

Sleep Hygiene Practices: Where to Now?

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Abstract: This paper examined why sleep hygiene practices work in some cases and not in others with a focus on non-clinical population. Sleep hygiene rules target lifestyle and environmental factors. Changing sleep-wake routines, avoiding alcohol, caffeine, bright light, and vigorous exercise near bedtime, and improving the sleeping environment (making it darker, quieter, and cooler) should yield a better night's sleep. However, the factors that predispose to sleeping difficulties are divergent among individuals. Additionally, current sleep hygiene practices fail to consider critical factors that can affect sleep, such as emotional stress (worries, stress, anxiety, anger, and fear); daytime exposure to light (that regulates the sleep-wake cycle); and human's deep-seated habits where motivating change takes time and may necessitate behavioral therapy. The paper posits that sleep hygiene practices need (1) to be tailored individually, demanding a precision medicine approach, (2) consider negative emotions that can impact sleep and (3) incorporate a behavioral change and a commitment to planned actions for its successful implementation. Further, recommendations are provided to guide future research into sleep hygiene practices.

Keywords: sleep habits; lifestyle factors; wellbeing; negative emotions



Citation: Chow, C.M. Sleep Hygiene Practices: Where to Now? *Hygiene* **2022**, *2*, 146–151. <https://doi.org/10.3390/hygiene2030013>

Academic Editor: Evangelia Nena

Received: 5 August 2022

Accepted: 14 September 2022

Published: 16 September 2022

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1. Introduction

Two processes that usher in sleep include the circadian timing of sleep and the sleep homeostatic process, where prior waking with cumulated sleep debt drives sleepiness [1,2]. Quality sleep is essential to replenish cognitive alertness and maintains physical and emotional wellbeing [3,4]. Sleep hygiene, coined by Hauri in 1977 [5], was a set of rules on how to sleep better at night [6]. These rules target lifestyle and environmental factors that can influence sleep.

Sleep hygiene recommendations were originally delivered individually as intended by Hauri [5]. This practice has since been extended to include sleep hygiene education and its practices being administered to groups. However, the factors that predispose those to sleeping difficulties are disparate between individuals, since sleep is as individual as the individual [7].

2. Sleep Hygiene Practices

Lifestyle practices targeted by sleep hygiene relate to behavior near bedtime that may have an impact on sleep. This behavior concerns lifestyle choices that we make consciously, and/or habits that we “fall into” unintentionally. Some choices can be detrimental to sleep, whereas others are beneficial. Caffeine, alcohol, and nicotine affect sleep negatively whereas exercise can be positive for sleep. Humans are creatures of habit, for example, slipping into the habit of drinking too much coffee or alcohol or doing less exercise. These entrenched habits can be unfavorable for sleep.

There are a range of environmental factors which affect sleep hygiene. A conducive sleeping environment is one that is dark, quiet, and cool. Excessive screen time, before bedtime, has been shown to decrease sleep duration and sleep efficiency [8,9]. The bedroom should be quiet at a noise level below 35 dB [10]. Sleeping too hot or too cold interrupts

sleep [11]. An ambient temperature range of 17–28 °C at 40–60% relative humidity favors sleep [10], depending on whether one is sleeping nude or with clothing, and the bedding and sleepwear type. Sleeping in wool sleepwear quickens sleep onset compared with cotton, and reduces fragmented sleep compared with polyester sleepwear in older adults [12], due to the greater ability of the wool fiber to buffer humidity and temperature changes [13]. Poor sleepers also had less wakefulness sleeping in wool than in cotton [12]. A supportive mattress and pillow are important for spine health and uninterrupted sleep.

Unfavorable lifestyle practices at or near bedtime, daytime activities that negatively influence cognitive wellbeing, or a poor sleeping environment are precipitating factors that confer poor sleep hygiene and poor sleep. Intense training and competition are stresses that can undesirably disrupt an athlete's sleep. Similarly, stressful life events can unsettle sleep. Furthermore, social and academic factors [14], the family environment [15], and cross-cultural differences for sleep practices [16] may contribute to poor sleep habits and sleep disturbances (Figure 1). Thus, identifying the precipitating factors is a fundamental step to correcting poor sleep hygiene. Some behavioral change may then be required to address the precipitating factors to improve sleep outcomes. Both the identification and addressing of the precipitating factors require an individual approach.

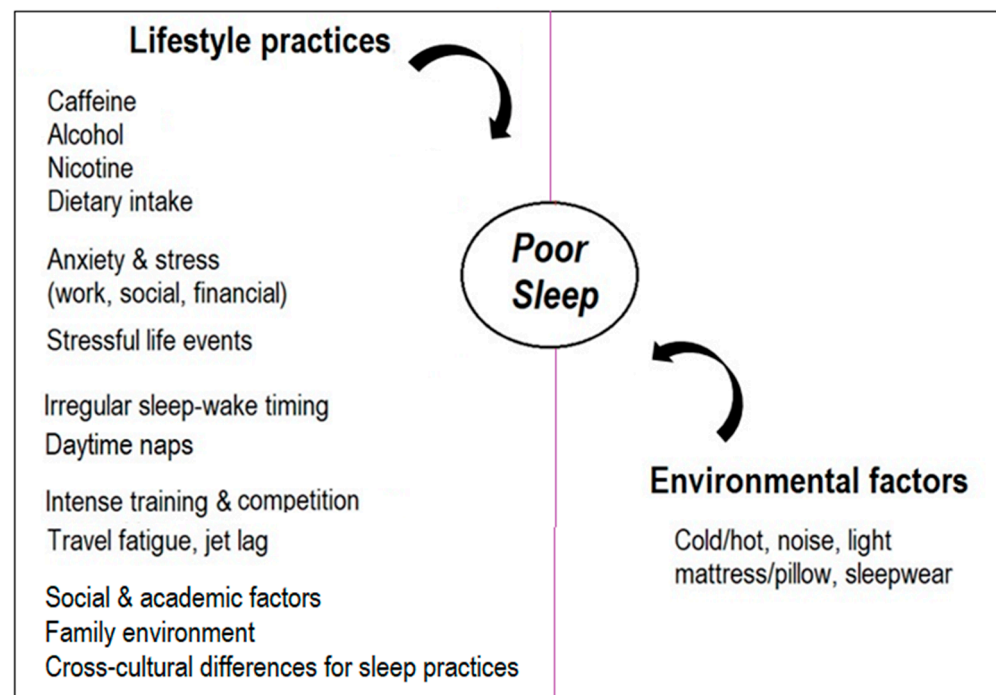


Figure 1. Precipitating factors lead to poor sleep hygiene and poor sleep.

3. Sleep Hygiene Programs in Non-Clinical Populations

Studies that examined sleep hygiene programs have reported inconsistent findings. Sleep hygiene education did not significantly improve sleep in adolescents [17,18] and IT workers [19]. On the other hand, sleep hygiene education benefited the sleep of athletes [20–23], female workers [24], and adolescents [25,26]. Several points are notable. In the adolescent studies with negative findings [17,18], participants with sleep disorders or insomnia symptoms were excluded and individual precipitating factors were neither identified nor targeted as a part of the sleep hygiene investigations. In contrast, in the adolescent studies [25,26] that showed sleep improvements, these were randomized controlled trials; one [25] targeted participants with chronic sleep reduction, and the other implemented planned behavioral change and actions [26] (see later). In professional rugby league athletes [21], although sleep hygiene education produced positive sleep changes, the benefits were not sustained at the one-month follow-up. Additionally, subjective data were not

supported by objective actigraph data in one of the successful studies [22]; and, in a further study, sleep was improved because of previous sleep restriction [25]. These short-term sleep outcomes could point to a Hawthorne Effect, where participants responded by modifying their behavior when being observed. Alternatively, lifestyle habits are salient and are not easily broken, leading participants to fall back to their old (non-sleep hygienic) ways.

Notably, a series of four 60 min group sessions on sleep hygiene education, delivered at a 2 week interval across 2 months, showed a remarkable efficacy in implementing sleep hygiene practices and improving sleep quality (Pittsburgh Sleep Quality Index questionnaire), sleep duration, and reducing daytime sleepiness in adolescents at both 1 month and 6 month follow-ups [26]. This study used a four-prong approach providing information on sleep and sleep hygiene behavior and implementing both self-monitoring of behavior and an action plan. As noted earlier by Brown, knowledge about sleep and sleep habits on its own is not translated to improved sleep quality [27]. Whilst sleep education is necessary, success of the Lin et al., program required the application of planned behavioral change and planned actions (e.g., re-constructing the physical environment for sleep, self-monitoring of behavior, and a planning sheet about when, where, and how sleep hygiene was performed each night, and strategies for counteracting potential barriers when implementing a behavioral change) [26]. In this study, concentration on behavioral change necessitated an action plan for each participant and thus facilitated the implementation of positive sleep hygiene practices [28].

4. Precipitating Factors for Poor Sleep Are Unique to Individuals

Shimura et al. (2020) [29] highlighted numerous factors that influence sleep quality other than those previously defined in sleep hygiene practices. They identified that long commuting times (that may shorten sleep duration), the regularity of mealtime (affecting the activity of clock genes), missing dinner, a lack of vegetable intake, night caps (snacking prior to bedtime), and light exposure in the morning and night (see below) were associated with disturbed sleep. These findings suggest that recognition of factors that perturb individuals' sleep importantly informs targeted sleep hygiene practices. Reliable elucidation of these factors for an individual would be expected to occur in a one-on-one precision medicine practice.

A salient piece of work by Cheek, Shaver and Lentz (2004) [30] clearly highlights unique factors, other than the 'usual' sleep hygiene practices, that may contribute to sleeping difficulties. Contrary to expectations, they reported that women with insomnia used less caffeine and alcohol per day and had smaller variations in day-to-day bedtimes than their counterparts who were good sleepers. This work highlights that individual, unique factors (e.g., life stressors, level of natural light exposure) may exacerbate poor sleep, and good sleep hygiene is not exclusively practiced by those without insomnia. Remarkably, there is no provision of recommendations in sleep hygiene practices for negating the impact of negative emotions on sleep and of circadian disruptions due to irregular sleep-wake schedules.

5. Precision Medicine Approach to Sleep Hygiene

An individualized approach to sleep hygiene practice is recommended, given the different levels of sensitivity to different aspects of sleep hygiene, e.g., some individuals are more sensitive to caffeine than others, some can fall asleep with lights on while others need a pitch-black room to be able to sleep. This variation in sensitivity of individuals seems to be a valid point in arguing the need for precision medicine approach to sleep hygiene. Moreover, group practice is feasible where individuals with similar exposures are enrolled in randomized controlled trials. A few scenarios and approaches are presented below:

Scenario 1. Individuals with circadian disruption. In non-clinical populations, sleep-wake irregularity is associated with circadian disruption [31]. Irish et al. (2015) [32], in a comprehensive review, recommended future research into the relative importance of bedtime versus rise time regularity. This paper proposes two approaches to sleep-wake

timing irregularity by (1) targeting rise-time to bring about regular bedtimes and (2) by strengthening the body clock through morning light exposure and exercise. A regular rise time has the potential advantage of regularizing bedtime theorizing that cumulative prior waking drives up sleep pressure, thus establishing sleep propensity [1,2] regardless of the timing of bedtime. Indeed, anchoring the rise time to help re-establish a consistent sleep-wake schedule is one of few instructions implemented in stimulus control therapy (cognitive behavioral therapy) for persistent insomnia [33]. This paper also proposes a strategy for strengthening the body clock through morning light exposure and exercise, since circadian disruption of sleep-wake timing is commonplace. Daily exposure to natural light serves to align the body clock to the light-dark cycle, since our body clocks entrain to sun time [34]. The consequent melatonin suppression can increase alertness and lift mood [35,36], and blue light, the strongest synchronizer of the circadian timing system in the visible light spectrum, has its highest exposure in the morning hours with twice as much in summer as in winter [37]. Accumulating evidence also suggests that regular exercise can facilitate the syncing of muscle and other peripheral clocks [38]. Thus, exercising outdoors in the morning can harvest the synergistic effects of light and exercise in phase shifting [39,40] and advancing the sleep-wake rhythms. However, consideration should be given to individual chronotypes. For example, morning light exposure and exercise may further advance the sleep of an early chronotype who goes to bed early and rises early. Thus, a future investigation that includes a deliberate second dose of bright light exposure in the afternoon/late afternoon may serve to counteract an earlier bedtime but provide the optimal health effects of aligning the body clock to the natural cycle of light and dark.

Morning light exposure has important benefits in synchronizing circadian rhythms and sleep-wake cycles, suppressing melatonin, and increasing alertness, however, avoiding or blocking night-time/bedtime blue light exposure from screen usage will mitigate negative sleep effects [41].

Scenario 2: Sleep disturbances in adolescents. Research has suggested that a disorganized family environment can contribute to adolescent sleep disturbances [15]. Indeed, irregular family lifestyle and routines including bedtime were associated with poor sleep hygiene practices and predicted poor sleep [15]. Implementation of sleep hygiene practices at the family level would model good sleeping behavior to adolescents and help establish regular sleep-wake patterns.

Scenario 3: Intense training and competition in athletes. Intense training depletes muscle and liver glycogen stores and limits training and competitive performance [42]. An increased intake of high-glycemic index (GI) carbohydrate not only speeds up recovery [42] but also shortens sleep onset latency via an increased availability of tryptophan [43]. Additionally, foods rich in tryptophan (e.g., kiwi fruit, tart cherry juice) [44,45] have been shown to promote sleep. Thus, sleep hygiene practice may include ingestion of sleep-promoting nutritional factors especially high-GI foods following heavy training or competition in athletes, although these foods are not recommended for people with diabetes [46].

A further strategy for athletes includes a warm bath/shower. Evidently, a 10 min warm shower (~40 °C) taken 20 min before bedtime eased sleep onset and improved sleep efficiency as observed in soccer players during the competitive season [47].

6. Conclusions and Recommendations

Sleep hygiene encompasses the practice of various lifestyle factors with consideration of a conducive sleeping environment as applied by Hauri. However, different interpretations on what encompasses as sleep hygiene have changed over time. Notably, sleep hygiene education is often group-administered, and planned behavioral change and actions have been implemented successfully. Many factors that predispose people to sleeping difficulties are disparate between individuals, thus applying precision medicine is a key to success in sleep hygiene practice.

Strengthening the body clock through morning light exposure and exercise should guide future research into sleep hygiene practices. Managing negative emotions can allay anxiety to better manage sleep. Specifically, it is recommended that future research in sleep hygiene includes work on:

- the regularity of timing of rise time;
- morning light exposure and exercise for easy transition to sleep and sleep maintenance;
- strategies that manage negative emotions at bedtime;
- establishing high GI carbohydrates or tryptophan-rich foods for ease of sleep onset following intense training/competition in athletes.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The author declares no conflict of interest.

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