

Sleep Health Promotion Interventions

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Sleep health promotion is the public health field that is concerned with improving sleep health in primarily healthy populations. Good sleep health is characterized by subjective satisfaction, appropriate timing, adequate duration, high efficiency, and sustained alertness during waking hours (Buysse,2014). As in the last decade evidence has been mounting that good sleep is crucial for health, sleep health promotion is receiving increasing attention in public health. In this contribution, an overview is provided of the sleep health promotion interventions that have been described in reviews.

Keywords: sleep ; sleep hygiene ; effectiveness ; program evaluation ; public health ; systematic review

1. Introduction

Sleep health has been defined as “a multidimensional pattern of sleep-wakefulness, adapted to individual, social, and environmental demands, promoting physical, and mental well-being” ^[1]. Insufficient sleep may contribute to chronic diseases, such as obesity ^[2], cardiovascular disease ^[3], and diabetes ^[4]. Lack of sleep may also lead to depression ^[5], other mood disorders ^[6], and reductions in cognitive performance, including memory and learning difficulties ^[7]. Workplace injuries, accidents, and medical errors can also result from insufficient sleep, as daytime drowsiness and fatigue can diminish alertness and decrease reaction time ^{[8][9]}.

Poor sleep health is a global issue, and studies show an increasing prevalence of inadequate sleep ^{[10][11]}. One study estimated that, by 2030, the total number of older adults with sleep problems in low-income countries will be 260 million, an increase from 150 million in 2010 ^[10]. Ohayon (2011) estimated that the prevalence of people with sleep deficits in various countries ranged from 20% to 41.7% ^[12]. Worldwide, insufficient sleep affects every age group, although in many countries it remains unidentified and underreported ^{[10][13]}. Poor sleep also negatively affects the world economy. A combined estimate for the U.S., Canada, the UK, Germany, and Japan, put the annual economic loss due to sleep problems at USD 680 billion ^[14].

Most large-scale public health education programs and campaigns have been created to influence diet and exercise, without considering sleep ^{[15][16]}. Likewise, the US health agenda in 2010 included guidelines for physical activity and diet as important health-related behaviors, and sleep was not included ^[17]. However, sleep has recently made its way onto the US health agenda ^[18], and sleep deprivation reduction is also an emerging public health priority in the UK ^[19].

Therefore, the aim of promoting healthy sleep is expected to receive growing attention in the next decades. Sleep health promotion involves improving sleep duration and quality. Such work targets sleep-related health behaviors and knowledge among healthcare professionals, policy makers, and the general population ^{[20][21]}. Sleep duration is normally defined as the cumulative amount of sleep during the nightly episode of rest, or over a 24-h period ^[22]. Sleep quality is described as “one’s satisfaction with the sleep experience, integrating aspects of sleep initiation, sleep maintenance, sleep quantity, and refreshment upon awakening” ^[23]. Measures and tools for measuring sleep duration and quality vary, and can be classified as objective or subjective.

Several systematic reviews and meta-analyses have been conducted on sleep health interventions, examining different intervention types, target groups, and settings. However, an ‘umbrella review’, providing an overview of all systematic reviews published across the wide-ranging field of sleep health promotion, is missing from the literature. The purpose of this umbrella review is to systematically summarize the scope and effectiveness of sleep interventions in primarily healthy populations, i.e., not diagnosed with a sleep disorder or specific disease. More specifically, it aims to determine what kinds of non-pharmacological sleep health interventions have been implemented, in what target groups and settings, and how effective they are in improving sleep quality and duration. This overview of sleep health interventions across the lifespan is also meant to introduce interested researchers to this relatively new field of sleep health.

2. Sleep Intervention Types and Their Effectiveness

The most commonly observed intervention types were sleep education and behavior change methods. Sleep education interventions consist of providing basic education about sleep (e.g., what is sleep and its health benefits), often combined with sleep hygiene tips (e.g., 'No caffeine in the evenings'). Sleep education is frequently conducted in school-aged populations, such as children or college students. Behavior change methods are interventions based on behavioral theories, i.e., strategies to improve sleep by augmenting certain associations with sleeping. Examples of this include using bedtime routines for children, or not rewarding attention seeking and crying at bedtime. As the examples show, behavior change methods often target infants, although some adult subgroups, such as athletes and shift workers, were targeted as well [24][25].

Another common intervention was relaxation techniques. This could involve using such techniques during the day (such as mindfulness) or specifically around bedtime (e.g., progressive muscle relaxation, and listening to music). In interventions defined as 'mind–body interventions', meditative techniques are combined with physical exercise, such as tai chi. In contrast, physical exercise interventions only involved physical activity to improve sleep, without explicit relaxation components (e.g., aerobics). While these three intervention types were observed in various target groups, mind–body and physical exercise were investigated in adults in particular [26][27][28][29][30].

Fewer reviews included aromatherapy and/or massage, which involved the use of fragrant oils that are inhaled or massaged into the skin. Massage is implemented alone or often in combination with aromatherapy, involving manual techniques implemented by a therapist (e.g., back massage and foot reflexology). These interventions are often observed in healthcare facilities, such as nursing homes. Another less commonly observed sleep intervention type is environmental interventions, the modification of sleep environments. Examples include bright light and noise or temperature adjustment, the techniques most often used in healthcare settings. Later school start times were also less commonly observed, which involved changing the time of school starts to correspond with the circadian rhythms of adolescents (teenagers undergo a delay in their sleep–wake rhythm, as a consequence of biological processes during puberty) [31]. However, this is the most common intervention for adolescents, when considering the number of study participants. School districts may set policies to start school days at 9:00 instead of 8:00, as is recommended by the included reviews [32][33][34]. Likewise, the American Academy of Pediatrics recommends that middle and high schools aim to start no earlier than 8:30 [35].

The most common example among the therapies was cognitive behavioral therapy, which aims to support patients in identifying and changing destructive or disturbing patterns of thoughts that negatively affect behavior and emotions [36]. It should be noted that cognitive behavioral therapy for insomnia is widely acknowledged as an effective treatment for people diagnosed with insomnia [37]. However, in the present review, addressing the general public, evidence for its effectiveness was limited. Lastly, multicomponent interventions were commonly observed. In particular, sleep education was often combined with behavior change methods, though physical exercise, mindfulness, and environmental modifications were sometimes combined with sleep education too.

Although the 11 defined intervention types adequately describe the sleep health interventions in the included reviews, the distinctions between the intervention categories were sometimes not as straightforward as might be assumed. For example, giving sleep hygiene tips was considered sleep education, but these tips often suggest bedtime relaxation or creating a dark, quiet sleeping environment. One could then argue that education on sleep hygiene also has relaxation and environmental components. Furthermore, CBT and BCM partly share their theoretical underpinning. Nevertheless, CBT and BCM were considered as separate intervention types, as techniques as well as implementers varied considerably. However, in determining the 11 intervention types, the main focus of an intervention could always be identified.

Three categories showed substantially more evidence for improving sleep duration and/or quality: behavior change methods, mind–body exercise, and later school start times. These categories consistently demonstrated statistically significant improvements with relatively large effect sizes. Many reviews featuring behavior change methods and mind–body exercise included rigorous RCT study designs. This included two meta-analyses primarily analyzing behavior change methods [38][39], and two meta-analyses of exclusively mind–body exercises [28][30]. Later school start times also demonstrated strong effects in two reviews with particularly large participant samples. The eight additional intervention types defined in this review also demonstrated some promising impacts on sleep, but with less research conducted and/or less consistent evidence. Some techniques demonstrated higher effectiveness than others within categories. For example, listening to music seemed to be more effective than other relaxation techniques.

These conclusions should be interpreted with caution. There was heterogeneity in study designs, outcome measures, populations targeted, and specific techniques. Generalization is another concern, as some data is from narrow target groups or settings and results may not be applicable in other contexts. For instance, physical exercise to improve sleep was mostly implemented for women, and environmental interventions were mainly applied in healthcare settings. These interventions may not demonstrate similar effectiveness in other populations or settings. Moreover, there were contradictory findings regarding the relative effectiveness of some specific techniques within categories. For example, one meta-analysis showed aromatherapy to be more effective than massage ^[40], while another showed that massage was the more effective technique of the two ^[41].

2.1. Implications for Practice and Future Research

Sleep health promotion has been gaining attention in public health, and effective interventions are being developed that improve sleep duration and quality in the general population. Currently, policies regarding sleep have been implemented within different countries and organizations, including later school start times, regulations for shift worker hours, and public education on sleep health ^{[32][42]}. Practitioners and policy makers may profit from the insights of this present review to extend such initiatives.

This review also suggests recommendations for future research. As previously mentioned, some intervention types have only targeted specific groups or have not been investigated thoroughly. For instance, mind–body and physical exercise has had promising results among adults and elderly people, so future research could demonstrate if this approach would be effective in children or adolescents. In this age of smartphone technology, apps may be a new channel for sleep intervention implementation, which could be further explored (e.g., to implement behavior control methods more systematically).

In the included reviews, the lack of behavioral theory in intervention development was surprising. Behavioral theory is used to effectively predict and alter many health behaviors, but its use has been very limited in sleep health ^{[43][44]}. In fact, only one included review specifically reported and emphasized the foundations of behavioral theory within its interventions ^[45]. While there is a small amount of research regarding the factors influencing sleep health and sleep behaviors ^{[46][47]}, most interventions were not developed explicitly considering these factors, nor how they apply to specific target groups. More research into sleep-related factors and the application of theoretical frameworks of behavior change are lacking in the literature, requiring further research. To steer the reporting and comparability of reviews, following PRISMA guidelines is also heavily encouraged in future reviews.

3. Conclusions

This umbrella review is the first to provide an overview of strategies used in the rapidly evolving field of sleep health promotion, shedding light on target populations and intervention settings. Later school start times, behavior change methods, and mind–body exercise provided the most evidence of effectively improving sleep. Other interventions, such as sleep education, relaxation techniques, physical exercise, aromatherapy, massage, psychotherapy, and environmental interventions, also showed promising but inconsistent or limited results. Conclusions should be considered with caution, as there was high heterogeneity between studies. Nevertheless, this umbrella review can be seen as a first step towards reaching a greater understanding of sleep health promotion.

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