Occupational Health Science
https://doi.org/10.1007/s41542-021-00100-w

ORIGINAL RESEARCH REPORT

How are you Sleeping? Leadership Support, Sleep Health, and Work-Relevant Outcomes

Brian C. Gunia[1,2] · Amy B. Adler[2] · Paul D. Bliese[2,3] · Kathleen M. Sutcliffe[1]

Received: 21 January 2021 / Revised: 2 September 2021 / Accepted: 6 September 2021

Abstract

Employee sleep matters for organizations, but it is less clear what organizations can do to promote sleep health. One potential leverage point is leaders. At present, we know relatively little about the ways leaders might support employees' sleep health. The current research builds and tests theory suggesting that when organizational leaders display sleep-specific consideration behaviors (which the literature terms "sleep leadership"), employees exhibit positive, subsequent changes in sleep at home as well as goal pursuit and impulse control (loosely indicative of self-regulation) at work. A time-lagged, field-based study of U.S. Army soldiers supports this prediction and shows that sleep health mediates the link between sleep leadership and the two outcomes indicative of self-regulation. These findings suggest that leaders who demonstrate concern about employee sleep may initiate a positive feedback loop spanning work and home, benefiting the employee and organization.

Keywords Supervisory support · Domain-specific leadership · Sleep leadership · Sleep · Self-regulation

About one-third of U.S. adults suffer from low-quality sleep (National Sleep Foundation, 2020), and more than a third report sleeping for less than the recommended seven hours per night (Centers for Disease Control and Prevention [CDC], 2014). Unhealthy sleep among employees is associated with problematic behaviors (e.g., Barnes, et al., 2015), mental health symptoms (e.g., Luxton et al., 2011), cognitive deficits (e.g., Nilsson et al., 2005), and physical illnesses (CDC, 2014). Additionally,

✉ Brian C. Gunia
brian.gunia@jhu.edu

[1] Carey Business School, Johns Hopkins University, 100 International Drive, Baltimore, MD 21202, USA

[2] The Center for Military Psychiatry and Neuroscience, Walter Reed Army Institute of Research, Silver Spring, MD, USA

[3] Darla Moore School of Business, University of South Carolina, Columbia, SC, USA

Published online: 29 September 2021

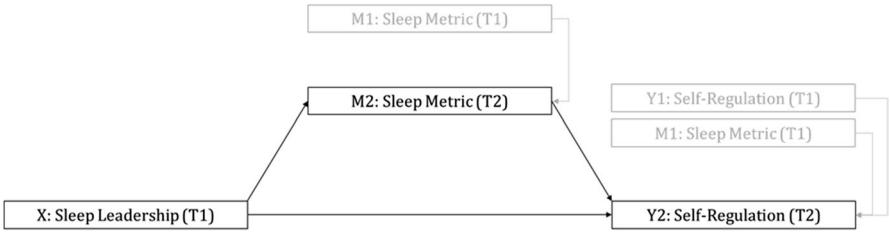

Fig. 1 Theoretical relationships in the current research

evidence suggests that insufficient sleep costs the U.S. more than $411 billion per year (Hafner et al., 2017), and fatigue-related productivity losses cost organizations $1967 per employee per year (Rosekind et al., 2010). In safety-critical industries such as healthcare, public transport, and manufacturing, the costs go beyond productivity loss to include matters of life and death (e.g., Brossoit et al., 2019). In short, unhealthy sleep presents a serious risk for employees and their organizations.

To date, and with several exceptions described below, research designed to improve sleep patterns has primarily focused on changes that individuals (often those suffering sleep problems) can initiate themselves. In the present study of a high-risk occupational group (the U.S. military), we investigate a set of sleep-supportive behaviors by organizational leaders that could positively influence employee sleep health and its downstream consequences over time. That is, we examine whether sleep-specific consideration behaviors by leaders (which the literature terms "sleep leadership"; e.g., Gunia et al., 2015) elicit positive changes in subsequent employee sleep at home and outcomes such as goal pursuit and impulse control at work. These relationships are depicted in Fig. 1.

Unhealthy Sleep

Previous research has characterized unhealthy sleep as both a consequence and a cause of events at work. As a consequence, unhealthy sleep reflects negative work-to-home spillover (Grzywacz & Marks, 2000), such as when low job control (Nomura et al., 2009) or emotional labor at work (Wagner et al., 2014) spill over into unhealthy nightly sleep. As a cause of work-related events, unhealthy sleep reflects negative home-to-work spillover (Wagner et al., 2014), such as when unhealthy sleep at home results in problematic behaviors (Barnes et al., 2015) or cognitive deficits (e.g., Nilsson et al., 2005) at work.

Although the sleep-as-consequence perspective implies that leaders may sometimes exacerbate their employees' unhealthy sleep, little research has addressed whether or how leaders might support sleep (i.e., reduce a form of negative work-to-home spillover). The present study examines whether sleep-specific consideration behaviors by leaders are related to reductions in employees' unhealthy sleep. Likewise, although the sleep-as-cause perspective implies that unhealthy sleep may exacerbate negative outcomes at work, little research has addressed whether

healthier sleep might support work outcomes (i.e., reduce a form of negative home-to-work spillover). The present study examines whether healthier sleep prompted by sleep-supportive consideration behaviors can reduce employees' self-regulatory difficulties at work.

Sleep-Supportive Consideration and Sleep Health

Sleep-specific consideration by leaders is rooted in the literature on "domain-specific leadership," which occurs when leaders influence employees to achieve targeted, desirable outcomes like enhanced safety (Clarke, 2013) or work-family balance (Hammer et al., 2009). Leaders exert influence within a domain by demonstrating genuine concern about the desired outcome and actively supporting employee efforts to attain that outcome (Mullen & Kelloway, 2009). In particular, leaders convey their concern by providing employees with social ("encouraging") and tactical ("enabling") support.

Domain-specific leadership's basis in caring as a source of influence places it within the "consideration" versus "initiating structure" side of leadership (Judge et al., 2004). Unlike general leadership consideration (or other broad forms of leadership),[1] however, domain-specific leadership has more targeted effects. For example, safety-specific leadership predicts safety-related outcomes more strongly than general consideration or other forms of leadership (Clarke, 2013; Mullen & Kelloway, 2009). Similarly, family-supportive leadership predicts work-family and related outcomes like turnover (Hammer et al., 2009, 2011).

Based on these previous studies, we examine whether sleep-specific consideration behaviors by leaders elicit positive changes in employees' sleep health and its consequences. In so doing, we adopt the literature's term for sleep-specific consideration behaviors by leaders—"sleep leadership" (e.g., Gunia et al., 2015)—defining this construct as a set of consideration behaviors in which leaders both encourage and enable employees to obtain healthy sleep. They might "encourage," for example, by emphasizing the importance of healthy sleep or by urging an employee to sleep sufficiently before a difficult task—thereby triggering a social-cognitive learning process (Bandura, 1969) in which employees learn to value sleep by observing the leader. Similarly, leaders might "enable" by adjusting an employee's schedule to facilitate sleep or by setting guidelines about late-night email—behaviors that "channel" (Ross & Nisbett, 2011) employee sleep patterns in a healthier direction. Together, these social-cognitive and channeling factors fit the recommended features of sleep-supportive interventions (Redeker et al., 2019).

Although consideration behaviors that encourage and enable employees to obtain healthier sleep could be considered a form of managerial rather than leadership behavior, we employ the term "sleep leadership" for three reasons. First, three

[1] Domain-specific leadership has also been conceptualized as a form of transformational leadership. Our conceptual framework builds from work placing particular emphasis on the consideration components of domain-specific leadership (e.g., Mullen & Kelloway, 2009).

published papers have used that term (Adler et al., 2020; Gunia et al., 2015; Sianoja et al., 2020), and we sought to avoid any confusion associated with using a different term for the same construct. Second, sleep leadership is fundamentally conceptualized as a form of consideration, and consideration is one of the two fundamental elements of leadership according to the influential Ohio State leadership model (Judge et al., 2004). Finally, our study context is the U.S. Army, which defines leadership as "influencing people by providing purpose, direction, and motivation, while operating to accomplish the mission and improve the organization" (U.S. Army Regulation 600–100, 2017). Since encouraging and enabling healthier sleep provides both direction and motivation to engage in behavior conducive to accomplishing the mission and improving the organization, we felt that "sleep leadership" was appropriately labelled for use in this particular context.

We sought to extend and build upon published studies on sleep leadership in several important ways. The first such study, a cross-sectional pilot, introduced a sleep leadership measure and found correlations with sleep health and unit climate in the U.S. Army (Gunia et al., 2015). The second examined how ratings of sleep leadership and leadership focused on work-family balance related to subjective, cross-sectional sleep health measures and objective sleep health measures collected over 21 days in a National Guard sample (Sianoja et al., 2020). Among other findings, this study documented the incremental validity of sleep leadership over leadership focused on work-family balance in improving subjective ratings of sleep impairment and sleep disturbance. The third study randomly assigned military leaders to a sleep leadership condition or a waitlist control condition and found that training resulted in healthier sleep outcomes for both leaders and unit members (Adler et al., 2020).

Building on this research, we sought to document whether sleep leadership is related to *changes* in employee sleep patterns over time. Although prior research identified promising associations, two of these studies were based on cross-sectional survey data (Gunia et al., 2015; Sianoja et al., 2020), raising the specter of static relationships, halo effects, or common method issues. The third study had a stronger design but only assessed subordinates at one time point, and, given the observed power, the authors encouraged replication (Adler et al., 2020). For these reasons, it remains important to examine whether sleep leadership results in real and durable changes in sleep over time. Indeed, before real organizations would consider engaging their leaders on the topic of sleep-specific consideration, they would likely need evidence of real and durable changes in employee sleep patterns that are related to relevant outcomes.

The current study used a time-lagged design to examine changes in employee sleep over time, testing the degree to which sleep leadership reduces the work-to-home spillover associated with unhealthy employee sleep. Our theory provides strong reasons to suspect that sleep leadership's "encouraging" component would trigger sleep-supportive, social-cognitive learning, whereas its "enabling" component would directly elicit healthier sleep behaviors. This theory, coupled with promising results from prior research, lead to the following prediction:

Hypothesis 1: Sleep leadership is related to positive changes in employee sleep over time.

Sleep-Supportive Consideration, Goal Pursuit, and Impulse Control

As a second contribution, we sought to extend the nascent literature by examining the effect of sleep-supportive consideration on important, work-relevant employee outcomes. Since prior studies have focused largely on the relationship between sleep-supportive consideration and sleep itself (Adler et al., 2020; Gunia et al., 2015; Sianoja et al., 2020), focusing on subsequent employee outcomes extends our understanding of the downstream consequences in important ways. The current study focuses on whether sleep leadership predicts changes in goal pursuit and impulse control, which are both loosely indicative of self-regulation. Specifically, we examine whether sleep-supportive consideration by leaders has an indirect relationship with employees' goal pursuit and impulse control through their sleep health.

Across many work contexts, effective job performance requires employees to engage in self-regulatory processes such as goal pursuit and impulse control. Completing a complex work project, for example, requires employees to maintain focused attention and avoid distractions or impulses. Yet, doing so is cognitively taxing, drawing heavily on particular brain regions such as the prefrontal cortex (Chuah et al., 2010). Since unhealthy sleep interferes with the performance of this and other brain regions (e.g., Altena et al., 2008; Barnes, 2012), it tends to undermine effective goal pursuit, impulse control, and other self-regulatory processes (e.g., Barber & Munz, 2010; Barnes, 2012; Christian & Ellis, 2011).

Notwithstanding the neural basis of this relationship, much of the supporting evidence comes from studies focusing on behaviors and outcomes, particularly by demonstrating that sleepy individuals have difficulty engaging in goal-relevant activities and achieving goals. For example, individuals who experience unhealthy sleep have difficulty maintaining focused attention (Krause et al., 2017), avoiding distractions (Chuah et al., 2010), and ultimately remembering to pursue and achieve their goals (Scullin & McDaniel, 2010). Sleepy individuals also experience difficulty managing their impulses appropriately. For example, they tend to respond to stimuli both quickly and incorrectly (Anderson & Platten, 2011), display emotional outbursts (Scott & Judge, 2006), and overweight present versus future payoffs (Reynolds & Schiffbauer, 2004). In sum, the evidence suggests that unhealthy sleep interferes with goal pursuit and impulse control, both indicative of the types of self-regulatory processes essential for effective work performance. This evidence, coupled with our prediction that sleep-supportive consideration by leaders is associated with healthier sleep (H1), suggests that sleep-supportive consideration should also be indirectly associated with enhanced goal pursuit and impulse control *through* sleep health. Thus:

Hypothesis 2: Sleep leadership is indirectly related to positive changes in goal pursuit over time, through positive changes in sleep health.
Hypothesis 3: Sleep leadership is indirectly related to positive changes in impulse control over time, through positive changes in sleep health.

Supportive evidence for these hypotheses stands to shed light on the ways that domain-specific leadership behaviors can influence meaningful individual and organizational outcomes.

Method

Data were collected in a field-based, time-lagged study of individuals operating in a high-stakes work context—the U.S. Army. This two-wave study was part of a broader data collection. This context was appropriate for a focus on sleep leadership, as Army leaders are expected to pay attention to unit member sleep as part of managing operational stress concerns, and this emphasis is reflected in the Army's Field Manual 22–51 (2009).

Procedure and Participants

Participants were active-duty U.S. Army soldiers from a brigade combat team located on a military base in Germany (i.e., in garrison). The brigade had recently returned from a combat deployment to Afghanistan, and the first time period we examined was roughly six to seven months post-deployment during June/July/August of 2014 (T1), with follow-up surveys collected about four to five months later in December 2014 (T2). At both time points, participants completed an anonymous paper survey, and surveys were linked over time via a code. Sleep leadership and control variables were assessed at T1; sleep health, goal pursuit, and impulse control were assessed at both T1 and T2 to model changes over time.

In total, 2528 soldiers completed the T1 survey, and 2048 completed the T2 survey; however, the final sample was reduced by several requirements. First, participants had to provide platoon and company information at T1 because of the nested nature of the data (soldiers nested within platoons, which are nested within companies and higher levels of nesting as described below), and missing data reduced the T1 sample to 2377. Second, we examined only respondents who could be linked over time, which resulted in a sample of 808. This amount of study attrition is typical for time-lagged military studies in which units rather than individuals are followed (e.g., Adler et al., 2011; Cacioppo et al., 2015). Finally, given the nature of routine leadership changes within military units (leadership assignments are typically for 24 months), we included only those participants who reported a leadership change at T1. This was a conscious analytical choice, in that these participants would presumably be adjusting to new leadership styles, including new approaches to sleep leadership, between T1 and T2, allowing for a more direct test of our predictions about change at T2. In the end, these requirements resulted in a sample of 663 over the two time periods. Minor variations in sample sizes across analyses occurred due to some missing values.

Consistent with the demographic make-up of a typical brigade combat team, 94.7% of the 663 respondents were male; over half (57.9%) were between 18 and 24 years old, 20.7% were between 25 and 29, and the remainder were 30 or older;

and 41.6% of participants were married. The sample consisted mostly of junior enlisted personnel (63.5%) and non-commissioned officers (NCOs; 26.7%); the remainder (9.7%) were officers or warrant officers.

Since participants were in garrison rather than deployed, sleeping conditions were more comparable to those in a civilian setting. While soldiers were not asked about their housing conditions, married participants lived and slept in separate apartments or houses on post or in nearby villages. Unmarried soldiers, particularly those who were junior enlisted or junior NCOs, generally lived in barracks on post. Although they slept in their own room or shared with roommates of similar rank (and thus were not under the direct supervision of leadership), the barracks may have been periodically monitored to enforce quiet hours.

Measures

Sleep Leadership (T1) Participants completed a sleep leadership scale (Gunia et al., 2015) adapted in three ways: The referent was changed from "service members" to "soldiers" for this Army-only sample; one item about considering sleep when planning operations was simplified; and one item about reducing sleep distractions was added. The 10 questions were compiled into a T1 sleep leadership scale ($\alpha = 0.94$; see Appendix).

Changes in Sleep Health (T1 and T2) Unhealthy sleep symptoms are often summarized into two categories: insufficient sleep quantity and poor sleep quality (Barnes, 2012). Since evidence suggests that sleep quality and quantity have parallel and additive (though weakly correlated) effects (Litwiller et al., 2017), we conceptualized problems with sleep quality and sleep quantity as distinct measures of unhealthy sleep. We assessed sleep health at T1 and T2 by asking participants to complete self-reports, a valid method given the positive correlation between subjective and objective sleep health measures (Barnes, 2012). At both time periods, sleep quality problems were measured via four questions from the Insomnia Severity Index (Morin et al., 2007), which has been used in other studies with soldiers (e.g., Adler et al., 2017). Items related to problems falling asleep and staying asleep over the past two weeks (1 = None to 5 = Very severe), sleep satisfaction (1 = Very satisfied to 5 = Very dissatisfied), and how much sleep interfered with functioning (1 = Not at all to 5 = Very much; T1 $\alpha = 0.90$; T2 $\alpha = 0.88$). Sleep quantity was measured (adapted from the Pittsburgh Sleep Quality Index; Buysse et al., 1989) by asking participants to report their average sleep in a 24-h period over the past two weeks (1 = 3 or fewer hours, 2 = 4 h, 3 = 5 h, 4 = 6 h, 5 = 7 h, 6 = 8 or more hours).

Changes in Goal Pursuit and Impulse Control (T1 and T2) Participants completed the same set of goal pursuit and impulse control questions at T1 and T2. These included three validated and conceptually distinct measures indicative of goal pursuit and/or impulse control. As an indicator of goal pursuit, soldiers completed two items measuring impairments in their current ability to obtain workplace-relevant goals (completing physical training and performing well overall; 1 = No difficulty at all

to 5 = Extreme difficulty; T1 α = 0.73; T2 α = 0.76; items from Herrell et al., 2014). As indicators of impulse control, soldiers completed four validated items assessing impulsive, anger-related behaviors over the last three months (1 = Never, 5 = Five or more times; scale reliabilities at both time periods were moderate at α = 0.61; Adler et al., 2017), and 12 items measuring whether participants had engaged in impulsive, risky activities over the last three months (e.g., "Driven recklessly," "Looked to start a fight" on a Yes / No response scale where higher values indicate more risk-taking; T1 α = 0.77; T2 α = 0.80; adapted from Adler et al., 2011).

Demographic and Control Variables (T1) Following common practice for research related to mental health in the military (for a summary: Ramchand et al., 2015), we controlled for gender and military rank. Rank was treated as a categorical variable with junior-enlisted personnel as the reference category. We also controlled for leadership consideration using three items from a scale developed and validated by the Army as a measure of global, supervisory leadership skills (Lopez et al., 2019). Respondents rated their immediate supervisor on specific behaviors using five response options (1 = Never to 5 = Always). Items were: "tells Soldiers they have done a good job," "embarrasses Soldiers in front of other Soldiers," (R), and "tries to look good to higher-ups by assigning extra missions or details to Soldiers" (R) (α = 0.72). By controlling for consideration, we were able to examine whether sleep leadership has incremental effects beyond general consideration, and to argue against "halo effects."

Group Identification and Analytic Approach

The data were nested with soldiers in platoons (lower level) within higher levels of nesting in companies, battalions, brigades, etc. While each level may account for unique variance, the lower levels inherit from the higher levels (Snijders & Bosker, 2011), and more proximal Army units tend to exert more influence on soldiers than do more distal units. For these two reasons, we relied on mixed-effects models with random intercepts for platoon membership (the most proximal level for individual respondents).

Our mediation models were based on the two-wave mediation change model (Valente & MacKinnon, 2017) using a form of 1-1-1 mediation (Preacher et al., 2010). That is, all variables were conceptualized and modeled as individual-level constructs. Our rationale for relying on individual-level variables was twofold: First, empirical studies often show that variables reflecting personal states have weak unit-level properties. For instance, Murray and Short (1995) found that ICC(1) values for mental-health related constructs were less than 0.05 among young non-military adults, and Adler and colleagues reported unit-level properties for mental health outcomes in a military setting of less than 0.04 (Adler et al., 2015). Items that ask respondents to rate shared aspects of their social environments tend to have higher ICC(1) values (see Bliese et al., 2019). Second, given the highly individual nature of sleep problems, we anticipated that leaders might tailor their sleep-related behaviors to specific employees' needs.

As expected, ICC(1) variables for the sleep, goal pursuit, and impulse control variables tended to be low: sleep quality problems (ICC = 0.02), sleep quantity (ICC = 0.06), goal pursuit (ICC = 0.01), anger behaviors (ICC = 0.02), and risky behaviors (ICC = 0.00). The two forms of leadership had slightly higher ICC(1) values: sleep leadership (ICC = 0.07) and consideration (ICC = 0.08). While these ICC(1) values are small, they suggest the presence of some shared variance. Therefore, we use mixed-effects models with a random intercept for platoons in all analyses to control for any existing group-level effects in the 1-1-1 mediation analyses.

In the two-wave mediation models (Valente & MacKinnon, 2017; see Fig. 1), the first stage involves testing whether T1 sleep leadership is related to T2 sleep quality or quantity (in separate models) while controlling for the respective T1 sleep health measures and additional covariates. As noted by Valente and MacKinnon, the ANCOVA-based model provides a "base-free measure of change" (p. 432, see also Cronbach & Furby, 1970). In our application, a significant stage 1 coefficient between T1 sleep leadership and T2 sleep quality or quantity after adjusting for the respective T1 sleep health measures is an indication that sleep leadership is associated with changes in sleep health. The stage 1 coefficient represents the "a" path for estimating indirect effects. In the second stage, the outcome is regressed on the T1 and T2 sleep quality or quantity values along with T1 sleep leadership and controls. Mediation requires the T2 sleep health variable associated with the change be significantly related to the outcome, and this coefficient represents the "b" path for estimating indirect effects.[2]

The significance of the indirect effect was based on the default quasi-Bayesian confidence intervals with 1,000 simulations. Details about the quasi-Bayesian approach are provided in Imai et al. (2010), but involve fitting models and repeatedly simulating model parameters from the sampling distribution. All mediation tests were conducted using the mediation package in R (Imai et al., 2010; Tingley et al., 2014), with the base mixed-effects models estimated using the lme4 package for R (Bates et al., 2015).

Results

Table 1 provides descriptive statistics and correlations for the primary study variables.

Sleep Leadership and Sleep Health

H1 predicted that T1 sleep leadership would be associated with positive changes in sleep health from T1 to T2. The models in Table 2 and results in the online

[2] Valente and MacKinnon describe a design where the predictor is random assignment to condition. In contrast, we apply their ANCOVA model to describe changes associated with perceived differences in sleep leadership as the predictor. Given our lack of random assignment, we cannot draw strong causal claims.

Table 1 Descriptive statistics and correlations

	M	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Sleep leadership (T1)	2.30	1.00										
2. Sleep qual. probs. (T1)	2.13	0.96	−0.31***									
3. Sleep qual. probs. (T2)	2.24	0.99	−0.29***	0.63								
4. Sleep quantity (T1)	3.61	1.22	0.23***	−0.65***	−0.43***							
5. Sleep quantity (T2)	3.50	1.21	0.22***	−0.41***	−0.59***	0.61***						
6. Work. impair. (T1)	1.57	0.81	−0.19***	0.32***	0.30***	−0.19***	−0.15***					
7. Work. impair. (T2)	1.45	0.75	−0.18***	0.31***	0.49***	−0.19***	−0.24***	0.47***				
8. Anger beh. (T1)	1.35	0.54	−0.18***	0.38***	0.30***	−0.33***	−0.27***	0.25***	0.20***			
9. Anger beh. (T2)	1.37	0.58	−0.20***	0.29***	0.38***	−0.25***	−0.27***	0.25***	0.31***	0.53***		
10. Risky beh. (T1)	1.06	0.13	−0.13**	0.24***	0.18***	−0.19***	−0.14***	0.16***	0.14***	0.30***	0.24***	
11. Risky beh. (T2)	1.06	0.13	−0.17***	0.22***	0.27***	−0.19***	−0.17***	0.15***	0.26***	0.24***	0.39***	0.40***

*N*s range from 633 to 662 due to missing data; valid *N* (listwise deletion) = 580

*$p < 0.05$

**$p < 0.01$

***$p < 0.001$

Table 2 Indirect effects

	ACME estimate	LL 95% CI	UL 95% CI	*p*
Sleep leadership—Δ sleep quality probs.—Δ workplace impairment	−0.027	−0.052	< −0.001	0.028
Sleep leadership—Δ sleep quality probs.—Δ anger behaviors	−0.011	−0.022	< −0.001	0.030
Sleep leadership—Δ sleep quality probs.—Δ risky behaviors	−0.002	−0.004	< −0.001	0.038
Sleep leadership—Δ sleep quantity—Δ workplace impairment	−0.009	−0.021	< −0.001	0.028
Sleep leadership—Δ sleep quantity—Δ anger behaviors	−0.005	−0.013	< −0.001	0.046
Sleep leadership—Δ sleep quantity—Δ risky behaviors	> −0.001	−0.002	<0.001	0.350

ACME average conditional mediation effect

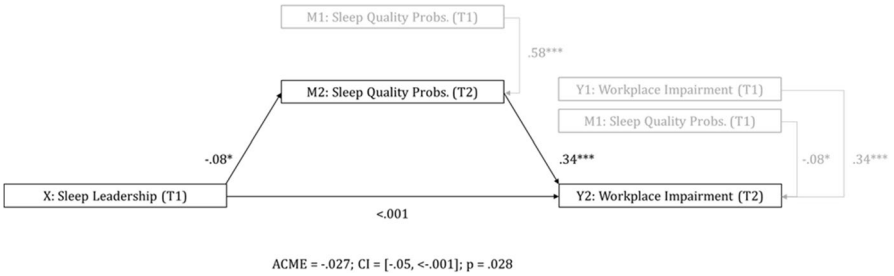

Fig. 2 Empirical example

supplementary materials generally support this hypothesis, as sleep leadership significantly predicted better T2 sleep health (controlling for T1 sleep health) in all three models predicting problems with sleep quality and two of the three sleep quantity models. As shown in the supplementary materials, the *t*-values varied somewhat on a model-by-model basis as a function of differences in sample size. The average *t*-value was 2.09 in absolute terms for the relationship between sleep leadership and sleep health after controlling for T1 sleep health and other covariates. In the model involving sleep leadership, sleep quantity, and risky behaviors, the *t*-value did not meet statistical significance with a 95% confidence level but was directionally consistent ($p < 0.07$).

Sleep Leadership, Sleep Health, Goal Pursuit, and Impulse Control

H2 and H3 predicted an indirect relationship whereby the T1-T2 change in sleep health would mediate the relationship between T1 sleep leadership and the T1-T2 change in goal pursuit and impulse control. The models in Table 2 and results in the online supplementary materials generally support these hypotheses, as better sleep health significantly predicted better T2 goal pursuit and impulse control (controlling for T1 goal pursuit and impulse control) in all three models predicting problems with sleep quality and two of the three sleep quantity models. As shown in the supplementary materials, the average *t*-value was 4.83 in absolute terms for the relationship between sleep health variables and the goal pursuit and impulse control variables after controlling for T1 sleep health, T1 goal pursuit and impulse control, and other covariates. In the model involving sleep leadership, sleep quantity, and risky behaviors, the *t*-value did not meet statistical significance, but the findings were directionally consistent ($p = 0.30$). In all, the quasi-Bayesian confidence intervals excluded zero for the three sleep quality models and two of the three sleep quantity models. Overall, the results generally support indirect relationships. The only model that did not show a significant indirect relationship involved sleep quantity and risky behaviors. Figure 2 illustrates the full set of indirect relationships for the sleep leadership-problems with sleep quality-workplace impairment model; the relevant values for the other models are located in the online supplementary materials.

Discussion

This field-based study conducted in the U.S. Army over a four-to-five-month period documented salutary effects of sleep leadership on changes in sleep health, goal pursuit, and impulse control. Sleep-supportive consideration by leaders appeared to be associated with real and durable changes in employees' sleep health, and these changes in sleep health contributed to positive changes in behaviors indicative of self-regulation. Our results suggest that initial sleep-supportive consideration by leaders is not just associated with subsequent levels of sleep health. Rather, sleep leadership is associated with subsequent *changes* in sleep health, complementing cross-sectional evidence (e.g., Sianoja et al., 2020) by suggesting that sleep leadership has practical benefits over time.

Research and Organizational Implications

Our findings that sleep-supportive consideration by leaders was associated with improved sleep health (H1), which was associated with improved goal pursuit and impulse control (H2 and H3) over time, contribute to the domain-specific leadership literature by demonstrating that sleep leadership can elicit a variety of work-relevant changes. In addition to eliciting healthier sleep, sleep-supportive consideration by leaders appears to elicit positive changes in employees' capacity to pursue work-relevant goals and manage impulses, with the emphasis again on *change*. Our findings raise the intriguing possibility that leaders may initiate a feedback loop by reducing negative spillover from work-to-home (in the form of healthier sleep) and home-to-work (in the form of enhanced goal pursuit and impulse control). If so, then sleep-supportive consideration by leaders may ultimately prompt changes spanning work-to-home-to-work. Future research could unpack this possibility further, following the effects of sleep leadership over longer time periods and studying whether sleep leadership sets off extended chains with domain-specific nudges.

As another implication worth unpacking, our measure of sleep-supportive consideration prompted participants to provide a global evaluation of their supervisor's sleep leadership behaviors rather than evaluate any personal interactions with the leader. Nevertheless, the low ICC values in our study suggest that group members differed in their global evaluations, implying that leaders may use sleep-supportive consideration in the context of interactions with individual employees. Based on these findings, future research may benefit from continuing to explore the level at which other forms of domain-specific leadership such as safety-specific or family-supportive leadership operate. Evidence that other forms of domain-specific leadership unfold in individual interactions could help us better understand how targeted leadership approaches compare to broader leadership approaches geared for groups and collectives.

On the surface, the organizational implications of our findings are complicated by the fact that leader-initiated conversations about employee sleep may, at least in some contexts, infringe on private matters, much like conversations about personal

finances or marital satisfaction (Burns, 2010). Nevertheless, organizations increasingly recognize that the topic of sleep deserves leaders' attention (e.g., Miller, 2015). In particular, the risks associated with problematic sleep suggest that simply recognizing the prevalence of unhealthy sleep may be insufficient and that leadership engagement might be needed to prevent adverse work outcomes. Building on practitioner (van Dam & van der Helm, 2016) and scholarly trends (e.g., Sianoja et al., 2020), our research highlights one role that leaders might play in supporting employee sleep. Organizations wishing to test the validity of this possibility might consider piloting sleep leadership in groups that are at-risk from unhealthy sleep, or make efforts to counter the perception of sleepless nights as "badges of honor" (e.g., Lockley et al., 2007).

Limitations and Future Directions

Despite its strengths, the current research has limitations that can help direct future research. First, our study examined self-reported rather than objective sleep. Although previous research has demonstrated that they correlate reliably (Barnes, 2012), studies of sleep-supportive consideration involving objective sleep measures would be welcome. Second, our study lacked randomization and thus does not allow for strict causal claims (see Bodner & Bliese, 2018). That said, our time-lagged design and focus on participants who had recently experienced a leadership change increase confidence in the causal order somewhat. Finally, we followed prior research in studying sleep leadership in the military because of the relevance of sleep leadership and the importance of sleep, goal pursuit, and impulse control in this occupational context. However, military service members often face elevated levels of risk, which may threaten their sleep health and self-regulatory processes, and the military operates within hierarchical teams in which leaders have clearly-defined roles. These differences from certain non-military contexts suggest that our findings may generalize most readily to other high-risk occupations with similar team structures (e.g., law enforcement, first responders, search and rescue).

Indeed, with this potential limitation in mind, we conducted a separate online data collection using a sample of adult employees from many occupations outside the military.[3] Participants recruited via the Prolific Academic platform ($n = 321$) read a scenario about a hypothetical supervisor who had engaged in either sleep leadership or one of two control forms of leadership (consideration or initiating structure). Reactions of these non-military employees to sleep leadership were quite positive. Indeed, those responding to sleep leadership rather than the two control types of leadership expected to prioritize sleep and obtain more and better sleep, and they rated the supervisor in the scenario as more trustworthy. Sleep leadership and the control types of leadership did not differ in perceived appropriateness, and participants indicated that could readily envision their actual supervisors at work using all three types of leadership. Finally, participants' real occupations were not associated

[3] A full writeup of this study and its results are available on request.

with their responses. Though based on a scenario and subject to the associated limitations, these results do begin to suggest that the benefits of sleep leadership may not be limited to the military or other high-risk occupations. More work on that possibility would enhance the literature.

Despite the noted limitations of our work, we believe it plays an important role in building our collective knowledge about sleep leadership. Indeed, our findings may be timely given the pandemic-related shift toward virtual work, which may have blurred lines and thus exacerbated spillover between work and home (Thomason & Williams, 2020). If so, then efforts to encourage and enable healthier sleep may take on increased urgency today.

In sum, despite the potentially increasing prevalence of unhealthy employee sleep, our work suggests that organizations are not necessarily fated to suffer the fallout. Rather, their leaders can engage in sleep-specific consideration behaviors. To the extent they do, sleep leadership may offer a unique opportunity to extend theory and improve employee health.

Appendix

Sleep Leadership Scale

T1 Sleep Leadership Scale

For the following statements, complete the answer that best describes your opinion of what is generally true for YOUR IMMEDIATE SUPERVISORS using the scale provided (1 = never to 5 = always):

1. Ask Soldiers about their sleeping habits
2. Encourage Soldiers to get adequate sleep
3. Plan unit schedule/operations so that Soldiers have time to get adequate sleep
4. Encourage Soldiers to nap when possible
5. Encourage Soldiers to get extra sleep before missions that require long hours
6. Work to ensure Soldiers have a good sleep environment (quiet, dark, not too hot or cold)
7. Support the appropriate use of prescription/sleep medications (like Ambien) when Soldiers need help with sleeping
8. Discourage the use of caffeine or nicotine use within several hours before trying to go to sleep
9. Encourage Soldiers to try to go to sleep on time
10. Encourage Soldiers to reduce sleep distractions by using earplugs, eye-masks or other strategies

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s41542-021-00100-w.

Acknowledgements The authors wish to thank Maurice Sipos and Jeffrey Thomas for their support of this research.

Funding Our study was funded by the Walter Reed Army Institute of Research.

Data Availability The data and material from our study are not publicly available due to restrictions related to human participant protection requirements within the Walter Reed Army Institute of Research, but can be made available upon request.

Code availability Not applicable.

Declarations

Ethical Approval The Institutional Review Board at the Walter Reed Army Institute of Research approved this research to guarantee the protection of the rights of the human subjects involved.

References

Adler, A. B., Bliese, P. D., LoPresti, M. L., McDonald, J. L., & Merrill, J. C. (2020). Sleep leadership in the army: A group randomized trial. *Sleep Health, 7*, 1–7.

Adler, A. B., Britt, T. W., Castro, C. A., McGurk, D., & Bliese, P. D. (2011). Effect of transition home from combat on risk-taking and health-related behaviors. *Journal of Traumatic Stress., 24*, 381–389.

Adler, A. B., Brossart, D. F., & Toblin, R. L. (2017). Can anger be helpful?: Soldier perceptions of the utility of anger. *The Journal of Nervous and Mental Disease, 205*(9), 692–698.

Adler, A. B., Williams, J., McGurk, D., Moss, A., & Bliese, P. D. (2015). Resilience training with soldiers during basic combat training: Randomisation by platoon. *Applied Psychology, 7*, 85–107.

Altena, E., van Der Werf, Y., Sans-Arigita, E. J., Voorn, T. A., Rombouts, S. A. R. B., Kuijer, J. P. A., & van Someren, E. J. W. (2008). Prefrontal hypoactivation and recovery in insomnia. *Sleep, 31*, 1271–1276.

Anderson, C., & Platten, C. R. (2011). Sleep deprivation lowers inhibition and enhances impulsivity to negative stimuli. *Behavioral Brain Research, 217*, 463–466.

Bandura, A. (1969). *Principles of behavior modification*. Holt, Rinehart, & Winston.

Barber, L. K., & Munz, D. C. (2011). Consistent-sufficient sleep predicts improvements in self-regulatory performance and psychological strain. *Stress and Health, 27*, 314–324.

Barnes, C. M. (2012). Working in our sleep: Sleep and self-regulation in organizations. *Organizational Psychology Review, 2*, 234–257.

Barnes, C. M., Lucianetti, L., Bhave, D. P., & Christian, M. S. (2015). "You wouldn't like me when I'm sleepy": Leaders' sleep, daily abusive supervision, and work unit engagement. *Academy of Management Journal, 58*, 1419–1437.

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*, 1–48.

Bliese, P. D., Maltarich, M. A., Hendricks, J. L., Hofmann, D. A., & Adler, A. B. (2019). Improving the measurement of group-level constructs by optimizing between-group differentiation. *Journal of Applied Psychology, 104*, 293–302.

Bodner, T. E., & Bliese, P. D. (2018). Detecting and differentiating the direction of change and intervention effects in randomized trials. *Journal of Applied Psychology, 103*, 37–53.

Brossoit, R. M., Crain, T. L., Leslie, J. J., Hammer, L. B., Truxillo, D. M., & Bodner, T. E. (2019). The effects of sleep on workplace cognitive failure and safety. *Journal of Occupational Health Psychology, 24*, 411–422.

Burns, K. (2010). 40 topics you can't discuss at work. U.S. News & World Report. Retrieved from https://money.usnews.com/money/blogs/outside-voices-careers/2010/04/28/40-topics-you-cant-discuss-at-work. Accessed 28 April 2010

Buysse, D. J., Reynolds, C. F., III., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28*, 193–213.

Cacioppo, J. T., Adler, A. B., Lester, P. B., McGurk, D., Thomas, J. L., Chen, H., & Cacioppo, S. (2015). Building social resilience in soldiers: A double dissociative randomized controlled study. *Journal of Personality and Social Psychology, 109*, 90–105.

Centers for Disease Control and Prevention. (2014). Retrieved April 27, 2021, from https://www.cdc.gov/sleep/data_statistics.html

Christian, M. S., & Ellis, A. P. J. (2011). Examining the effects of sleep deprivation on workplace deviance: A self-regulatory perspective. *Academy of Management Journal, 54*, 913–934.

Chuah, L. Y. M., Dolcos, F., Chen, A. K., Zheng, H., Parimal, S., & Chee, M. W. L. (2010). Sleep deprivation and interference by emotional distractors. *Sleep, 33*, 1305–1313.

Clarke, S. (2013). Safety leadership: A meta-analytic review of transformational and transactional leadership styles as antecedents of safety behaviours. *Journal of Occupational and Organizational Psychology, 86*, 22–49.

Cronbach, L. J., & Furby, L. (1970). How we should measure "change": Or should we? *Psychological Bulletin, 74*, 68–80.

van Dam, N. H. M., & van der Helm, E. (2016). There's a proven link between effective leadership and getting enough sleep. *Harvard Business Review Digital Articles, 2016*, 2–5.

Grzywacz, J. G., & Marks, N. F. (2000). Reconceptualizing the work–family interface: An ecological perspective on the correlates of positive and negative spillover between work and family. *Journal of Occupational Health Psychology, 5*, 111–126.

Gunia, B. C., Sipos, M. L., LoPresti, M., & Adler, A. B. (2015). Sleep leadership in high-risk occupations: An investigation of soldiers on peacekeeping and combat missions. *Military Psychology, 27*, 197–211.

Hafner, M., Stepanek, M., Taylor, J., Troxel, W. M., & van Stolk, C. (2017). Why sleep matters-The economic costs of insufficient sleep: A cross-country comparative Analysis. *Rand Health Quarterly, 6*, 11.

Hammer, L. B., Kossek, E. E., Anger, W. K., Bodner, T., & Zimmerman, K. L. (2011). Clarifying work–family intervention processes: The roles of work-family conflict and family-supportive supervisor behaviors. *Journal of Applied Psychology, 96*, 134–150.

Hammer, L. B., Kossek, E. E., Yragui, N. L., Bodner, T., & Hanson, G. C. (2009). Development and validation of a multidimensional measure of family supportive supervisor behaviors (FSSB). *Journal of Management, 35*, 837–856.

Herrell, R. K., Edens, E. N., Riviere, L. A., Thomas, J. L., Bliese, P. D., & Hoge, C. W. (2014). Assessing functional impairment in a working military population: The Walter Reed functional impairment scale. *Psychological Services, 11*, 254–264.

Imai, K., Keele, L., & Tingley, D. (2010). A general approach to causal mediation analysis. *Psychological Methods, 15*, 309–334.

Judge, T. A., Piccolo, R. F., & Ilies, R. (2004). The forgotten ones? The validity of consideration and initiating structure in leadership research. *Journal of Applied Psychology, 89*, 36–51.

Krause, A. J., Ben Simon, E., Mander, B. A., Greer, S. M., Saletin, J. M., Goldstein-Piekarski, A. N., & Walker, M. P. (2017). The sleep-deprived human brain. *Nature Reviews Neuroscience, 18*, 404–418.

Litwiller, B., Snyder, L. A., Taylor, W. D., & Steele, L. M. (2017). The relationship between sleep and work: A meta-analysis. *Journal of Applied Psychology, 102*, 682–699.

Lockley, S. W., Barger, L. K., Ayas, N. T., Rothschild, J. M., Czeisler, C. A., & Landrigan, C. P. (2007). Effects of health care provider work hours and sleep deprivation on safety and performance. *The Joint Commission Journal on Quality and Patient Safety, 33*, 7–18.

Lopez, A. A., Adler, A. B., Cabrera, O. A., & Thomas, J. L. (2019). Validation of the WRAIR leadership scale. *Military Behavioral Health, 7*, 125–134.

Luxton, D. D., Greenburg, D., Ryan, J., Niven, A., Wheeler, G., & Mysliwiec, V. (2011). Prevalence and impact of short sleep duration in redeployed OIF soldiers. *Sleep, 34*, 1189–1195.

Miller, S. (2015). Employers see wellness link to productivity, performance. Society for Human Resource Management. Retrieved from https://www.shrm.org/resourcesandtools/hr-topics/benefits/pages/wellness-productivity-link-.aspx. Accessed 25 Feb 2015

Morin, C. M., Vallieres, A., & Ivers, H. (2007). Dysfunctional beliefs and attitudes about sleep (DBAS): Validation of a brief version (DBAS-16). *Sleep, 30*, 1547–1554.

Mullen, J. E., & Kelloway, E. K. (2009). Safety leadership: A longitudinal study of the effects of transformational leadership on safety outcomes. *Journal of Occupational and Organizational Psychology, 82*, 253–272.

Murray, D. M., & Short, B. (1995). Intra-class correlation among measures related to alcohol use by young adults: Estimates, correlates and applications in intervention studies. *Journal of Studies on Alcohol, 56*, 681–694.

National Sleep Foundation. (2020). The National Sleep Foundation's 2020 Sleep in America® poll shows alarming level of sleepiness and low levels of action. Retrieved April 27, 2021, From https://www.sleepfoundation.org/professionals/sleep-america-polls/2020-sleepiness-and-low-action

Nilsson, J. P., Soderstrom, M., Karlsson, A. U., Lekander, M., Akerstedt, T., Lindroth, N. E., & Axelsson, J. (2005). Less effective executive functioning after one night's sleep deprivation. *Journal of Sleep Research, 14*, 1–6.

Nomura, K., Nakao, M., Takeuchi, T., & Yano, E. (2009). Associations of insomnia with job strain, control, and support among male Japanese workers. *Sleep Medicine, 10*, 626–629.

Preacher, K. J., Zyphur, M. J., & Zhang, Z. (2010). A general multilevel SEM framework for assessing multilevel mediation. *Psychological Methods, 15*, 209–233.

Ramchand, R., Rudavsky, R., Grant, S., Tanielian, T., & Jaycox, L. (2015). Prevalence of, risk factors for, and consequences of posttraumatic stress disorder and other mental health problems in military populations deployed to Iraq and Afghanistan. *Current Psychiatry Reports, 17*, 37.

Redeker, N. S., Caruso, C. C., Hashmi, S. D., Mullington, J. M., Grandner, M., & Morgenthaler, T. I. (2019). Workplace interventions to promote sleep health and an alert, healthy workforce. *Journal of Clinical Sleep Medicine, 15*, 649–657.

Reynolds, B., & Schiffbauer, R. (2004). Measuring state changes in human delay discounting: An experiential discounting task. *Behavioral Processes, 67*, 343–356.

Rosekind, M. R., Gregory, K. B., Mallis, M. M., Brandt, S. L., Seal, B., & Lerner, D. (2010). The cost of poor sleep: Workplace productivity loss and associated costs. *Journal of Occupational and Environmental Medicine, 52*, 91–98.

Ross, L., & Nisbett, R. E. (2011). *The person and the situation: Perspectives of social psychology*. Pinter & Martin Publishers.

Scott, B. A., & Judge, T. A. (2006). Insomnia, emotions, and job satisfaction: A multilevel study. *Journal of Management, 32*, 622–645.

Scullin, M. K., & McDaniel, M. A. (2010). Remembering to execute a goal: Sleep on it! *Psychological Science, 21*, 1028–1035.

Sianoja, M., Crain, T. L., Hammer, L. B., Bodner, T., Brockwood, K. J., LoPresti, M., & Shea, S. A. (2020). The relationship between leadership support and employee sleep. *Journal of Occupational Health Psychology, 25*, 187–202.

Snijders, T. A., & Bosker, R. J. (2011). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. Sage.

Thomason, B., & Williams, H. (2020). What will work-life balance look like after the pandemic? *Harvard Business Review, 2020*, 1–4.

Tingley, D., Yamamoto, T., Hirose, K., Imai, K., & Keele, L. (2014). Mediation: R package for causal mediation Analysis. *Journal of Statistical Software, 59*, 1–38.

U.S. Army Field Manual 22–51. (2009). Leaders' manual for combat stress control.

U.S. Army Regulation 600–100. (2017). Army profession and leadership policy.

Valente, M. J., & MacKinnon, D. P. (2017). Comparing models of change to estimate the mediated effect in the pretest-posttest control group design. *Structural Equation Modeling, 24*, 428–450.

Wagner, D. T., Barnes, C. M., & Scott, B. A. (2014). Driving it home: How workplace emotional labor harms employee home life. *Personnel Psychology, 67*, 487–516.