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CLINICAL REVIEW

Why healthy sleep is good for business

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SUMMARY

People spend large portions of their lives working, often to the detriment of sleep. Businesses often ignore the importance of employee sleep despite evidence showing sleep health is crucial to positive employee outcomes. In this review we address the effect of sleep on employee health, performance, and workplace relationships. We examine the impact of work characteristics on employee sleep. Finally, we discuss opportunities for businesses to improve employee sleep to maximize success.

A healthy employee is an effective employee, but how we define employee health has tremendous implications for identifying and implementing interventions to maximize employee effectiveness. Although a proper diet and regular exercise are well-understood crucial elements of employee health [1], the vital role of sleep is often overlooked. This represents both a massive blind spot and tremendous opportunity for employers to create policies leveraging employee sleep health to maximize commercial success and create a harmonious workplace [2] (see Fig. 1).

Sleep is established as a major contributor to overall human health and well-being, yet attainment of healthy sleep remains out of reach for many. Employment related factors such as work schedules, workload, norms, stress, and interpersonal mistreatment are severely overlooked contributors to poor population sleep health [3]. Broad based societal sleep optimization will not occur until businesses appreciate the massive opportunity cost of sleep damaging workplace policies.

Businesses answer to many stakeholders, but shareholders focused on profit maximization get the most attention. Efforts to improve employee sleep by the sleep medicine community would do well to focus their efforts on demonstrating how sleep positively impacts corporate bottom lines. Indeed, well-rested employees miss less work [4], do a better job when present [4], have fewer workplace accidents [5], make better decisions [6], and interact more positively interpersonally [7]. Unfortunately, these positive impacts on workplace performance are often underappreciated by managers. Pressure to meet challenging performance objectives provokes them to extend work hours or create work schedules antithetical to human circadian rhythms. These managers weigh productivity gains of additional work time against productivity losses of impaired employee sleep. More often than not, sleep ends up compromised [3,8]. Until managers fully understand the breadth and depth of the untoward effect of insufficient sleep and circadian misalignment on work-related outcomes, they will continue to shape the work context in a manner which undermines sleep. Contemporary business climates often assume a zero sum game between sleep and corporate success. However, a deeper exploration of the issue reveals an opportunity which forward thinking organizations already understand - healthy employee sleep and corporate success are directly correlated [3,9–12].

In this manuscript we review the literature examining the effects of sleep on employee health and work-related outcomes. We summarize the current literature and clarify how employees become less effective at conducting their work (and more harmful to the businesses themselves) when they get insufficient or poor quality sleep. We then discuss the manner in which businesses can address these workforce-related sleep issues.

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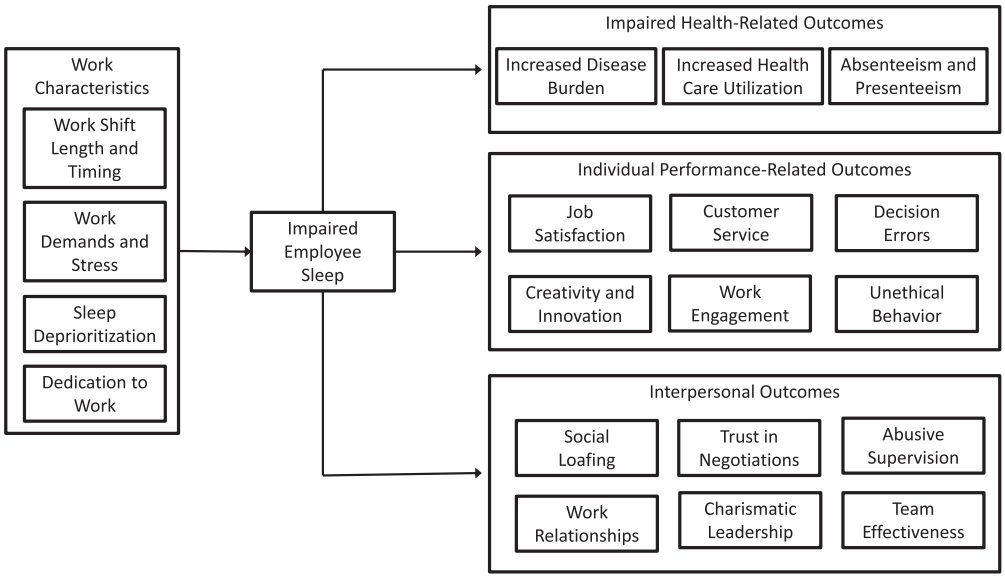

Fig. 1. How Work Influences and is Influenced by Sleep.

Impaired health-related outcomes

Sleep health encompasses a combination of factors necessary for sleep optimization. Sleep duration of seven or more hours on a nightly basis is recommended to support optimal health in adults [13]. Bedtimes and wake times must be consistent and allow sleep to regularly occur at night in harmony with human circadian physiology. Sleep quality (e.g., minimal arousals, normal sleep architecture) must be good and sleep disorders must either be absent, or if present, treated. Sleep is impaired when devoid of any of these components. From a workplace perspective, sleep curtailment, along with circadian disruption due to shift-work schedules causing irregular sleep-wake times, and undiagnosed and untreated sleep disorders are the biggest contributors to sub-optimal sleep.

Increased disease burden

Habitually insufficient sleep is the most common cause of sleepiness in society. Indeed, the Centers for Disease Control and Prevention indicate approximately a third of U.S. adults sleep less than the recommended 7 h per night, with 15% sleeping <6 h [14,15]. Short sleep is associated with a myriad of chronic health conditions, including cardiovascular diseases (e.g., stroke, hypertension, myocardial infarction) [16–19], diabetes [19–21], and psychiatric disorders including depression, substance dependence, and suicidal thoughts and behaviors [22–24].

Insufficient sleep, along with snoring, negatively impacts cancer survival and short sleep compromises immune function with untoward effects on vaccine response and increased susceptibility to the common cold [25–27]. Inadequate sleep increases motor vehicle accident risk [28,29]. Falling asleep at work at least once a week occurs in 32%–36% of shift workers and risk of occupational accidents is at least 60% higher for non-day shift workers [30]. Road and workplace accidents related to excessive sleepiness, to which shiftwork is a significant contributor, are estimated to cost $71-$93 billion per annum in the United States [31]. More broadly, an individual sleeping on average < 6 h per night has a 13% higher mortality risk than an individual sleeping between 7 and 9 h [4].

Shiftwork sleep disorder, characterized by both sleepiness and insomnia, is becoming more common, with 1 in 5 employees worldwide working nontraditional shifts. Shift-work schedules typically result in insufficient, poor quality sleep as it occurs outside traditional sleep hours at night and is misaligned with circadian rhythms. As such, shift-work is associated with cardiovascular [32] and metabolic [33] diseases and is considered a likely carcinogen [34].

Increased health care utilization

Sleep-related illnesses increase healthcare utilization affecting corporate financial health, particularly for self-insured organizations. Insomnia is associated with high health care utilization with direct and indirect costs valued in the tens of billions of dollars annually [35–38]. Annual direct costs of insomnia are estimated at nearly $14 billion, while physician and medical expenses for insomnia patients are estimated at $5580 annually, nearly $4220 more than matched controls [39]. Another analysis indicates that poor sleep health among shift-workers carries an estimated economic impact of between $30 and 40 billion U.S. annually in terms of direct and indirect health care costs [4,31,40,41]. Annual direct and indirect costs of sleep disorders (e.g., OSA, insomnia, narcolepsy, parasomnias, sleep-related movement disorders) in Australia were recently estimated at 4.5 billion, representing 0.8% of GDP and nearly $4000 per citizen with a sleep disorder [42].

Absenteeism and presenteeism

At the macro-level, the association of short sleep with increased mortality reduces the size of the workforce. Moreover, insufficient sleep is a major contributor to absenteeism (e.g., workplace absence due to illnesses) and presenteeism (e.g., sub-optimal work performance due to working while ill). Short sleep related absenteeism and presenteeism both reduce workplace efficiency.

When compared to workers sleeping the normal 7–9 h per night, those sleeping <6 h lose approximately six working days per year due to absenteeism and presenteeism [4]. As a result those sleeping <6 h per day report on average a 2.4% loss in productivity

compared to those sleeping between 7 and 9 h [4]. Even workers sleeping on average 6–7 h per night still experience a loss of 3.7 workdays and an overall 1.5% productivity loss [4]. All told, from a macro-economic perspective, the U.S. economy loses the equivalent of 1.23 million working days due to insufficient sleep annually, corresponding to roughly 9.9 million working hours [4].

Overall, the effects of insufficient sleep and sleep impairment on human health impact corporate bottom lines in myriad ways. An Australian group assessed the economic costs of sleepiness resulting from insufficient sleep and sleep disorders (e.g., obstructive sleep apnea, restless legs syndrome, insomnia) – collectively referred to as "inadequate sleep". They factored in related productivity losses, caregiving, work and vehicle related accidents, welfare payments, and foregone tax revenue. The total annual financial cost of inadequate sleep was $17.9 billion dollars, of which 68% was comprised of productivity losses largely due to absenteeism and presenteeism [43]. The RAND corporation estimates that various forms of sleep curtailment costs the U.S. Economy $411 billion dollars per year, equivalent to 2.28% of GDP [4].

As previously mentioned, the absence or effective treatment of sleep disorders is an important element of sleep health and another major sleep factor impacting corporate bottom lines. A recent economic analysis demonstrated the diagnosis and treatment of obstructive sleep apnea (OSA) for the estimated 25 million Americans with this disease would save the U.S. economy over $100 billion per year [44]. The single largest contributing factor to these costs are lost productivity from absenteeism and presenteeism (58%), followed by increases in healthcare utilization (20%), motor vehicle accident cost (18%) and workplace accidents (4%) [45]. Indirect costs such as absenteeism, productivity loss, and motor vehicle collisions resulting from insomnia were estimated annually to top $100 billion [38].

These previous estimates focus almost entirely on health-based reasons that poor or insufficient sleep is bad for business. A separate literature examines a litany of other negative outcomes at work beyond the health-mediated effects of absenteeism and presenteeism. Thus, current estimates of the business cost of insufficient sleep narrowly focused on health-based mechanisms are severe underestimates of the sum total cost to businesses.

Individual performance-related outcomes

Job satisfaction and customer service

Sleep deprivation, insomnia, and, poor sleep quality lead to negative and unstable moods and emotions [46] as well as low job satisfaction [47,48]. Displaying specific moods or emotional states to customers is an important aspect of many service-related occupations (e.g., "service with a smile"). Sleep deprived employees experiencing negative moods are unable to regulate emotional displays and become less effective in customer-facing roles. This increases the risk of negative customer experiences. Moreover, managers seeking to inspire employees are more challenged when addressing sleep deprived employees. Indeed, an individual who is sleep deprived by 2.2 h will perceive his or her leader as 7% lower in charisma, even holding constant the characteristics of the leader and the leader's behavior [49]. It is reasonable to assume that employees in customer service roles similarly suffer decrements in their charisma as well.

Decision errors, creativity, and innovation

The untoward cognitive effects of insufficient sleep are directly relevant to work outcomes. Businesses spend tremendous resources training employees and actively encourage ongoing learning through formal and informal venues. Many important memory-related processes occur during sleep [50,51]. Sleep deprivation impairs memory and learning, compromising the benefits of these training efforts. Sleep deprivation also undermines efficiency in switching among tasks, increasing task switching costs and compromising multitasking performance [52,53]. Indeed, attention management in general suffers [54], with attention often drifting toward the employee's own sleepiness rather than the task at hand [55]. Thus, insufficient sleep can impair on the ability of employees to effectively manage their attention and apply their most relevant knowledge to making effective decisions.

The strategic and tactical direction of a business is driven by employees, particularly those occupying influential management positions. These managers must decide appropriate levels of risk and reward when making decisions. Risk processing becomes increasingly distorted as managers become more sleep deprived, such that insufficient sleep leads to increased pursuit of irrationally high levels of risk. For example, 75 h of sleep deprivation led to a 40% increase in the propensity to take risks, even given the same payoff probabilities [56]. Sleep deprived entrepreneurs are less effective at avoiding bad opportunities [57], leaving them vulnerable to wasting resources and potentially jeopardizing the business venture itself.

Of broad relevance to many work activities, insufficient sleep increases impulsivity and reduces self-control [58]. Thus sleep deprived managers and other employees struggle to make rational intertemporal choices between short term investments and long term payoffs [59]. A review of the literature on sleep and decision making indicates insufficient sleep leads to broad decrements in decision effectiveness such that sleep deprived decision makers are especially likely to lead their businesses astray. Even worse, people lack insight into their increased propensity to make errors when sleep deprived and they underestimate the degree to which they are impaired [60,61]. As a result, sleepy decision makers in business contexts making bad decisions fail to realize their mistakes and miss opportunities to fix them, ultimately harming the business.

However, it is not just extreme sleep deprivation which produces harmful cognitive effects. The effects of cumulative sleep restriction on cognitive performance have also been explored as well. In one study, subjects were restricted to 5 h of sleep per night for four consecutive nights. Resultant cognitive performance decrements were compared to that of alcohol consumption and found to be on par with having a blood alcohol concentration close to the legal limit for driving [62].

Innovation is highly valued and considered the lifeblood of many industries and businesses. Unfortunately, creativity and innovation are substantially compromised by the harmful cognitive effects of impaired and shortened sleep. Insufficient sleep lowers the likelihood of achieving creative insight into solutions to difficult problems. For example, a full night of sleep deprivation leaves people 60% less likely to reach such insight [63]. Similarly, sleep deprivation undermines the ability to find linkages between seemingly unrelated concepts [64], as well as undermines flexibility in cognitive processes [6]. In a field study examining entrepreneurs, researchers found that the entrepreneurs were less creative after a short night of sleep [65].

Work engagement and unethical behavior

Given the untoward effect of sleep impairment on affect and cognition, it is no surprise that an interdisciplinary literature exists examining how sleep influences behaviors relevant to workplace success. The effect of sleep deprivation on mood and job satisfaction leaves employees less likely to engage in helping behavior

toward their colleagues [48]. More broadly, insufficient sleep leads to lower levels of overall work engagement the next day [66]. One study in particular revealed that an hour less sleep led to an increase of approximately 5% in procrastination [67], and a 3%–6% increase in cyberloafing (measured as Google searches within the entertainment category) [68]. In the extreme, insufficient sleep can even lead to people falling asleep on the job; indeed nearly a third of Americans fall asleep at work at least once per month [69].

Moreover, because insufficient sleep compromises self-control and moral awareness, unethical behavior becomes more prevalent in the sleep deprived state; a 2.2 h decrement in sleep leads to a 10% decline in moral awareness [70]. Because sleep deprivation undermines self-control, it leads to an increase in the prevalence of unethical behavior [71]. This finding is perhaps the most replicated effect of sleep deprivation in the management and applied psychology literature [72–74]. Thus, sleep deprived employees are not only less effective in conducting their work, but also more likely to cause harm to the businesses employing them or the customers they serve through unethical behavior. Simply put, insufficient sleep increases the probability of business scandal.

Overall, the literature indicates a clear impact of sleep on individual work outcomes. Indeed, one recent study in particular highlights the breadth of these outcomes. Participants experiencing insomnia were randomly assigned to receive internet-based cognitive behavioral therapy for insomnia or a waitlist [75]. In contrast to the control condition, the treated group not only experienced improvements in their insomnia, but also showed improvements in their mood, self-control, job satisfaction, helping behavior toward colleagues at work, and decreases in negative behaviors at work. Thus, employees with insomnia become happier and more effective employees when their sleep improves.

Interpersonal outcomes

Social loafing and trust

Overall, sleep deprived employees are less effective in conducting their individual work. However, business success also requires employees to work together effectively. Unfortunately sleep deprivation compromises effective workplace collaboration by causing social loafing [76], in which a given member of a group free rides on the efforts of others. In the context of negotiation, sleep deprivation undermines trust and lowers the probability of reaching an agreement [77].

Abusive supervision, work relationships, and charismatic leadership

Leadership is a topic of paramount importance to businesses. Leaders are disproportionately influential in directing the efforts of employees to the benefit of the business. Effective leadership enhances the performance of an entire workgroup, whereas ineffective leadership harms workgroup performance. A study examining 88 leaders across a variety of industries plus their subordinates indicates that abusive supervision increases following a night of poor sleep quality, and this led to an immediate commensurate decrease in the work engagement of subordinates [78]. In contrast, when the same leader gets a night of high quality sleep, abusive supervision the next day is low, with a commensurate benefit to the work engagement of his or her subordinates.

Related research indicates sleep of both leaders and subordinates influences their working relationship [79]. When leaders are sleep deprived, they express more hostility, which undermines their subordinates' estimation of the quality of the working relationship. Even worse, sleep deprived leaders are unaware of the degree to which their own insufficient sleep harms their work relationships with their subordinates. The same works in reverse; sleep deprived subordinates express more hostility as well, which undermines their leader's estimation of the quality of that work relationship. Subordinates are also unaware of the harmful effects their insufficient sleep has on the relationship.

Sleep restricted leaders are also less charismatic and inspirational and less effective in displaying positive emotions when communicating with subordinates, lowering perceptions of the leaders charisma [49]. Thus, sleep restricted leaders are less able to excite and motivate employees to fully commit to their business mission. Given the importance of leader charisma to business success, this is potentially a devastating effect.

Team effectiveness

A bird's eye view of these aggregated effects highlights how insufficient sleep erodes the value of human capital within businesses [3]. Overall, sleep deprived employees conduct their work less productively and ethically, work less well together, make poorer decisions in pursuit of business goals, and lead others less effectively. As a result, work groups are less effective when their members are sleep deprived [80]. The breadth and depth of this impairment is undoubtedly underestimated by business leaders, provided they consider it at all.

Work characteristics

These harmful effects of insufficient sleep on work are especially problematic because workplaces themselves are often a major contributor to inadequate sleep. Time is a scarce resource and working long hours often comes at the expense of sleep [8]. Further, work is often scheduled at times conflicting with natural circadian rhythms and processes, such that employees trade away sleep time that otherwise would occur in optimal circadian windows for work activity that is undoubtedly impaired [81]. Late nights spent at work, early morning start times, and shift work schedules are the most obvious example of this tradeoff [11,82–84].

Shiftwork is the most extreme example of mismatches between natural circadian processes and required work schedules. In most people, sleep occurs best at night in conjunction with natural melatonin secretion patterns from the pineal gland. Many employees engaged in work schedules inconsistent with circadian rhythms suffer from shiftwork sleep disorder [41,85]. Suboptimal timing of sleep due to shiftwork is a difficult phenomenon that is unevenly distributed across various groups [86]. Shiftwork is especially common in hotels and restaurants, transportation and communication, agriculture, and health industries. Younger adults and men tend to be more likely to engage in shiftwork. Those identifying as black are most likely to engage in shiftwork, followed by those identifying as Latina and then Asian. Whites are least likely to engage in shiftwork. Age is inversely correlated with probability of engaging in shiftwork. Moreover, a study conducted in Canada indicated that immigrants were especially likely to engage in regular shiftwork [87].

Even lesser forms of work-based circadian mismatches are problematic for the sleep of employees. For example, using smartphones late at night undermines the sleep of employees [66], in part from exposure to blue light that suppresses the natural production of melatonin occurring in dim light at night. Travel among different time zones and being on call for work can also be problematic for employee sleep [11].

Moreover, employee experiences at work can undermine sleep. Above and beyond the effects of the number and timing of work hours, heavy and stressful job demands create anxiety making it more difficult for employees to sleep well at night [81]. Even the act

of managing emotions when interacting with customers during a workday can lead to anxiety which produces insomnia [88]. Perhaps not surprisingly, experiencing job insecurity [89], workplace injustice [90] incivility from colleagues [91,92], and abusive supervision from leaders [93] can all lead to difficulties sleeping well at night.

Social norms at work can promote the idea that sleep should be deprioritized to ensure workplace and career success. Sadly, many work contexts portray sleep as for the weak, and sleep deprivation as a badge of honor [2,94]. Leaders can be central nodes for these ideas based on the manner in which they communicate about sleep, their role modeling behavior, and how they reward employees for being available for work during typical sleep hours. These actions send clear signals that undermine the importance of sleep within a corporate culture [95].

In addition to these external work factors, employees' own dedication to work can undermine their sleep opportunities. Employees pursuing a calling (having a high passion for work, and experiencing it as meaningful) often have difficulties psychologically detaching from work to get a good night of sleep [96]. When employees leave unfinished tasks at work, they often ruminate about those tasks in a manner that impairs sleep [97], an effect especially pronounced when leaders have high or unrealistic performance expectations.

Finally, recent research highlighting work-to-family conflict can lead to longer sleep latency, insufficient sleep, poor sleep quality, and insomnia [98–100]. Thus, work can influence sleep through pressure work puts on family demands, and the time scarcity and strain which accompany this role conflict [8,88]. Moreover increasing the degree to which leaders are sympathetic to employee family demands leads to improvements in sleep [101], suggesting that there are workplace interventions which can address the issue of harmful effects of work on sleep.

Research Agenda for Workplace Health Promotion Programs

Corporate environments which undermine sleep are clearly harmful to the financial well-being of these business entities. A corporate culture devaluing sleep encumbers high opportunity cost akin to commercial aircraft flying with empty seats – the plane is still in the air, but profits are compromised. The simple, unavoidable facts are: we spend a third of our life sleeping, sleep impacts every aspect of human physiology, and there is no substitute for sleep. Successful corporate leaders understand the crass sentiment that “sleep is optional” undermines corporate culture and success by harming employee health and well-being.

All told, businesses that understand the opportunity sleep health affords to strengthen their bottom line would do well to create a corporate culture valuing sleep. This is best accomplished by implementation of Workplace Health Promotion Programs (WHPPs) focused on sleep-wellness and fatigue management to optimize employee sleep health [31]. Indeed, health care spending per employee falls by approximately $3 for every $1 spent on WHPPs, while absenteeism and presenteeism costs fall about $2 for every $1 spent on WHPPs [31]. This investment in employee health serves to not only recoup some of the aforementioned costs, but also create a happier workplace that will attract and retain top talent [102]. Specific to the context of sleep, an emerging literature examining employer-initiated interventions to improve employee sleep reveals preliminary indications that a potentially broad swath of interventions such as sleep hygiene education programs, timed napping before or after work, promoting increased daytime physical activity levels, referral for sleep disorders treatment, and modifying workplace environmental characteristics such as lighting may serve as effective approaches [103,104]. There are likely many effective interventions which will be revealed in future research, potentially targeting employees, supervisors, the social context at work, and activities outside of work.

Businesses can and should act in their own self-interest by facilitating the sleep health of their employees. Sleep medicine researchers must continue deepening their investigations of the relationships between sleep and work. Business leaders should seek ways to translate this research into work policies not only as a means to improve employee health, but also to improve their own bottom lines.

Conclusion

The sleep community has only recently begun to investigate the impact of sleep on work-related outcomes. However, the literature has advanced to the point at which a clear conclusion is possible: healthy sleep is good for business. Many business outcomes are aided by healthy sleep, and in turn work characteristics also influence sleep. Managers of businesses can benefit their organizations by shaping their workplace environments to create better conditions for employees to get the sleep that they need.

Practice points

- Managers should focus on human sustainability when leading employees, focusing specifically on sleep health as a way to sustain high levels of performance and work satisfaction over time
- Ensuring sleep-friendly schedules for employees (or at least minimizing sleep-disrupting schedules) will improve employee sleep and work outcomes and increase the likelihood of attracting and retaining top talent.
- Managers (especially those working in the context of 24 h operations) should seek ways to mitigate the harmful effects of non-sleep-friendly work schedules when the demands of a work environment forestall the optimization of work schedules for sleep.

Research agenda

- Continued expansion of investigations of the effects of sleep into a broader array of work-relevant outcomes, as well as the effects of work experiences on sleep
- Extension of the literature examining the effects of sleep on work outcomes to include chronic sleep restriction rather than just acute sleep deprivation
- Assessment of the benefits of transitioning to a corporate culture that values sleep to prove to upper management the investment is worth the cost.
- Development of a broader set of interventions businesses can use to improve the sleep of their employees
- New research to examine how best to translate this literature into policy changes in businesses

Conflicts of interest

The authors do not have any conflicts of interest to report.

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