



Research Findings for Sleep Disorders: A Literature Update

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Authors' contributions

This work was carried out in collaboration between all authors. Author AA outlined and provided the first ten pages and idea for the study. Author WB provided guidance and direction for the papers content and author WGW wrote the remaining pages of the document, made needed revisions and completed the publication process. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

According to the Center for Disease Control and Prevention long-term sleep difficulties are reported by 50 to 70 million individuals in the U.S. population. These difficulties include a variety of symptoms that effect an individual's everyday lives including their health, mood, and cognition. In response to this international issue, mental health professionals and health care facilities have conducted numerous studies to investigate effective ways to treat sleep disorders. Due to the abundance of research and treatment options, it may be difficult for researchers, practitioners, and educators to have a comprehensive understanding of sleep disorders and treatment. The purpose of this review article is to provide a review of the damaging effects, risk factors, and current treatments of sleep disorders. This review includes a brief look of around 130 research studies that discuss the causes and/or effects of maladaptive sleep behavior, as well as the effective treatment methods. Based on the research reviewed, we conclude that sleep issues are a serious problem that can be treated effectively through a variety of practices, techniques, and medications.

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1. INTRODUCTION

In a review of major advances made in sleep science over the past 70 years, Shepard et al. [1] referred to sleep disorders as a “public health concern” (p. 61). Additionally, it has been estimated that 50-70 million American adults have chronic sleep difficulties [2] and just over 68% of adolescents in the United States get less than 8 hours of sleep on an average school night [3]. As a result, the National Center on Sleep Disorders Research (NCSDR) developed a *Sleep Disorders Research Plan* identifying five key goals for improving sleep health. Of their five goals, three share a common theme of increasing professional and public awareness of risks, consequences, preventions, and treatments of sleep disorders. Furthermore, the NCSDR urges interdisciplinary collaboration if we are to bridge the existing gap between scientific knowledge and public benefit [4]. Based on these themes, it is imperative that a comprehensive understanding of the best and most efficient sleep disorder treatments exist today. Therefore, the purpose of this article is to raise awareness, encourage dialogue, and offer a broad review of current research findings related to the prevention and treatment of sleep disturbance and disorders. By doing so researchers, clients, and providers can make important decisions regarding which treatment is most worth their effort, money, and expertise.

Nearly 90 sleep-related disorders have been identified in the International Classification of Sleep Disorders (ICSD), ranging from narcolepsy to insomnia [1]. The high prevalence of sleep and circadian problems, along with alarming empirical evidence connecting sleep disruption to disability, disease, and mortality, has prompted Congress and the Department of Health and Human Services to identify continued scientific investigation as a matter of high priority [3]. Accordingly, the National Center on Sleep Disorders Research (NCSDR) has called on researchers and clinicians across healthcare domains to engage in training and advocacy which will help hasten the popularity, availability, and overall use of enhanced sleep therapies [4]. As well, the NCSDR offered confidence in the ability of science and new technology to fulfill its part in the mission of advancing knowledge of sleep behavior and related disease mechanisms.

Though numerous studies have broadened our understanding of sleep’s crucial role in human

health, sleep science remains a relatively new field [5]. The dawn of electric lighting brought with it social and economic changes, which altered sleep patterns substantially and as a result, the NCSDR estimates that overall sleep time has decreased by 20% over the last century in the U.S. Moreover, research by LeBlanc et al. (2007) found that 30% of their sample reported having trouble with initiating and maintaining sleep. This is critical information because sleep deprivation, whether total or partial, has been found to be detrimental to mood [6], learning [7], athletic performance [8,9], general health [10], and can lead to increased risk for motor vehicular accidents [11]. Therefore, one can conclude that the increased prevalence of disrupted sleep patterns is likely wreaking havoc on the overall well-being of those who suffer from sleep issues and warrants immediate attention.

One step in fulfilling the mission of NCSDR is to provide key information on sleep health to both the general public and health care professionals in a meaningful and succinct way. Goal 4 of the *Sleep Disorders Research Plan* specifically aims to “Enhance the translation and dissemination of sleep and circadian research findings and concepts to improve health care, inform public policy, and increase community awareness to enhance human health” [4]. Communication between and among affected individuals, medical and mental health practitioners, researchers, and policy makers is vital to the accelerated advocacy, understanding, and application of available information. Interdisciplinary collaboration need not stop there, as it is equally important for educators and employers to recognize the potential hazards of disturbed sleep on academic and job success [12].

2. SLEEP RESEARCH IN DIFFERENT POPULATIONS

2.1 College Students and Sleep

A common population reporting trouble with sleep is college students. During their college years, students are adjusting to the many developmental, academic, and social demands which are a significant part of emerging adulthood [13,14]. Consequently, increased stress and time restraints impact their sleep behavior, adversely affecting academic performance, as well as physical and emotional health [13,15,7]. As young adults develop

patterns of behavior to cope with increasing responsibilities, maladaptive habits in sleep behavior can also develop [15,16]. With numerous studies suggesting an epidemic of sleep deprivation among college students [7,17] a focus is needed on the importance of preventing and treating sleep-related issues within the population. Leaders of higher education institutions have the opportunity to bring awareness and guidance to the next generation of families and professionals on a matter that fundamentally impacts the health of our nation.

Despite myriad studies evidencing problems in sleep quality among college students [13,17,18, 19,20], along with decades of findings associating poor sleep with negative health [16, 21,22,23], mood [6,24], cognitive [25,26] and academic consequences [7,27], sleep disorders continue to be underdiagnosed and undertreated [4,6].

In a study of 1,125 college students at a large, Midwestern university, Lund et al. [17] found that stress provided the most reliable explanation for poor sleep quality, especially for women. Tension and stress accounted for 24% of the variance in sleep quality, while 68% of the students identified stress as the factor which most interfered with initiating sleep. Stress predicted sleep interference, more than mood, caffeine, alcohol, electronics, and consistency of sleep schedule. Like a domino effect, high levels of perceived stress in college students predicted poor sleep quality, and inconsistent total sleep time predicted a decline in academic performance [28]. Based on these findings and the multitude of studies that support issues in college students sleep behavior, it is imperative that educators and administrators alike seek out methods to resolve this issue in a way that better the lives of their students.

2.2 Adolescents and Sleep

Concerning the sleep behaviors and difficulties within the adolescent population, alarming numbers were found in a recent study of South Texas children that 43% of elementary school students (n = 499) and 29% of middle school students (n = 1008) reported trouble sleeping [29]. Researchers outside of the United States have also found alarming information related to the prevalence of sleep difficulties of adolescents as Hysing, Pallesen, Stormark, Lundervold, & Sivertsen (2013) report that 65% of their sample

(n = 10,220) reported a sleep latency that exceeded 30 minutes and that insomnia rates found amongst this sample approached approximately 18.5% [30]. In Wheaton, Chapman, and Croft's (2016) recent meta-analysis, the authors discuss the prevalence of sleep deprivation amongst adolescents and the need to address these issues while also reviewing literature that suggest potential solutions [31]. The authors analyzed 38 reports that sought to better understand the sleep difficulties of high school adolescents and concluded that the early start times of classes is likely a direct contributor of maladaptive sleep behaviors as well as dysfunctional sleep symptoms.

Orzech, Acebo, Seifer, Barker, and Carskadon [32] have sought to better understand the negative effects of sleep-issues among adolescents, particularly in how they affect physical and mental health. The researchers found that longer sleepers had less instances of illness as determined by participants self-report of illness events and illness-related absences. Decreased sleep quantity was found to often be a precedent for becoming ill. In regards to mental health, Matamura et al. [33] concludes that late bedtimes and short sleep duration may predict depression and anxiety in junior high and high school students. However, when looking at the relationship between sleep and mental health in adolescents, one must also consider the recent research of Tavernier, Choo, Grant, and Adam (2016) suggesting that mental health may actually be having an impact on sleep. In this study, 77 high school students were assessed on sleep hours, latency, efficiency, and length of waking during the night as they compared to reported emotions. The authors concluded that adolescents who reported higher levels of adverse social evaluative emotions and periods of high arousal experiences had a lower sleep quantity than other students and, interestingly, participants who reported experiencing sadness, depression, and/or loneliness had shorter awakenings and longer overall sleep time than students who reported being calm [34]. Additionally, Schalkwijk, Blessinga, Willems, Van Der Werf, & Schuengel (2015) found evidence that academic stress is negatively associated with sleep quality and had a positive relationship with sleep reduction amongst adolescents. The researchers also found that social support moderated these relationships. As social support increased, there was a stronger negative relationship between sleep quality and

sleep reduction [35]. To conclude, adolescents are another subset of the general population affected by sleep difficulties that can benefit from sleep intervention and treatment.

2.3 Adults and Sleep

As it pertains to adults in the general population, research investigating the relationship of sleep issues often focuses specifically on job performance. For example, a multitude of these studies have found repeated evidence that sleepiness within the workplace leads to a poorer overall performance [12,36,37]. Mullins et al. (2014) found that sleepiness at work not only reduced productivity, but increased accidents, avoidance behavior, absenteeism, lateness, and turn-over rate. Furthermore, research suggest that inadequate sleep has been found to have repercussions that affect an individual's ability to succeed academically and economically, particularly for those who are both students and employees [12]. One can only assume that the negative consequences of sleep deprivation on an individual employee likely trickle down to affect businesses, bosses, and consumers.

Sleep disorders and detriments in sleep have also been found to have a negative effect on the general health of adults. For instance, recent studies have found that a lack of sleep quality and quantity can result in increased risk of stroke in middle-aged men and women [38] impair cognitive performance [39], and create disrupted inhibitory control [40]. Likewise, detriments in sleep have also been found to increase the frequency of falls [41] and generate poor overall performance in older adults [42]. Because the effects of sleep difficulties point to these multiple grim outcomes in the adult population, it is imperative that risk factors and empirically supported treatments are fully understood.

3. RISK FACTORS

While there is a paucity of research related to preventive strategies for sleep difficulties and disorders, many researchers approach prevention by either identifying risk factors or illuminating sleep promoting practices. For instance, Lundh and Broman [43] argue that risk factors including arousability, delayed stress recuperation, worrying, and emotional conflicts in personal relationships and are often based on personality factors such as sleep-related beliefs, attitudes, or perfectionistic standards. These personality standards predispose the individual

to respond to adversity with increased sleep-interfering behaviors and also employ maladaptive sleep-interruptive processes. Furthermore, Lund et al. (2010) found that high levels of academic and emotional stress are associated with poorer sleep quality.

Maladaptive coping methods aimed at reducing sleepiness may also be evidence of risk factors for sleep related difficulties, including consumption of energy drinks and caffeine pills [44]. Additionally alcohol use has been found to directly link to staying up later, getting fewer hours of sleep, and maintaining inconsistent sleep patterns within the college population [19]. A regression analysis indicated that volume of alcohol, but not frequency of use, was a significant predictor of later sleep schedules, which correlated with daytime sleepiness [19]. Students who reported drinking larger quantities of alcohol also reported going to bed later and feeling sleepier during the day.

A relatively new risk factor that may predict poor sleep outcomes as it pertains to quality and latency includes the amount of time spent playing video games. For instance, Exelmans and Van den Bulck (2015) found that the amount of time an adult played video games significantly predicted sleep quality, fatigue, insomnia, bedtime, and rise time. The researchers write that each hour per day that participants played video games delayed the time they went to bed by almost seven minutes, and delayed the time they got out of bed by around 14 minutes. Furthermore, Exelman and Van den Bulck determined that gaming volume was negatively related to overall sleep quality [45] which aligns with other studies that have been found to support these findings amongst adolescents [46,47].

4. NON-CLINICAL TREATMENTS

4.1 Adjusting School Start Times

Hershner and Chervin [7] suggest that adjusting class times to encourage adequate sleep may be a cost and time effective step toward promoting healthy sleep practices amongst adolescents. In response to these delayed circadian preferences, Cukrowicz et al. (2006) found that starting morning class just 30 minutes later decreased daytime sleepiness by nearly 35%, increased positive mood, and voluntarily produced an earlier bedtime by 15 minutes in high school adolescence [48]. In addition Owens, Belon, and

Moss (2010) found that this delay resulted in fewer students reporting depression [49]. Moreover, a study that observed eighth graders starting school an hour later than usual showed improved attention and performance over the course of a five-day period [50].

Currently, prevention is based on protective and management strategies gleaned from various theoretical concepts of human behavior, cognition, tradition, and biological processes which have been studied in relation to sleep problems. However, advancements in sleep science should continue to influence our understanding of problematic sleep processes and therefore improve our diagnostic and treatment practices [1]. Eventually, these advancements may come to serve as a first line of defense in preventing harmful habits rooted in inadequate knowledge, misguided beliefs, and unhealthy social norms [51,52]. As further research is conducted on the effect of starting academic programs later in the day, educators should take note to see if these systems are effective, and if so, seek to implement them within their own school systems.

4.2 Sleep Hygiene Education

Educating college youth on healthy sleep habits can serve to improve their overall well-being and health-preserving behavior [7,16]. A recent study suggested that college students are interested in such information, but have not been exposed to it on campus [14]. Advocating sleep health by disseminating information in college settings is a priority, which could begin with sleep education classes, online programs, and university policies encouraging adequate sleep [7]. Additionally, sleep hygiene programs bring awareness to the destructive consequences of poor sleep habits [15], as well as provide instruction for constructive sleep practices [7,15,53]. In an effort to create a short but comprehensive list of healthy sleep behaviors the Division of Sleep Medicine at Harvard Medical School (2007) recommended these 12 sleep hygiene tips aimed at facilitating healthy sleep [54]:

- 1- Avoid caffeine, nicotine, and alcohol in the hours before bedtime, they impede sleep.
- 2- Enhance sleep environment. Create a dark, quiet, cool, comfortable, electronic-free room.
- 3- Establish a relaxing pre-sleep routine. (e.g. light reading, soothing music, warm bath).

- 4- Go to bed when truly tired. If trouble falling asleep, go to another room until tired.
- 5- Don't watch the clock. It can increase stress, delaying sleep.
- 6- Take advantage of natural light during the day. The sun regulates sleep-wake cycles.
- 7- Keep a consistent sleep schedule. Routine also helps with sleep-wake cycle regulation.
- 8- Avoid or limit napping. If you must, keep it short and before 5 p.m.
- 9- Eat light in the evening. Have dinner several hours before bed.
- 10- Drink enough at night not to wake up thirsty, but not close to bedtime.
- 11- Exercise early in the day promotes sleep, but delays sleep within three hours of bedtime.
- 12- Stick with it. Some steps may be easier to do, but together can improve restful sleep.

In addition, the CDC (2012) focused on four practices for promoting healthy sleep; each is covered above in numbers two, seven, and nine of the Harvard (2007) instructions. Importantly, both institutions acknowledge that good sleep hygiene is effective for mild to moderate sleep disturbance, though more severe sleep disorders may require clinical intervention.

However, there is also conflicting literature about sleep hygiene. In a review of potential interventions, Hershner and Chervin (2014) reported that daytime naps that are long enough to allow REM and slow wave sleep (60-100 minutes) may benefit academic performance, certain memory tasks, and visual perception tasks. Additionally, they found a need for continued investigation into cost and time effective strategies for implementing educational programs for college students. Additionally, while good sleep hygiene practice had a strong relationship with improved sleep quality, knowledge of sleep hygiene and practice had a weak association [7]. This may imply that knowledge may not be enough to promote practice. This finding was supported in a sample of high school students who indicated increased motivation during sleep education interventions, but positive results did not translate into sustained behavior changes [55]. Addressing the gap between motivation and maintenance appears to be an avenue for further study, as well as the development of cost-effective educational programs. Furthermore, research using clinical samples show a relationship between sleep education and improved sleep,

but there is limited information as to the effectiveness of sleep education and the general public [56].

A number of studies have pointed to inconsistencies in the effectiveness of sleep hygiene methods, a lack of research on effective intervention programs, and the transfer from motivation to maintenance behavior. Perhaps, research designs could begin to address questions such as, how much sleep health information would it take to reach a threshold of relevance among college youth, and what kind of support in the form of programs, advocacy, and university policy changes would be necessary to sustain and develop proactive student behavior? Given the established pervasiveness of sleep deprivation among college students, along with the detrimental consequences to both students and higher-education institutions, it appears a worthwhile task to shift sleep hygiene from the realm of non-clinical treatment to a mass prevention strategy. In spite of short-term financial, time, and professional energy investments, long-term gains may prove beneficial as it pertains to academic performance [57], mental health improvements [58] and student's overall health [10].

A number of independent studies that supported elements of the preceding recommendations for proper sleep practices, include music therapy [59], light exposure [60], regulation of sleep-wake cycles with attention to circadian rhythms [60, 62], and timely use of melatonin [63].

4.2.1 Music therapy

In a meta-analysis of ten randomized studies, music with relaxing melodies applied in a passive way was found to be effective in treating acute and chronic sleep disorders among different ages, settings, and geographic locations, $Z = 2.45$, $p = 0.01$. Of the ten studies that were examined, each was required to have a randomized controlled design, participants over 18 years of age, passively applied music in an effort to improve sleep quality, and a subjective or objective method of measuring sleep quality [59].

Specific findings from the meta-analysis showed that quality of sleep was significantly improved by music in both acute and chronic sleep disorders. Additional results from four of the ten studies indicated a cumulative dose effect between music and chronic sleep disorders. Moreover, subjective and objective measures of

improvement in sleep quality revealed similar results, specifically that the improvements of music therapy on sleep in treating acute and chronic sleep disorders were significant ($SMD = -1.30$, 95% CI [-1.86, -0.73]), and maintained their significance at a three week follow-up assessment. To explain this dynamic the authors argue that music acts upon biological and physiological systems of an individual, which may activate a soothing and sleep-inducing quality.

Other more specific research that discusses the effect of music on sleep has found that utilizing music as a means to improve sleep can extend stage three and four of deep sleep consciousness and, therefore, improve overall sleep quality [64]. Additionally, Shum, Taylor, Thayala, and Chan (2013) find that participants over the age of 55 who listened to 40 minutes of soft, sedative, instrumental music, for six weeks had significant improvements in sleep quality, and argue that utilizing the model may improve the therapeutic relationship between a client and the mental health provider [65]. Similar results have been found amongst the elderly population in the work of Chan, Chan, & Mok [66] who observed that soft slow music reduced depression symptomology and improved sleep quality at four weeks, though no differences were observed following the four week period. Moreover, music therapy has been shown to be effective in increasing sleep quality with traumatized refugees [67], children undergoing serious medical treatment [68], college students [69], individuals with depression [70], and women in shelters who suffer from anxiety [71].

Furthermore, researchers argue that music therapy may be a risk-free substitute to pharmacological sedation [68] and should be implemented into many healthcare facilities [69,70]. Music therapy is a low cost and effective treatment of sleep related difficulty that can be both performed at home and without clinical assistance.

4.2.2 Bright light exposure, circadian rhythm, and melatonin treatment

Three treatments that encourage sleep hygiene and follow a common thread in improving sleep cycles include bright light exposure, circadian rhythm, and melatonin treatment. Though the three treatments can be used separately, they are most effective when combined. For example, by monitoring light exposure, taking into account

an individual's circadian rhythm, and increasing melatonin levels through appropriately timed dosing schedules, one may be able to improve and stabilize sleep-wake patterns. Several studies document the benefits of this multimodal approach for restoring circadian realignment [61, 62]. The good news is, these natural treatment schedules can be managed at home, require minimal financial obligation, and lack many of the disturbing side effects as well as the risk of addiction caused by more common forms of pharmacological treatments for chronic sleep problems [60]. Additionally, melatonin alone when compared to a placebo, decreased the amount of time it took participants to fall asleep, increased sleep quantity, and significantly improved sleep quality [63]. Hollway and Aman [72] also have positive findings regarding melatonin, concluding that melatonin seems to be the safest options to use with children who have developmental disabilities after reviewing 58 articles on pharmacological interventions. Moreover, the beneficial effects of melatonin have been shown not to decline with continued use, and only benign side-effects were observed when compared those associated with other pharmaceutical sleep treatments [63].

4.3 Public Directed Awareness

Communication campaigns designed to change specific beliefs which influence unhealthy behaviors have been useful in many areas of health promotion, however, little research has been done to identify target messages concerning sleep health [51]. In an effort to inform future health campaigns that will encourage optimal sleep habits among college students, Robbins and Niederdeppe (2015) conducted a two-phase research project with a sample of undergraduates, including an elicitation study ($n = 31$) and a population survey ($n = 361$). The authors found that both attitude and perceived control were significant predictors of behavioral intention. However, perceived control was the strongest predictor of healthy sleep behavior. False beliefs such as, "having less stress will enable students to get adequate sleep," were related to unhealthy sleep behavior [51].

5. CLINICAL TREATMENTS

While non-clinical approaches often offer solely behavioral-based recommendations for improving sleep [7], clinical treatments provide psychological interventions for chronic sleep problems, such as insomnia [1,43,73,74,75].

Researchers agree that insomnia is the most prevalent sleep-related problem and is characterized by difficulty initiating and maintaining asleep, resulting in daytime distress and fatigue, but not sleepiness [43,74,76]. Symptoms of insomnia and cognitive distortions about sleep behaviors have a well-documented reciprocal relationship, such that cognitive distortions about sleep often result in maladaptive and lasting sleep behaviors [43,75].

Numerous articles report empirical evidence empirically-supported treatments for insomnia [1,53,73,74,76]. Some treatment options include sleep restriction therapies, meditation models, mindfulness therapy, cognitive behavioral concepts with both individual and group modalities, relaxation/stress reduction techniques, psychoeducation, and pharmaceutical treatments.

5.1 Behavior Therapies

In regards to adjusting behavior as it relates to sleep disorders, a variety of behavioral therapies have become popular. These therapies include several forms of behavioral and cognitive adjustments that include sleep restriction therapy, meditation therapy, mindfulness therapies, cognitive therapy, and cognitive behavioral techniques.

5.1.1 Sleep restriction therapy

Sleep restriction therapy (SRT) has been supported as an effective way to reduce insomnia-related symptoms and improve overall sleep [77,78,79,80,81]. As utilized in Miller et al.'s (2013) study, sleep restriction therapy is best understood as a reduction in the amount of hours participants are allowed to sleep on each given day [80]. During Miller et al.'s earlier (2012) study, participants were restricted to a five-hour sleep window with the potential to increase the sleep window by 15 minutes if their overall sleep efficiency reached 90% [79]. Additionally, the participants were restricted to a specific time to get out of bed and recorded their bed times and wake times in a sleep diary. Participants of the study had significant decreases in sleepiness/fatigue and negative mood after three weeks, as well as a significant interaction for alert cognition and alertness at rise-time.

Miller et al.'s (2014) study on effect size regarding SRT considered nine specific studies to be relevant for assessment out of the 21 found

to be specifically related to sleep restriction. The authors found that sleep restriction as a stand-alone treatment could be viewed as an efficient treatment for chronic insomnia. More precisely, the authors found that SRT played a consistent role in improving sleep latency, wake time, and overall sleep efficiency. The authors conclude that the effect size of SRT, based on the 9 relevant studies, is moderate to large and should therefore be a primary form of treatment for sleep-related deficiencies [79].

Sleep restriction therapy has been found to improve total sleep time and insomnia symptoms [77,80]. However, during the studies that observed these improvements evidence was found that suggest some adverse side effects to sleep restriction therapy. For instance, Kyle et al.'s (2014) found that in the early stages of SRT, daytime sleepiness and objective performance enhancement increased as total sleep time decreased. Though these results diminished over time, the authors show evidence for side effect considerations, particularly at the beginning of SRT [77].

Similar results were true of Miller et al.'s (2013) research, which found that in SRT's initial stages, patients reported increased sleepiness/fatigue and decreased alert cognitions [80]. In a further review of acute side effects of SRT, Kyle et al. (2011) report that, of their sample, at least 50% of participants reported some form of impairment. Within this group the researchers found that 100% reported fatigue, 94% reported extreme sleepiness, 89% reported decreased motivation or energy and 72% reported a headache or migraine. Upon further analyses, the authors found that patients of SRT had a mean of 7.2 ($SD = 2.4$) side effects per patient with the highest occurrences at the beginning of the therapy. Though these side effects exist in regards to SRT, research supports that it is effective in treating insomnia [78].

5.1.2 Meditation therapy

Ong and Sholtes (2010) define meditation as, "an activity of personal transformation and self-regulation that embodies concentration, awareness, and compassion" [82]. Though meditation is not a new practice, some researchers are beginning to study the role that exercise may play in regards to sleep and addressing sleep concerns [82,83,84]. As a stand-alone treatment, Jain and Shapiro (2013) found positive and immediate improvements in a sample of 34 participants who reported sleep

difficulties. During their study, participants took part in three 45-minute meditation sessions focused on breathing exercises, meditative imagery, and non-judgmental awareness meditation. The researchers found that, out of their sample, up to 65% had significantly improved scores on the American Insomnia Survey and the Pittsburg Sleep Quality Index. More specifically, the participants reported around a 46% decrease in daytime dysfunction, a 44% improvement in sleep efficacy, and even a 21% decrease in need for sleep medication at the conclusion of the treatment. Due to these results and the simplicity of the therapy, Jain and Shapiro (2013) strongly recommend this as a treatment approach for sleep deprivation. The authors point out evidence that the therapy takes less time than behavior therapies and can be much easier to teach and learn. The researchers conclude that, even if not used as a stand-alone treatment, meditation therapy should be seriously considered as a compliment to addressing sleep concerns [83].

When it comes to utilizing meditation alongside other treatment, Ong et al.' (2008) found evidence that meditation plays a role in the overall success of cognitive behavioral therapies for sleep dysfunction. Specifically, the researchers found that meditation can play a substantial role in decreasing pre-sleep arousal and sleep related distress when paired with sleep restriction and stimulus control. Based on the results of participants who completed the integrated program, the authors conclude that participation in meditation may accelerate sleep quality and pre-bedtime arousal improvements [84].

5.1.3 Mindfulness therapy

Mindfulness therapy has seen a surge of popularity as a form of treatment for a variety of mental health issues [84]. Mindfulness therapy has been effective in increasing sleep efficiency and decreasing total wake time [84,86]. The therapy has also been found to be effective working cooperatively alongside antidepressants [84] and superior in treating sleep related disorders than sleep hygiene intervention [84, 86]. In a study conducted by Hubbling, Reilly-Spong, Krietzer, and Gross (2014) it was found that patients with chronic insomnia who completed an eight week mindfulness-based stress reduction program reported increased sleep quality including feeling more refreshed upon waking, decreased stress regarding

insomnia, and a better ability to cope when insomnia occurred [87].

In mindfulness therapy, the therapist guides the client to focus on awareness of the present moment [85]. As it pertains to insomnia, therapists intend for clients to become more aware of the internal cognitions and external events that surround periods of wakefulness. For instance, clients who awaken during the night would then make an effort to be aware of their present state and then focus on that present moment awareness in an effort to re-route their cognition from the thoughts that may be keeping them awake [88].

The goal is to teach and practice metacognitive awareness. In metacognitive awareness, clients are geared to focus on their insomnia and its symptoms objectively, which grants them the ability to have more control over their sleeping behaviors. When clients begin to look at thoughts and patterns surrounding their sleep, they are then able to effectively divert their attention to the techniques of mindfulness therapy while letting go of the external stimuli that effects their sleep [88].

5.1.4 Cognitive behavioral therapy for insomnia

Cognitive behavioral therapy for Insomnia (CBT-I) is based on the idea that sleep-related issues are caused by both cognition about sleep and the behaviors that surround those beliefs. Schwartz and Carney (2012) define CBT-I as, "a short-term, multi-component treatment that has demonstrated strong efficacy in treating insomnia", [89] while Spielman, Caruso, and Glovinsky (1987) more clearly define the theory by reporting that three major contributors of insomnia exist including predisposing factors, precipitating events, and perpetuating attitudes and practices [90]. In regards to predisposing factors such as sex, race, or age, Siebern and Manber (2011) state that these can include biological and psychological characteristics that are most often part of the genetic makeup of the patient. The researcher's further state that these factors may increase one's risk for developing insomnia once a precipitating event occurs [76].

The fact that a precipitating event plays a role in the development of insomnia has rarely been more clearly supported than that of the work of Morin et al. (2004). Morin et al.'s (2004) research on 345 patients evaluated for insomnia found

that around 75% of their sample could identify at least one event that triggered their insomnia. The researchers point out that these events were most often related to family, health, and work or school events and commonly perceived as negative events. The researchers remark that the nature of these events may differ according to age of onset, but not in terms of gender or severity [91].

Cognitive Behavioral therapist believe that when these two factors, predisposing factors and precipitating events, take place, perpetuating attitudes and practices begin to develop [76,90] As negative attitudes, anxiety, and maladaptive behaviors to cope with the event persist, often sleep problems begin to arise. For example, Siehern and Manber (2011) point out that those who attempt to improve sleep by spending more time in bed while alert and/or anxious may inadvertently condition their body that their bed is a place that they are supposed to be awake. The authors further explain that responding to this with further distress eventually leads to increased maladaptive and inaccurate beliefs related to sleep and overall anxiety around bedtime [76].

CBT-I has been recommended as the standard treatment for sleep related issues [92]. Schwartz and Carney's (2012) found greater improvements in participants that completed CBT-I than comparison groups in factors such as, reductions in bedtime, napping, rise time variability, overall time in bed, and hyperarousal. The researchers also found evidence to support that CBT-I can be credited with improvements in negative beliefs and attitude regarding sleep, sleep related self-efficacy, and participant's sleep locus of control [89].

Schoenfeld, Deviva, and Manber (2012) explain that CBT-I is comprised of several behavioral and cognitive processing techniques related to sleep including, stimulus control therapy, sleep restriction therapy, relaxation training, cognitive restructuring, and sleep hygiene instructions. In each of these techniques, the goal is to develop consistent healthy sleep patterns, reduce arousal surrounding the bedroom and sleeping, and change beliefs related to sleep to positive attitudes and beliefs in an effort to improve overall sleep efficiency [93].

5.1.5 CBT-I with adolescents

In regards to utilizing cognitive behavioral therapy to treat insomnia in childhood, Paine &

Gradisar (2011) found that children who were treated using the practice had significant improvements in regards to sleep latency, wake after sleep onset, and overall sleep efficiency, but surprisingly not average sleep quantity. Children who were treated also showed a reduction in problematic sleep associations, separation anxiety, and reported anxiety. The authors conclude that these improvements were consistent following six months after treatment and make a strong case for the practice becoming the gold standard in treating childhood insomnia [94].

5.1.6 CBT-I and effects on comorbid conditions

In regards to treating common comorbid disorders such as PTSD, depression, and anxiety, CBT-I has been shown to have great promise [95,96]. Margolies et al.'s (2013) research supports a clinically significant change in improving sleep and PTSD symptoms in sample of 40 veterans in the Veterans Affairs Healthcare System. In this study, the research concludes that CBT-I is capable of improving both PTSD and Insomnia symptoms upwards of around 67% of the population [95].

Ulmer et al. (2011) finds similar but slightly lower results of improvement at 55%, but still makes a strong case for the use of CBT-I in treating sleep along with post-traumatic stress (96). The researchers report that interventions that targeting sleep are capable of producing short-term effects that often include significant reductions in severity of insomnia, nightmares, and additional PTSD symptoms.

5.1.7 CBT-I group therapy

Another successful form of CBT-I is its application in groups, which utilizes a similar model of evaluating and changing habits, perceptions, and behaviors related to healthy sleep performance. During this treatment, participants engage in CBT-I as a group and share individual experiences and triumphs in improving sleep related difficulty. In Koffel and Farrell-Carnahan's (2014) study, CBT-I group therapy was used to treat a sample of 21 veterans. The participants of this study all retained a diagnosis of insomnia with a comorbid condition that included an additional mental health diagnosis. Through six 90-minute weekly sessions, the researchers found that those who participated in the study showed improvements

in sleep latency, efficiency, insomnia scores, dysfunctional beliefs, and decreases in occurrences of nighttime awakenings [97]. Many researchers have found similar results supporting the efficacy of group therapy for insomnia in improving sleep latency and overall sleep efficiency [98,99,100,101].

Additionally, Norell-Clark, Jansson, Tillfors, Hollandare and Engstrom's (2015) recent study found that group CBT-I is significantly more efficient than relaxation treatment in decreasing insomnia severity, function impairment, and sleep latency. However, despite these results, relaxation treatment generated equal results to group CBT-I in increased of sleep quality and total sleep time, and decreases in early morning awakenings [102].

While CBT-I has been supported as an efficacious treatment method, Ong, Kuo, and Manber (2008) report that patients with increased levels of depression and lower sleep duration are the most likely to drop out of the treatment [103]. This is important for mental health providers seeking to utilize this method of treatment, as addressing the concern of treatment dropout can be critical to the cohesion and structure of the group. This issue may be adequately addressed by developing a strong therapeutic alliance with patients.

Though CBT-I groups often deliver results, Yamadera et al.'s (2013) study shows clear differences between CBT-I group therapy and the individual model. In this study of 45 participants 20 were placed in a group for individual therapy, while the other 25 were placed in a group therapy setting. Following the treatment, Yamadera et al. (2013) finds that individual participants of CBT-I showed significantly more improvement in sleep latency, efficiency, quality, duration, control, and even consequences of insomnia [104]. However, even with the knowledge that individual therapy outperforms group models for CBT-I, the evidence remains that group CBT-I is an effective method in treating insomnia, and should therefore be considered as a viable treatment method.

5.2 Relaxation and Stress Reduction Techniques

Relaxation and stress reduction techniques have been repeatedly reported as an effective way to treat sleep disturbance [105,106,107]. Research

suggest that these techniques can be instrumental in improving sleep for those with chronic pain [108] recent trauma experience [67], withdrawal concerns [109], nightmares [110], and physical health concerns, such as cardiac disease [111], multiple sclerosis [112], and many forms of cancer [113,114,115]. Moreover, relaxation and stress reduction have shown to be effective in improving sleep in multiple cultures [67,111,116,117], as well as younger [118] and older adults [107,119,120,121].

5.3 Psychoeducation

Though rarely studied as a stand-alone form of treatment, psychoeducation likely plays a major role in improving sleep deficiencies. Lee, Park, Jung, Moon, Keam, and Hahm (2014) found such results in their study which showed that a twenty minute lecture on stress management was helpful in acutely improving depression, sleep disturbance, and quality of life with cancer patients undergoing chemotherapy [122]. In regards to depression, similar results have been found by Casañas et al.'s study which shows promise for carry over into the realm of sleep disturbances and disorders [123].

When used to address sleep issues independently, Bonin, Beecham, Swift, Raikundalia, and Brown (2014) find CBT-I workshops to be a cost-effective solution to disseminate into communities. During this study the treatment was found to have an 80% likelihood of being cost-effective for the participants. Due to the well-known success of cognitive-behavioral treatments for sleep the researchers conclude that psychoeducational groups utilizing the principles of CBT-I warrant serious results for participants [124].

5.4 Pharmacological Treatments

Research conducted by Vaidya, Gavriel, Gangan, and Borse (2014) reports that approximately 10% of the general United States population utilized sleep medications. Additionally, significant increases in use were associated with persons above the age of 24 and of a history of depression or anxiety [125]. Furthermore, Owens, Rosen, Mindell, and Kirchner (2010) reported that sleep medicine prescriptions have doubled among adults and increased up to 85% among youth in the previous decade [49]. This is not surprising as Siririwardena, Qureshi, Dyas, Middleton, and Orner (2008) report that 87% of patients receive

the medication from their general practitioner, implicating that persons with sleep issues typically are not seeking assistance by dealing with a consulting sleep specialist within the medical or psychological field [126].

The results of studies regarding pharmacological treatment of sleep has been found to be effective in reducing sleep latency and REM sleep, while increasing total sleep time and stage two sleep [127]. Benzodiazepines, for example, the most prescribed form of sleep medication, work by acting as an inhibitor and enhancing chloride currents within the GABA receptor and have been shown to be effective in inducing sleep [128]. Though a variety of interactions take place, depending on the type of benzodiazepine, the medication typically causes effects of sedation and can be helpful in fostering a deeper sleep [127,128]. This form of pharmacological treatment has been found to be efficacious for initial symptoms of treatment, but also show a loss of effect due to client increase in tolerance. Additionally, side effects of benzodiazepines may include increased delusions, hallucinations, confusion, and disorientation [127]. Furthermore, researchers in Germany, recently observed that low doses of trazodone, mirtazapine, or agomelatine can be effective in long-term treatment of insomnia [129].

Though widely prescribed within the community, pharmacological treatments are not always supported in research. In Pigeon, Woosely, and Lichstein's (2014) research with insomnia patients, they found a relationship between suicidal ideation and patients with comorbid depression [130]. Additionally, Komada et al.'s (2011) research suggest that patients with comorbid depression reported significantly worse depressive symptoms when taking sleep medications than those who did not take the medication [131]. Further research finds that around 41% of patients in a sample size of 705 reported at least one side effect when using benzodiazepines while 18% reported desire to drop the medication completely [126].

In an effort to better understand the efficacy of antipsychotic medication on sleep, Water, Faulkner, Naik, and Rock (2012) administered the Pittsburgh Sleep Quality Index on 83 patients who were taking the medication in an inpatient setting. Though the researchers comment that the medications were linked with better sleep, they also report that they accounted for a small variance in general sleep quality. Additionally,

Water et al. (2012) report that, in combination with antidepressants, multiple antipsychotics did not appear to change participants sleep patterns. Moreover, the researchers reported that 70% of their sample still complained of issues related to sleep and, consequently, conclude that antipsychotic medication paired with antidepressants has limited efficacy and is not a fitting substitute for other sleep interventions [132]. Finally, Koch, Haesler, Tiziani, and Wilson (2006) warn against the use of sedating medication after a thorough review of the literature arguing that long-term efficacy, as it pertains to treating sleep, is questionable and can actually diminish the quality of life in older adults [133].

6. CONCLUSION

Given the high rates of sleep disruption among college students, adolescents, and the general population, one promising avenue of intervention may be increased access to and understanding of relevant empirical data informing university policy makers, campus mental health clinics, and college populations of available preventive and treatment resources. The purpose of this article is to provide a collective review of current, empirically supported mental health treatments and preventive measures which can be used to increase identification, education, and treatment of non-medical sleep disturbances. In comparison it appears that CBT for insomnia and other sleep related difficulties outpaces other forms in both efficacy, research, and funding. Therefore, those that wish to conduct research on sleep, or treat sleep disorders, would be wise to include measures that utilize CBT to produce comprehensive and effective results.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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