fatigue and microbreaks was .007 (95% CI [.002, .015]). As the CIs for both directions did not include zero, both H3a and H3b were supported.

For the cross-level moderation effect of perceived health climate on the within-person relationship between morning fatigue and microbreaks (H4), the results revealed that perceived health climate was positively associated with the random slope of morning fatigue on microbreaks ($\gamma = .08$, $p = .001$ in Table 3). Following Preacher, Curran, and Bauer (2006), we conducted simple slope tests to confirm the nature of the moderation effect. As shown in Figure 2, under the low perceived health climate (–1 *SD*), the within-person link between morning fatigue and microbreaks was not significant ($\gamma = .04$, $p = .275$), but it was significantly positive ($\gamma = .22$, $p < .001$) under the high perceived health climate (+1 *SD*). The difference between the two slopes was also significant ($\Delta\gamma = .18$, $p = .001$), which supported Hypothesis 4. These results suggest that only employees working in high health climate are likely to take micro-breaks on days when they have greater morning fatigue than their counterparts working in low health climate.

Last, following the method recommended by Preacher, Rucker, and Hayes (2007), we tested the conditional indirect effects to determine whether the estimated serial indirect effects differed for lower (–1 *SD*) versus higher (+1 *SD*) perceived health climate (H5). The results showed that the indirect effect of poor sleep quality on end-of-work fatigue via morning fatigue and microbreaks was significant under a *high* perceived health climate (–.014; 95% CI [–.029, –.003]), but became nonsignificant under a *low* perceived health climate (–.002; 95% CI

[–.008, .003]). The difference between these two indirect effects (at high versus low climate) was also significant (–.012; 95% CI [–.025, –.002]), supporting Hypothesis 5a. Similarly, the indirect effect of poor sleep quality on work engagement via morning fatigue and microbreaks was significant under a *high* perceived health climate (.012; 95% CI [.004, .025]), but became nonsignificant under a *low* health climate (.002; 95% CI [–.004, .008]). The difference between these two indirect effects (at high versus low climate) was also significant for work engagement outcome (.010; 95% CI [.002, .022]); hence, Hypothesis 5b was supported.

Supplementary analyses. Given that previous research (Kim et al., 2017, 2018) differentiated microbreaks into four categories (i.e., relaxation, nutrition-intake, social, and cognitive breaks), we conducted a series of supplementary analyses to explore the four types of microbreaks in detail. For example, a recent study showed differential effects of lunch break activities (Trougakos, Hideg, Cheng, & Beal, 2014): Socialization during lunch breaks was positively related to end-of-work fatigue but its resource-replenishing effect occurred only for employees with a high lunch-break autonomy. In our analyses, after controlling for daily work hours and workload, we tested a multilevel path model in which poor sleep quality predicted the two outcomes (end-of-work fatigue, work engagement) through morning fatigue and the four types of microbreaks. The path analyses results showed that morning fatigue predicted more frequent relaxation ($\gamma = .34$, $p < .001$), nutrition-intake ($\gamma = .11$, $p = .022$), and cognitive microbreaks ($\gamma = .33$, $p < .001$). But, unexpectedly, morning fatigue predicted *less frequent* social microbreaks ($\gamma = –.29$, $p < .001$). These results suggested that on days when employees have low self-regulation capacity in the morning, they tend to take *more* relaxation, nutrition-intake, and cognitive breaks, but *fewer* social breaks.

In addition, relaxation and cognitive microbreaks were negatively related to end-of-work fatigue ($\gamma = -.16$, $p = .015$ for relaxation breaks; $\gamma = -.16$, $p = .001$ for cognitive breaks) but positively related to work engagement ($\gamma = .12$, $p = .019$ for relaxation breaks; $\gamma = .10$, $p = .021$ for cognitive breaks). Nutrition-intake breaks were not related to end-of-work fatigue ($\gamma = -.03$, $p = .524$) but were positively related to work engagement ($\gamma = .08$, $p = .018$). Intriguingly, social microbreaks were positively related to end-of-work fatigue ($\gamma = .19$, $p = .007$)—which is consistent with Trougakos et al.'s (2014) finding—as well as to work engagement ($\gamma = .08$, $p = .043$). We revisit these exploratory findings in the discussion section.

Discussion

Study 1 supported the notion that microbreaks as short, voluntary respite activities represent a timely resource management strategy during work hours. Specifically, our path analysis results showed that poor sleep quality was positively related to morning fatigue which, in turn, was associated with more frequent engagement in microbreaks. Such engagement in microbreaks at work served as a resource-replenishing activity, leading to lower end-of-work fatigue and higher work engagement during the day. These serial mediated relationships at the day level were significant only for employees who perceived a high health climate but were not significant for those who perceived a low health climate. That is, the individually perceived health climate moderated the relationships.

Furthermore, our supplementary analysis revealed some interesting patterns of microbreaks. When individuals' self-regulation capacity was low, they were likely to refrain from social interactions during breaks but rather engage in relaxation, nutrition-intake, and cognitive breaks. This pattern leads us to speculate that self-regulation efforts might not be completely held at bay during social breaks at work (e.g., impression management). Intriguingly, unlike relaxation or cognitive microbreaks, social microbreaks were positively related to both end-of-work fatigue and work engagement. This result partly aligns with a recent finding that social interactions at work could promote job engagement, as employees gain inspiration, energy, and motivation from others during such activities (Owens, Baker, Sumpter, & Cameron, 2016). Although Owens et al. (2016) focused on the receivers of relational energy, they pointed out that employees may reciprocate the "energizer" role (giving energy to others) in social interactions; hence, those who constantly "energize" others may become exhausted themselves. In that sense, frequent social breaks might have taken a toll on employees' fatigue in our study, although they were positively related to work engagement. In addition, nutrition-intake breaks were positively related to work engagement but unrelated to end-of-work fatigue. This finding suggests that nutritional supplementation through snacks and beverages might facilitate task engagement but does not necessarily decrease fatigue levels (Hagger et al., 2010).

While Study 1 showed initial support for the conceptual model in Figure 1 based on the self-regulation resources and COR theories, we needed to further address four areas in Study 2 to provide stronger support for our hypotheses. First, the concurrent assessments of the mediator and outcome variables in Study 1 limit our ability to make causal inferences. Second, although Study 1 provided initial evidence for the moderating role of perceived health climate, we did not examine *how* it moderates the day-level relationships. Determining the exact mechanism underlying its moderation effect can clarify why perceived health climate allows individuals to take microbreaks when they are experiencing fatigue. Third, Study 1 used a sample consisting of only office workers in the United States, which limited the generalizability of the findings. Replicating the findings in another sample from a different background would further strengthen the external validity of the study findings.

Study 2

Overview

Building on the Study 1 findings, Study 2 expanded the model depicted in Figure 1. First, we separated the measurement points for the mediators and the outcome variables in our data collection through an experience sampling method (ESM). Next, our expanded model proposes microbreak-specific autonomy as an important mediator for the moderating effect of perceived health climate.

Mediated Moderation Effect of Perceived Health Climate via Microbreak Autonomy

To explain the moderating effect of perceived health climate on the link between morning fatigue and microbreaks, we propose employees' perceived control of microbreaks at work—namely, *microbreak autonomy*—as an explanatory mechanism. Perceived control, in general, refers to the degree to which individuals can decide an action at their discretion (Karasek & Theorell, 1990). Likewise, microbreak autonomy represents individuals' perceived ability to choose freely when to take short respites and how they will spend their breaks at work (cf. Sonnentag & Fritz, 2007; Trougakos et al., 2014). We contend that under a supportive health climate in which well-being and health are advocated and valued, employees may develop a greater sense of autonomy over their microbreaks as their coworkers and boss endorse various respite activities at work. COR theory also views individuals' autonomy and control as important resources that can facilitate resource-gain processes (Halbesleben et al., 2014; Hobfoll, 2011; Hobfoll et al., 2018). In other words, employees with greater microbreak autonomy may be able to exert discretionary control over planning and execution of their brief respite activities however they want, which will strengthen the path from morning fatigue to frequent engagement in microbreaks. Thus, we hypothesize that employees' perception of health climate is positively linked to their sense of microbreak autonomy, which is the mechanism by which perceived health climate moderates the relationship between morning fatigue and microbreaks.

Hypothesis 6: *Perceived health climate is positively related to microbreak autonomy.*

Hypothesis 7: *Microbreak autonomy moderates the relationship between morning fatigue and microbreaks. The day-level relationship will be stronger (versus weaker) for employees who perceive higher (versus lower) microbreak autonomy.*

Hypothesis 8 (mediated moderation): *Microbreak autonomy mediates the moderating effect of perceived health climate on the link between morning fatigue and microbreaks.*

In addition, combining H3 (serial mediation) and H5 (moderation), we test whether the within-person indirect effect of poor sleep quality on end-of-work fatigue and work engagement via morning fatigue and microbreaks differ by the levels of microbreak autonomy.

Hypothesis 9: *Microbreak autonomy moderates the day-level indirect effect of poor sleep quality on (a) end-of-work fatigue and (b) work engagement via morning fatigue and microbreaks, such that the indirect effect is stronger (versus weaker) for employees with high (versus low) microbreak autonomy.*

Method

Sample and procedure. We collected an ESM data from 222 full-time office workers for five consecutive workdays in South Korea. Participants were recruited in two ways. First, one of the authors used his personal network to contact upper managers from three educational organizations and two health care service organizations for their employees' study participation. Upon receiving organizational approval, their human resources managers posted the study advertisement on their intranet and/or on the bulletin boards in the office buildings. These recruitment advertisements included information about the study procedure for participating in the multiple surveys, compensation for participation (a $30 gift card per person), and the researcher's email address. Second, a similar advertisement was posted on community websites for office workers (i.e., café.naver.com, and café.daum.net) to increase the sample size. To be eligible for participation, respondents had to meet the following criteria: They were full-time employees who had a regular daytime work schedule (no shift workers), and they had a fixed lunchtime that offered an hour-long break (i.e., 12:00−1:00 p.m.). Interested participants contacted the researchers via email, and we provided an initial survey link.

A total of 353 eligible participants completed the initial survey, which assessed demographic information, perceived health climate, and microbreak autonomy (T0). About two weeks after the initial survey, respondents answered three daily surveys for five days from Monday to Friday. We separated the measurement points for poor sleep quality and morning fatigue (T1), microbreaks (T2), and outcome variables (T3). Specifically, we emailed the T1 survey link every morning at 8:30 a.m. to assess previous night's sleep hours, sleep quality, and morning fatigue. Next, we sent the T2 survey link right after the lunch hour at 1:00 p.m. to measure microbreaks during the morning work hours (e.g., 8:30 a.m. to 12:00 p.m.) and lunch-hour satisfaction (control variable). The last email was sent with the T3 survey link at the end of each workday at 6 p.m. to measure end-of-work fatigue and work engagement, and work hours and workload (control variables). To promote responses, friendly reminders were also sent.

As commonly occurs in daily diary research, many participants skipped some of the daily surveys (n = 88; e.g., completing only morning, afternoon, or end-of-work surveys) or did not complete any daily surveys after the first phase (n = 43). We removed those 131 participants from the analysis, so our final sample included 222 participants (63% of 353 individuals). Multiple independent t-tests showed that the final sample did not significantly differ from those removed in terms of their age, job tenure, perceived health climate, and microbreak autonomy (*p*-values = .34−.81). The final sample provided 1,024 day-level data points out of 1,110 points possible (222 participants × 5 workdays), yielding a compliance rate of 92%. On average, participants completed the T1 morning survey at 9:18 a.m. (*SD* = .51), the T2 afternoon survey at 1:27 p.m. (*SD* = .43) and the T3 end-of-work survey at 6:42 p.m. (*SD* = .86). The final sample consisted of 37% women and 63% men. On average, they were 36.48 years old (*SD* = 8.14) and had worked in their current job for 5.19 years (*SD* = 4.78). The majority of participants held a bachelor's or higher degree (70%). A wide variety of industries was represented, including health care and service (31.4%), manufacturing (22.3%), education (20.1%), IT and technology (13.1%), and others (13.1%). The data reported in this article was the first publication as part of a larger data collection effort (National University of Singapore #DER-19-0820; Employee recovery and its effects).

Measures. We used the same measures from Study 1 to assess the focal study variables: poor sleep quality, fatigue, microbreaks, work engagement, and perceived health climate. In addition to the same measures of control variables from Study 1, we added lunch-break satisfaction to partition out its possible effect on end-of-work fatigue and work engagement (e.g., Bosch, Sonnentag, & Pinck, 2018; Trougakos et al., 2014). A single item was used to assess lunch-break satisfaction (T2): "Today, I am satisfied with my lunch break activities" (1 = *Strongly disagree* to 5 = *Strongly agree*). Cronbach's alphas are reported in Table 5.

Microbreak autonomy. We adapted the four items of leisure-time control from the Work Recovery Experience Questionnaire developed by Sonnentag and Fritz (2007) to assess perceptions of autonomy over microbreaks. The items were: "During my breaks … (1) I can decide for myself what to do," (2) "I determine for myself how I will spend my time," (3) "I can do exactly what I want to do," and (4) I can decide my own break schedule during my workday" (α = .89).

Construct validity. We performed a multilevel confirmatory factor analysis (MCFA) to evaluate the fit of the measurement model. The measurement model included day-specific workload, fatigue, and work engagement at the within-person level (three Level-1 factors), and organizational health climate and microbreaks autonomy at the between person level (two Level 2 factors). Again, we did not include microbreak due to its formative nature. Results revealed that the hypothesized five-factor measurement model had an acceptable fit to the data: $\chi^2_{(df = 177)} = 633.98$, $p < .001$; CFI = .93; RMSEA = .04; and $SRMR_{within}$ = .04; $SRMR_{between}$ = .06. The model fit was better than that of the alternative two-factor model which combined the three within-person factors into one as well as combined the two between-person factors into one ($\chi^2_{(df = 121)} = 2102.83$, $p < .001$; CFI = .53; RMSEA = .13; and $SRMR_{within}$ = .17; $SRMR_{between}$ = .10). The hypothesized five-factor model yielded a significant fit improvement to the two-factor model ($\Delta\chi^2 = 1468.85$; $\Delta df = 56$, $p < .001$). Thus, our results provided construct validity evidence of the five latent constructs in the current data.

Analytical Approach

One-way random-factor ANOVA results and variance decomposition at Level-1 and Level-2 showed that it was appropriate to use multilevel modeling for the current data analyses: employees' sleep quality [ICC(1) = .24, $F(221, 1{,}024) = 2.48$, $p < .001$], morning fatigue [ICC(1) = .26, $F(221, 1{,}024) = 2.67$, $p < .001$], microbreaks [ICC(1) = .49, $F(221, 1{,}024) = 5.56$, $p < .001$], end-of-work fatigue [ICC(1) = .32, $F(221, 1{,}024) = 3.18$, $p < .001$], and work engagement [ICC(1) = .38, $F(221, 1{,}024) = 3.85$, $p < .001$]. Thus, substantial variability was due to within-person fluctuations in poor sleep quality (75.9%), morning fatigue (73.7%), microbreaks (50.8%), end-of-work fatigue (68.1%), and work engagement (62.0%; see Table 1). Accordingly, we used the same multilevel analytical approach to simultaneously estimate all path coefficients in the multilevel path analysis model.

Results

Preliminary analyses. Table 5 presents means, standard deviations, reliability estimates, and intercorrelations of the variables in Study 2. The bivariate within-person correlations showed that poor sleep quality was positively related to morning fatigue ($r = .28$, $p < .001$). Morning fatigue was positively related to microbreaks ($r = .19$, $p < .001$), while microbreaks were negatively related to end-of-work fatigue ($r = –.13$, $p < .001$) but positively related to work engagement ($r = .14$, $p < .001$). The two dependent variables (end-of-work fatigue and work engagement) were correlated with each other to a small degree ($r = –.24$, $p < .001$).

Hypotheses testing. Table 6 displays the results from the multilevel path analysis in Mplus 7.4 (Muthén & Muthén, 2007). We used Snijders and Bosker's (1999) formulas to calculate pseudo-R^2 for the effect sizes in predicting the outcomes. Predictors in the model accounted for 32% of the total variance in end-of-fatigue and 37% of the variance in work engagement, suggesting that the model explained a sizable proportion of the variation in the outcome variables. Hypothesis 1 predicted a positive relationship between poor sleep quality and morning fatigue. Controlling for temporal trends (i.e., day, sine, cosine) and previous night's sleep hours, poor sleep quality was positively associated with morning fatigue ($\gamma = .23$, $p < .001$), supporting Hypothesis 1. Hypothesis 2 predicted a positive relationship between morning fatigue and microbreaks. The results showed that morning fatigue was positively associated with microbreaks ($\gamma = .13$, $p < .001$), supporting Hypothesis 2.

Hypothesis 3 predicted a serial mediation effect: poor sleep quality → morning fatigue → microbreaks → (a) end-of-work fatigue and (b) work engagement. Our bootstrapping tests for multilevel mediation effects based on 20,000 Monte Carlo replications showed that the indirect effect of poor sleep quality on end-of-work fatigue via morning fatigue and microbreaks was –.004 (95% CI [–.010, –.003]). Also, the indirect effect of poor sleep quality on work engagement via morning fatigue and microbreaks was .004 (95% CI [.001, .009]). As the CIs for both directions did not include zero, both H3a and H3b were supported.

As Table 6 shows, perceived health climate was positively associated with microbreak autonomy (γ = .21 *p* = .010), supporting Hypothesis 6. Our results also found that the moderation effect of microbreak autonomy on the day-level relationship between morning fatigue and microbreaks was significant (γ = .07 *p* = .039). Following Preacher and colleagues (2006), we conducted simple slope tests to confirm the nature of the moderation effect. As Figure 3 indicates, under the condition of high microbreak autonomy (+1 *SD*), the within-person link between morning fatigue and microbreaks was positive (γ = .19, $p < .001$), whereas under the condition of low microbreak autonomy (–1 *SD*), there was no within-person link between morning fatigue and microbreaks (γ = .06, *p* = .122). The difference between the two slopes was also significant ($\Delta\gamma$ = .14, *p* = .039), which supported Hypothesis 7. The results suggest that only employees with high microbreak autonomy—and not their counterparts with low microbreak autonomy—are likely to take microbreaks on days when they have greater morning fatigue.

Hypothesis 8 predicted the mediated moderation effect. Our 20,000-repitition Monte Carlo bootstrapping tests showed that the indirect moderating effect of perceived health climate on the link between morning fatigue and microbreaks via microbreak autonomy was .017 (95% CI [.002, .040]). Because the CIs for both directions did not include zero, H8 was supported. The results suggest that employees with a high perceived health climate are more likely to have a high level of microbreak autonomy, which in turn amplifies their microbreak engagement when they experience high morning fatigue at work.

Last, following the method recommended by Preacher, Rucker, and Hayes (2007), we tested the conditional serial indirect effects to determine whether the estimated serial indirect effects differed at lower (–1 *SD*) versus higher (+1 *SD*) microbreak autonomy (H9a and H9b). The results showed that the indirect effect of poor sleep quality on (a) end-of-work fatigue via morning fatigue and microbreaks was significant under the condition of *high* microbreak autonomy (–.006; 95% CI [–.011, –.002]), but became nonsignificant under the condition of *low* microbreak autonomy (–.002; 95% CI [–.005, .002]). The difference between these two indirect effects (at high versus low climate) was also significant (–.004; 95% CI [–.009, –.002]), supporting Hypothesis 9a. Similarly, the serial indirect effect of morning fatigue on work engagement via microbreaks was significantly greater under the condition of *high* microbreak autonomy (.005; 95% CI [.002, .009]) in comparison to its smaller indirect effect under the condition of *low* microbreak autonomy (.001; 95% CI [–.002, .005]). The difference between these two indirect effects (at high versus low health climate) was also significant for work engagement outcome (.004; 95% CI [.002, .007]); hence, Hypothesis 9b was supported.

Supplementary analyses. We conducted a supplementary analysis to confirm our findings of Study 1 on the four types of microbreaks. After controlling for daily work hours and workload, we tested a multilevel path model in which poor sleep quality and morning fatigue predicted the two outcomes (i.e., end-of-work fatigue, work engagement) through the four types of microbreaks. The path analyses results showed that morning fatigue predicted more frequent relaxation ($\gamma = .14$, $p < .001$), nutrition-intake ($\gamma = .10$, $p = .015$), and cognitive microbreaks (γ

= .09, *p* = .022). Consistent with the findings of our Study 1 supplementary analysis, we found that morning fatigue predicted *less frequent* social microbreaks ($\gamma = –.08$, *p* = .019). These results confirmed our exploratory findings in Study 1 that on days when employees had low self-regulation resources in the morning, they were more likely to take relaxation, nutrition-intake, and cognitive breaks, but less likely to take social breaks.

In addition, relaxation and cognitive microbreaks were negatively related to end-of-work fatigue ($\gamma = -.10$, *p* = .005 for relaxation breaks; $\gamma = –.11$, *p* = .005 for cognitive breaks) but positively related to work engagement ($\gamma = .06$, *p* = .009 for relaxation breaks; $\gamma = .09$, *p* = .003, for cognitive breaks). Nutrition-intake breaks were not related to end-of-work fatigue ($\gamma = –.02$, *p* = .638) but were positively related to work engagement ($\gamma = .06$, *p* = .019). As our Study 1 showed, social microbreaks were positively related to end-of-work fatigue ($\gamma = .12$, *p* = .027) as well as to work engagement ($\gamma = .31$, $p < .001$). These results remained consistent with the exploratory findings in Study 1.

Discussion

In Study 2, we replicated the findings of Study 1 and addressed its limitations. The proposed model of daily resource fluctuations and microbreaks was robust across both of the independent samples. Specifically, our second study found that employees' poor sleep quality was positively associated with end-of-work fatigue and work engagement via their morning fatigue, which in turn led to more frequent microbreaks during morning working hours. This result confirmed that on days when employees had poor sleep quality during the previous night and therefore came to work in a poor self-regulatory resource state (e.g., morning fatigue), they were more likely to use resource-replenishing strategies (microbreaks) to regain their energy (end-of-work fatigue) and to better focus on work (work engagement). Study 2 also supported microbreak autonomy as an important mediator that explains why perceived health climate moderates the path from morning fatigue to microbreaks. Moreover, Study 2 also confirmed the interesting patterns of social microbreaks versus the other microbreaks as we found in Study 1. In summary, Study 2 not only confirmed the findings from Study 1 but also provided further explanations for employees' daily resource process and management at work.

General Discussion

Theoretical Implications

The findings from our two studies offer several important theoretical and empirical contributions to the work recovery literature. While growing evidence has pointed to work breaks as a possible way to refuel employees' energies while at work (e.g., Hunter & Wu, 2016; Kim et al., 2017, 2018; Kühnel et al., 2017; Trougakos et al., 2008; Zacher et al., 2014; Zhu et al., 2019), a dearth of research has addressed possible antecedents to microbreaks. Using the combined theoretical perspective of resources (self-regulatory resources and COR theories; Baumeister et al., 2000; Hobfoll et al., 2018; Muraven & Baumeister, 2000), this research identified high morning fatigue (due to poor nightly sleep) as an important day-level antecedent to microbreaks at work. Our evidence supported the previously untested notion that when employees have low energy, they pursue short respite opportunities more frequently while at work (Fritz, Ellis, Demsky, Lin, & Guros, 2013; Fritz et al., 2011). In short, our research enhances scholarly understanding of *why* employees take more or fewer microbreaks across different workdays.

In addition, the serial mediation results support our theorization that microbreaks connect employees' self-regulatory resource state earlier in the day with that at the end of work. Specifically, on days when individuals experience resource depletion in the morning, microbreaks can be an effective intervening strategy that allows them to momentarily regain energy so that they can more fully engage in their work and end their workday with less fatigue. This finding also aligns with the complementary theoretical model of "limited self," in which Inzlicht et al. (2014) proposed that as people strive to strike a balance between work and rest, when self-regulation capacity is low (e.g., fatigue), individuals will gravitate toward their preferred respite activity. Further, once they have enjoyed the activity, they will then have greater motivation to work, which is likely to yield greater rewards for them. Accordingly, our research suggests that microbreaks intervene in employees' self-regulatory resource fluctuations at work.

Importantly, our research also illustrates that the resource-gain process via microbreaks does not occur across individuals to the same degree. In other words, employees' discretionary pursuit of microbreaks to reverse their daily morning fatigue is contingent upon their perceptions of working conditions. Specifically, our findings suggest that under a supportive health climate, employees can develop a sense of microbreak autonomy, which then allows frequent engagement in brief respite activities to restore energy. In contrast, under a less supportive health climate, employees' microbreak autonomy decreases, so that they are more likely to slog away without breaks despite their high fatigue. Given that the extant recovery literature lacks scholarly knowledge and evidence of moderating factors in the recovery processes of work breaks (Trougakos & Hideg, 2009; for an exception, see Trougakos et al., 2014), this study makes an important contribution to the recovery literature. Moreover, our study extends COR theory by not only specifying an important moderating condition for the fluctuating resource-gain process but also demonstrating why the moderation occurs (Halbesleben et al., 2014; Hobfoll et al., 2018).

Practical Implications

The current study provides evidence-based insights for organizations and human resources managers regarding how employees manage their self-regulation capacity at work and benefit from engaging in short recovery activities at work (i.e., microbreaks). Our findings show that microbreaks can be an effective energy management strategy to replenish employees' regulatory resources at work when they experience low energy or state-depletion (high fatigue and poor sleep quality) in the morning. In other words, employees can strategically and proactively structure their workday to perform tasks and take microbreaks depending on their morning energy levels. To assist employees in performing this balancing act, organizations could provide more information on the energy management strategy of microbreaks via seminars. Such organizational education could help employees avoid carrying their low morning energy level forward throughout the day, but instead recover and get back on track. While off-the-job recovery during the previous night is not always guaranteed, employees should be able to enhance their work engagement and productivity via effective energy management (i.e., microbreaks) during the workday.

Further, this study demonstrates that the perceived health climate can facilitate employees' microbreak engagement when they need to restore their personal resources (i.e., high morning fatigue and poorer sleep quality). Previous research has suggested that perceived health climate promotes employee health and well-being by encouraging resource-inducing activities (e.g., recovery) both at work and outside of work (Zweber et al., 2016). Our findings go further, by advocating the benefits of building a pro-organizational health climate for employees' discretionary energy management strategies at work. Accordingly, organizations should take steps to deliberately foster an environment supportive of employees' health/well-being and a microbreaks-friendly culture or practice, so that employees will feel safe to take timely short breaks when needed. Organizational support for employees' recovery activities at work could range from devising formal or informal policies to providing resting areas for socialization and nutrition intake. For example, organizations might provide external Internet access (e.g., Facebook, YouTube), reclining chairs in an employee rest area, free coffee or tea, vending machines with energy drinks, magazines, and newspapers. With adequate support and resources, employees could manage their regulatory resources more effectively at work by taking advantage of microbreak opportunities and then getting back to work with recharged self-regulatory resources.

Last, our findings on the idiosyncratic patterns of microbreaks as a resource management strategy provide practical information for devising effective recovery activities. We found that employees were less likely to take social microbreaks when they lack self-regulatory resources in the morning and that these social activities were positively related to fatigue at the end of the workday. In other words, social interactions (e.g., chatting with colleagues) would not necessarily help tired employees regain energy. In addition, our supplementary analyses results revealed that caffeinated beverage consumption in the morning (in Study 2) was particularly helpful to energize resource-depleted employees at work, whereas microbreaks for general snacking and having non-caffeinated drinks had no effect.[2] Thus, taken together, organizations

[2] Thanks to an anonymous reviewer's request, we further ran post-hoc analyses in both Study 1 and Study 2 to explore the effects of caffeine consumption in specific. We took out the item of caffeinated beverage consumption from the nutrition-intake measure so that two types of microbreaks can be differentiated: microbreaks for caffein consumption vs. for having snacks and non-caffein beverage. Then, we ran the model with all types of microbreaks included (i.e., caffein consumption, snacking/non-caffein beverage, relaxation, social, and cognitive microbreaks). The results in both studies found that morning fatigue was positively associated with both caffeinated beverage consumption (Study1: $\gamma = .17$, $p < .001$; Study2: $\gamma = .14$, $p = .005$) and snacking (Study1: $\gamma = .08$, $p = .031$; Study 2: $\gamma = .14$, $p = .002$). In turn, caffeinated beverage consumption (Study1: $\gamma = .09$, $p = .007$; Study2: $\gamma = .09$, $p = .001$) was positively associated with work engagement, whereas microbreaks for snacking/non-caffein drinks were not related to work engagement (Study1: $\gamma = -.004$, $p = .916$; Study2: $\gamma = .003$, $p = .863$). Regarding end-of-work fatigue as an outcome, caffeinated beverage consumption did not predict end-of-work fatigue in Study 1 (report the

may want to provide resource management training that accounts for the different benefits of the microbreak activities. Such training could offer practical guidance regarding effective energy management and help employees better deal with high job demands throughout the day.

Limitations and Future Research Directions

Across two daily diary studies, we used a rigorous methodological approach to capture the dynamic patterns of employees' day-specific resource cycle with a focus on the mediation effects of microbreaks. Nevertheless, a few limitations arise when interpreting our results, yet also suggest future research directions. First, although we separated the assessment times of antecedent, mediator, and outcome variables in Study 2, we acknowledge that our correlational design still restricts strong causal inferences. Therefore, future research may use field experimental designs to enhance causal inferences (e.g., Sianoja et al., 2018). In addition, because our study relied on self-report measurements, we attempted to preemptively address the potential concerns of common-methods variance bias (CMV; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). For example, as Podsakoff et al. (2003) recommended, we used different response options such as agreement (agree/disagree), frequency (never/very frequently), extremity (not at all/extremely), and quality (good/bad). Moreover, CMV is less of a concern when moderation effects are found in a study because interaction effects cannot be artifacts of CMV as it decreases the sensitivity to interaction tests (Evans, 1985; Siemsen, Roth, & Oliveira, 2010). Nevertheless, we encourage further efforts to reduce CMV through objective assessments (e.g., sleep actigraphy, monitoring of microbreaks) or multisource measures of work outcomes.

values here), but in Study 2, caffeinated beverage consumption was negatively associated with end-of-work fatigue ($\gamma = -.09$, $p = .020$). The other three types of microbreaks (relaxation, social, cognitive microbreaks) showed the same significant patterns as in our supplementary analyses results.

Second, our supplementary analyses on different types of microbreaks provided interesting insights regarding their idiosyncratic roles in resource replenishment. As to the findings on social microbreaks' positive association with end-of-work fatigue, unlike other types of microbreaks, we encourage future research to further examine the differential effect of social microbreaks through the self-regulatory resource lens. For example, under which conditions would social microbreaks not deplete resources but rather maximize relational energy and work engagement? The answer to this question might depend on whether one assumes an "energizer" role toward others or receives relational energy from others during social breaks (cf. Owens et al., 2016). Further, we ran post-hoc analysis on nutrition-intake breaks to examine the effect of caffeinated beverage consumption in more detail. In fact, previous research suggested that caffeine can counteract one's resource-depletion state (e.g., feeling fatigued or energy is running low; Kim et al., 2017; Welsh et al., 2014). As reported in the footnote, microbreaks for caffeinated drinks (coffee, tea) seem to play an important role in resource replenishment during work hours, which is not surprising given the well-known arousal effect of caffeine. However, the reason for the comparatively weak recovery effect of snacking and non-caffeinated drinks is still unknown, and we speculate that simply intaking nutrition might not be sufficient for psychological recovery outcomes such as fatigue and work engagement. Thus, taken together, specific mechanisms of when and why certain types of microbreaks help replenish resources warrant future investigations.

Our time-interval assessment design, with its subjective frequency measure of microbreaks, was not conducive to examining to what extent the amount of time spent on microbreaks matters (e.g., the longer employees engage in microbreaks, the less they are able to spend their time for work). To address this concern, we assessed the duration of microbreaks in our second data and ran post-doc analyses to examine its effects. The multilevel path analyses revealed that there was no relationship between morning fatigue and microbreaks duration ($\gamma = .52$, $p = .117$). Also, microbreak duration had no effects on end-of-work fatigue ($\gamma = -.003$, $p = .390$) or work engagement ($\gamma = .001$, $p = .986$). These nonsignificant results suggest that taking longer breaks in the morning (in absolute terms) doesn't guarantee successful resource replenishment, but rather having short, voluntary respite activities as often as one wish is more important, which aligns with our theoretical conceptualization of microbreaks. However, we also acknowledge the limitation of our study structure that having respondents recall the exact duration of microbreaks taken could place too much cognitive demands given our time-interval assessment design. These issues could be examined with event-contingent sampling methods, whereby participants record their microbreak events and their characteristics (e.g., duration and immediate effects) every time they occur (Wheeler & Reis, 1991). As episodic assessments may provide a great deal of detail about breaks, researchers could accurately investigate the effect of how many and longer breaks are taken, and their impacts on employees (potential threats of long microbreaks on employees' time spent for work).

Lastly, one may question why employees come to work tired in the morning. The off-work recovery literature suggests that fatigue or depletion can be viewed as an outcome of poor recovery in the preceding time (see Sonnentag & Geurts, 2006, for a review). While our Study 2 suggests that poor sleep quality could be the reason, other specific recovery hindrance at home (e.g., overworking at night, family hassles) may also be linked to the next day's microbreaks at work as a means to compensate for insufficient recovery from the previous evening. Thus, future research could extend the timeline to investigate the possible interconnections between off-work and at-work recovery and explore how those relationships unfold over long- or short-term periods with respect to employees' energy and their work and well-being outcomes. Relatedly, Inzlicht et al.'s (2014) newer model of self-control assumes that individuals have a need to balance their work (labor) and rest (breaks, leisure) such that they shift between work and rest. However, these authors did not discuss the switching in terms of timing, duration, or other temporal aspects so future research may examine them.

Conclusion

Many of today's organizations view their employees as pivotal human capital for achieving success in the market, and their resource levels are intimately associated with organizational productivity. Thus, human resources practitioners and researchers continue to ponder how to effectively support employees' energy management both on and off the job. Our studies revealed the intervening roles of microbreaks in employees' resource management. Specifically, the results showed that employees are able to recover from morning fatigue after the rough night by taking short, discretionary respite activities while at work, and that such timely recovery is associated with lower fatigue and higher engagement at work. To enhance employees' efficient energy management and work experiences, we encourage organizations to take an active role in promoting a health-friendly culture and high autonomy for microbreaks. We hope that our research serves as a foundation for building additional theories around employees' regulatory resource fluctuation and management across their workdays.

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Table 1

Variance Decomposition of Major Study Variables Measured at the Day Level in Study 1

Construct	Study 1			Study 2		
	Within-Person Variance (σ^2)	Between-Person Variance (τ_{00})	% of Within-Person Variance	Within-Person Variance (σ^2)	Between-Person Variance (τ_{00})	% of Within-Person Variance
Poor sleep quality (IV)	.503	1.152	30.3%	.594	.187	75.9%
Morning fatigue (ME1)	.595	.533	52.7%	.535	.190	73.7%
Microbreaks (ME2)	.510	1.050	32.7%	.348	.336	50.8%
End-of-work fatigue (DV)	.527	.461	53.3%	.456	.213	68.1%
Work engagement (DV)	.384	1.164	24.8%	.214	.131	62.0%

Note. Level 1 n = 779 (Study1) and 1,024 (Study 2), Level 2 n = 98 (Study1) and 222 (Study2). The percentage of within-person variance was calculated by the following formula: $\sigma^2 / (\sigma^2 + \tau_{00})$. IV = Independent variable, ME = mediator, DV = dependent variable.

Table 2

Means, Standard Deviations, Reliability Estimates, and Intercorrelations among Study Variables in Study 1

	1	2	3	4	5	6	7	8	9
1. Perceived health climate									
2. Last night's sleep quantity	.09		.02	-.14***	-.13***	.03	-.08*	-.06	.05
3. Work hours	-.04	.38***		.004	-.03	.05	-.15***	-.04	-.13***
4. Workload	.15	-.04	-.24*		.07	.01	.06	.16***	.001
5. Last night's poor sleep quality	.09	-.02	.03	.31**		.32***	.31***	-.05	.06
6. Morning fatigue	.27**	-.15	-.32**	.49***	.55***		.35***	.14***	-.14***
7. Microbreaks	.23*	-.16	-.18	.33**	.58***	.52***		-.19***	.21***
8. End-of-work fatigue	.21*	-.15	-.30***	.59***	.56***	.31**	-.18		-.07
9. Work engagement	.02	-.02	-.18	.22*	.42***	.19	.49***	.21*	
M	2.97	7.17	7.66	3.09	3.21	2.81	2.63	2.57	3.18
Within-person *SD*	–	0.74	0.94	0.65	0.72	0.71	0.87	0.76	0.57
Between-person *SD*	1.18	0.52	0.72	0.75	0.84	0.95	0.80	0.83	0.84
Cronbach's alpha	.83	n/a[a]	n/a[a]	.83[b]	n/a[a]	.96[b]	n/a[c]	.91[b]	.87[b]

Note. Correlations below the diagonal represent between-person correlations (n = 98). Correlations above the diagonal represent day-level correlations within persons (n = 779). To calculate between-person correlations, we averaged within-person scores across days. All variables were within-person, except the between-person variable of perceived health climate.

[a]Single-item measure, [b]Average Cronbach's alpha across observations, [c]Formative measure.

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Table 3
Unstandardized Coefficients from the Hypothesized Multilevel Path Model in Study 1

Variable	Morning Fatigue		Microbreaks		End-of-Work Fatigue		Work Engagement	
	Estimate	*S.E.*	Estimate	*S.E.*	Estimate	*S.E.*	Estimate	*S.E.*
Intercept	2.72***	0.11	2.23***	0.09	2.73***	0.11	3.14***	0.10
Temporal controls								
Day[a]	.02	0.01	.01	0.01	-.02	0.01	-.01	.01
Sine	.01	0.04	.04	0.02	-.01	0.04	-.06	.03
Cosine	.03	0.04	-.03	0.02	-.03	0.04	-.04	.03
Control variables								
Last night's sleep hours	-.11**	0.03						
Work hours			-.06***	0.01	-.04	0.03	-.07	0.02
Workload			-.01	0.02	.17***	0.04	-.01	0.03
Focal variables								
Perceived health climate (A)			-.12	0.09	-.05	0.09		
Last night's poor sleep quality	.32***	0.04	.05*	0.02	.08	0.04	.03	0.03
Morning fatigue (B)			.13***	0.02	.19**	0.04	-.04	0.03
Microbreaks					-.20*	0.08	.18**	0.06
A x B[b]			.08**	0.02				
Within-level residual variance	.50***	0.03	.11***	0.01	.62***	0.03	.36***	0.02
Between-level residual variance	.81***	0.13	.48***	0.08	.61***	0.10	.63***	0.10

Note. All variables were within-person except the between-person variable of perceived health climate. [b] Hypothesized cross-level interaction term (H4). The results came from one path model that simultaneously estimated all coefficients presented in this Table.
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.
[a] Variable increased monotonically each day (from 1 to 10) to model linear trends over the course of the study (see Beal & Weiss, 2003).

Table 4

Results of Conditional Serial Indirect Effects of Poor Sleep Quality on the Outcomes via Morning Fatigue and Microbreaks in Study 1

	End-of-Work Fatigue			Work Engagement		
Condition	Estimate	*SE*	95% CI	Estimate	*SE*	95% CI
Low Health Climate	-.002	0.002	[-.008, .003]	.002	0.01	[-.004, .008]
High Health Climate	-.014	0.006	[-.029, -003]	.012	0.02	[.004, .025]
Difference	-.012	0.006	[-.025, -.002]	.010	0.02	[.002, .022]

Note. SE = Standard of error. CI = Confidence Interval.

Table 5

Means, Standard Deviations, Reliability Estimates, and Intercorrelations among Study Variables in Study 2

	1	2	3	4	5	6	7	8	9	10	11
1. Perceived health climate											
2. Microbreak autonomy	.20**										
3. Last night's sleep hours	-.07	-.14*		-.05	-.05	-.08*	-.20***	-.23***	-.21***	.004	-.02
4. Lunch-break satisfaction	-.05	.04	.13		.04	-.07*	-.11***	-.19***	-.001	-.11***	.11***
5. Work hours	-.02	-.07	-.09	.08		.06	.02	.05	-.07*	.09**	.04
6. Workload	.07	.04	-.15*	.001	.29***		.01	.09**	-.07*	.21***	-.003
7. Last night's poor sleep quality	.08	.17*	-.18**	-.11	.07	.20**		.28***	.16***	.10**	.03
8. Morning fatigue	.13*	.07	-.21**	-.24***	.06	.18**	.44***		.19***	.11***	-.06
9. Microbreaks	.15*	.41***	-.14*	.02	-.08	.01	.21**	.17*		-.13***	.14***
10. End-of-work fatigue	-.01	-.14*	-.14*	-.21**	.30***	.37***	.21**	.44***	-.15*		-.24***
11. Work engagement	.04	.12	.16*	.53***	.07	-.11	-.02	-.11	.19**	-.19**	
M	3.00	3.01	6.79	8.40	2.98	3.03	2.61	3.08	2.41	3.45	3.05
Within-person *SD*	–	–	1.16	0.62	0.47	0.58	0.68	0.65	0.52	0.60	0.41
Between-person *SD*	0.91	0.99	1.04	0.80	0.46	0.59	0.57	0.56	0.64	0.56	0.42
Cronbach's alpha	0.85	0.89	n/a[a]	n/a[a]	n/a[a]	0.84[b]	n/a[a]	0.92[b]	n/a[c]	0.93[b]	0.86[b]

Note. Correlations below the diagonal represent between-person correlations (n = 222). Correlations above the diagonal represent day-level correlations within persons (n = 1,024 − 1,025). To calculate between-person correlations, we averaged within-person scores across days. All variables were within-persons, except the between-persons variable of perceived health climate and microbreak autonomy.

[a]Single item measure, [b]Average Cronbach's alpha across observations, [c]Formative measure.

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Table 6

Unstandardized Coefficients from the Hypothesized Multilevel Path Model in Study 2

Variable	Microbreak Autonomy		Morning Fatigue		Microbreaks		End-of-Work Fatigue		Work Engagement	
	Estimate	*S.E.*	Estimate	*S.E.*	Estimate	*S.E.*	Estimate	*S.E.*	Estimate	*S.E.*
Intercept	.00	0.07	3.19***	0.09	2.04***	0.13	3.60***	0.09	2.97***	0.07
Temporal controls										
Day[a]			-.04	0.03	-.01	0.03	-.03	0.03	.01	0.02
Sine			-.001	0.05	-.001	0.04	.01	0.05	-.01	0.03
Cosine			.07	0.04	.07	0.03	.05	0.04	-.01	0.03
Control variables										
Last night's sleep hours			-.10***	0.02						
Lunch hour satisfaction							-.09	0.05	.09*	0.04
Work hours							.06	0.04	.03	0.03
Workload							.18***	0.04	.01	0.03
Focal variables										
Perceived health climate (A)	.21*	0.08			-.11	0.11	.03	0.05	-.01	0.04
Microbreak autonomy (B)					.04	0.10	-.05	0.05	.03	0.04
Last night's poor sleep quality			.23***	0.03	.09**	0.04	.06	0.03	.03	0.03
Morning fatigue (C)					.13***	0.03	.10*	0.04	-.06*	0.02
Microbreaks							-.14**	0.05	.11***	0.03
A x C					.05	0.04				
B x C[b]					**.07***	0.04				
Within-level residual variance			.48***	0.03	.31***	0.02	.42***	0.03	.21***	0.02
Between-level residual variance	.94***	0.09	.19***	0.03	.06	0.04	.21***	0.03	.13***	0.02

Note. All variables were within-person except the between-person variable of perceived health climate and microbreak autonomy. [b] Hypothesized cross-level interaction term (H7). The results came from one path model that simultaneously estimated all coefficients presented in this Table.
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.
[a] Variable increased monotonically each day (from 1 to 5) to model linear trends over the course of the study (see Beal & Weiss, 2003).

Table 7

Results of Conditional Serial Indirect Effects of Poor Sleep Quality on the Outcomes via Morning Fatigue and Microbreaks in Study 2

	End-of-Work Fatigue			Work Engagement		
Condition	Estimate	*SE*	95% CI	Estimate	*SE*	95% CI
Low Health Climate	-.002	0.001	[-.005, .002]	.001	0.001	[-.002, .005]
High Health Climate	-.006	0.003	[-.011, -.002]	.005	0.002	[.002, .009]
Difference	-.004	0.002	[-.009, -.002]	.004	0.002	[.002, .007]

Note. SE = Standard of error. CI = Confidence Interval

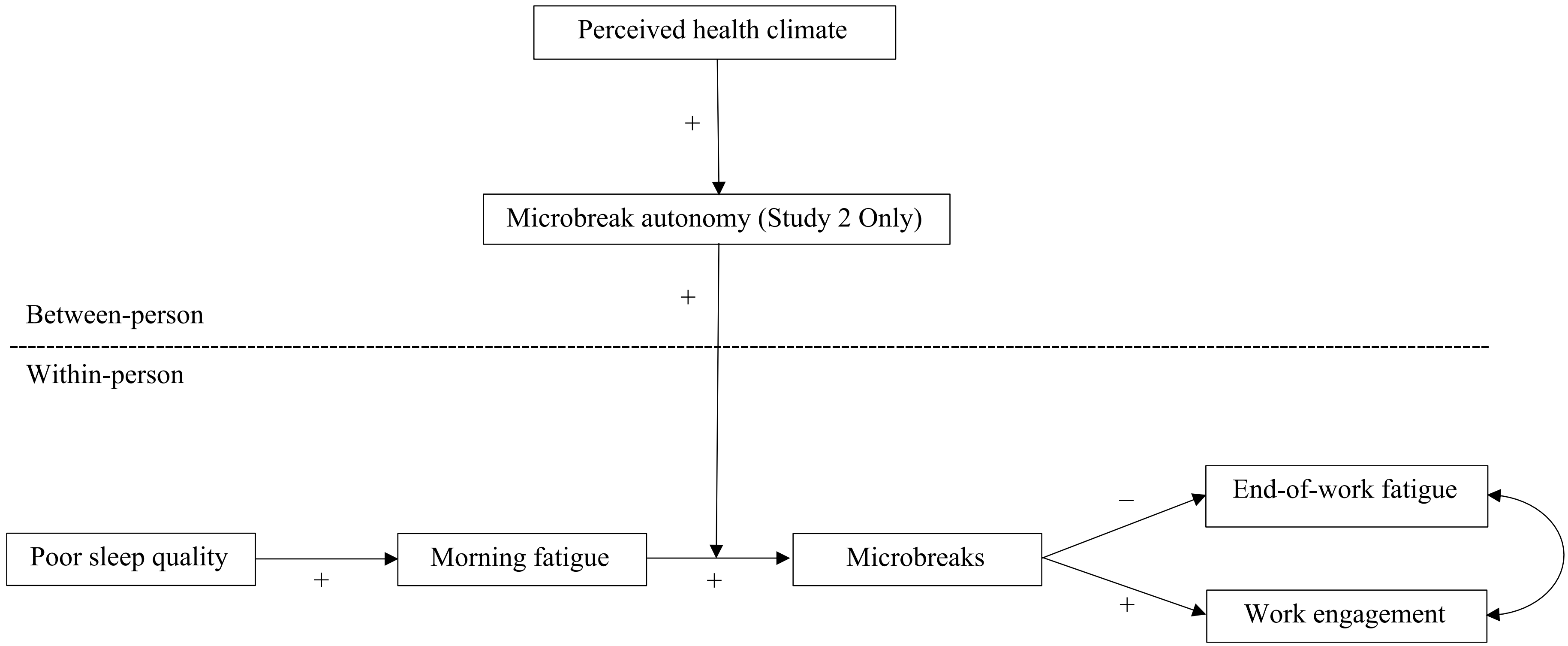

Figure 1. The conceptual model. Direct paths are omitted in this Figure for brevity.

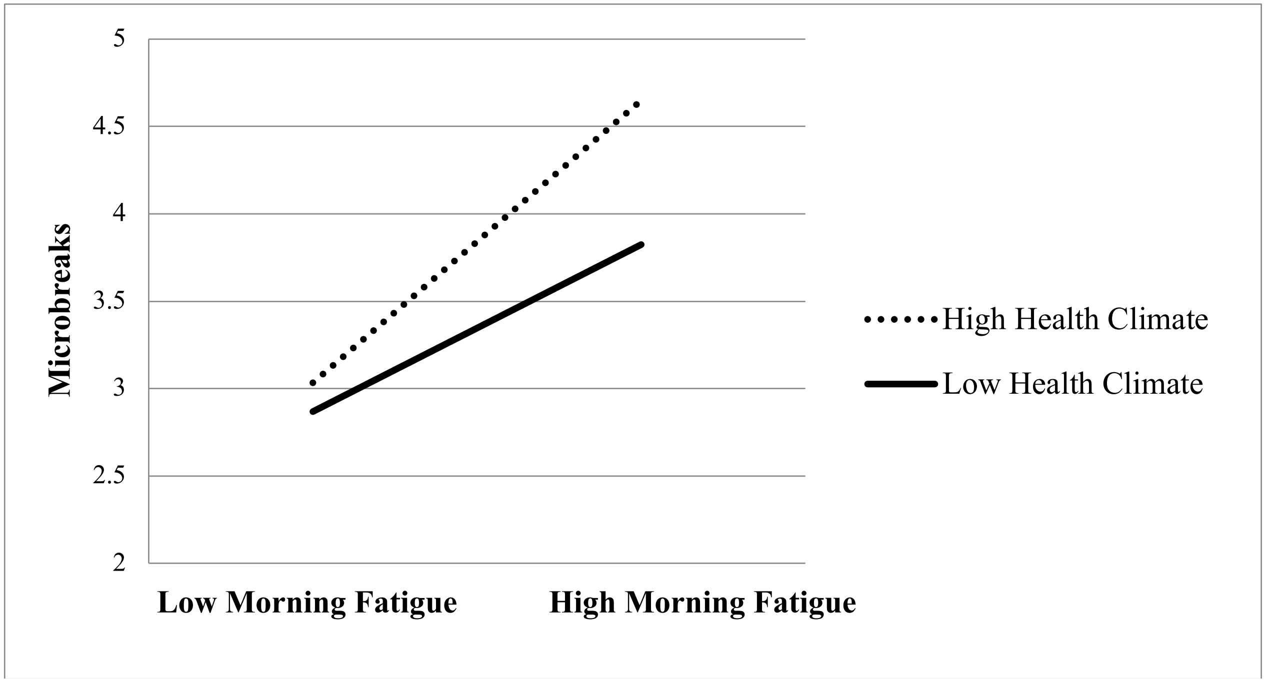

Figure 2. Perceived health climate moderates the day-level path from morning fatigue to microbreaks in Study 1

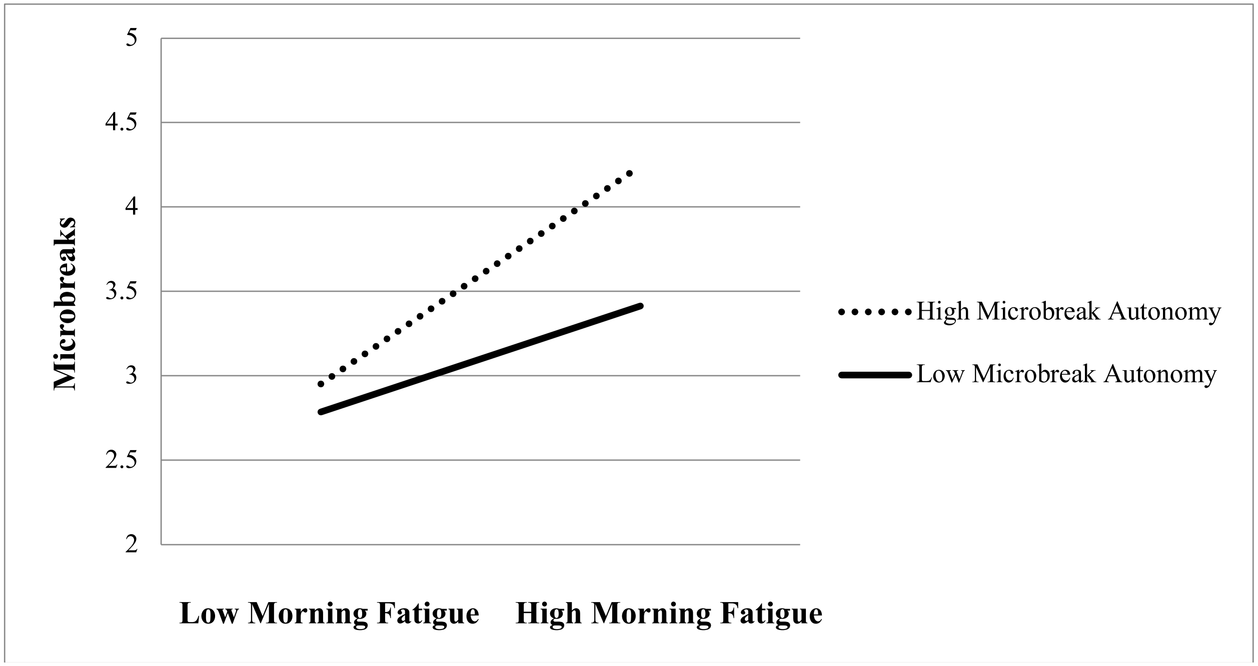

Figure 3. Microbreak autonomy moderates the day-level path from morning fatigue to microbreaks in Study 2.