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REVIEW ARTICLE

Public health burden of sleep disorders: underreported problem

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Abstract
Background Sleep is a naturally reversible process that plays an essential role in human wellbeing. Sleep enables optimal functioning of physical and mental health and contributes to quality of life and safety. There are many individuals among the general public who do not realize they are sleep deficient and are not aware of the effects of sleep deprivation on their health and on the safety of their peers. The National Highway Traffic Safety Administration estimates that drowsy drivers cause between 10 and 30% of all traffic accidents.
Purpose Many believe that sleep is a luxury and that by decreasing sleep they can maximize their productivity. In this article, we emphasize that sleep is a necessity and the only way to pay the sleep debt is to sleep. This review article aims to increase awareness of early signs of sleep deficiency, consequences of poor sleep, and proper sleep hygiene for healthcare professionals to influence practice in educating patients about needed changes in sleep behaviors.
Conclusions Sleep deficiency not only has side effects on the personal level, but also can cause harm on a larger scale through chronic disease, motor vehicle accidents, and workplace accidents. A better understanding of sleep and its effects encourages a better quality of life and fewer hazardous behaviors.
Clinical implications Sleep is an active state of recovery during which the optimal function of all body systems is reinstated. Sleep repairs and prevents occurrence of chronic diseases such as cancer, diabetes, and obesity.

Keywords Sleep disorders · Sleep deprivation · Accident prevention · Chronic disease

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Sleep is a naturally reversible state that contributes to the optimal development of physical and mental health (Macmillan and Halsey 1984). A study by Browman and Winslow (1989) reports that a third of life is spent sleeping. Adults and children with less than the recommended amount of sleep suffer from sleep deprivation and neurobehavioral and physiological effects on wellbeing. Somnipathy, or disordered sleep, covers a range of disturbances and disorders that are serious enough to interfere with normal physical, mental, and emotional functioning (Pagel 2007). It results from changes in normal sleep patterns caused by medical conditions or behavioral patterns. Sleep deficiency is a global issue causing a public health burden that requires increased awareness. In this review, we briefly discuss sleep deficiency, its epidemiology, risk factors, and health consequences and then focus on strategies to improve sleep and raise awareness.

Epidemiology of disordered sleep

Sleep needs vary over youth and adulthood. Per the National Sleep Foundation (2016), "school-age children (5–10 years) need 10–11 h of sleep daily, teens (10–17 years) need 8.5–9.5 h, and adults need 7–9 h" (p. 1). The Centers for Disease Control and Prevention (2015) report that 30% of adults sleep less than 6 h per day, and 31% of teens sleep at least 8 h on school nights. A study conducted by Bixler et al. (2001) documented a pattern of increasing prevalence of somnipathy until age 60, after which prevalence rates plateau.

Gender effects on sleep also vary with age. Prevalence of somnipathy in children does not differ significantly with gender, but begins to change during puberty. A comprehensive meta-analysis focusing on adults documented that insomnia predominates in females (Zhang and Wing 2006; Krishnan and Collop 2006). Sleep trends fluctuate depending on socioeconomic status and occupation. Socioeconomic status and education have an indirect relationship with sleep quality, and unemployment rates have a direct correlation with insomnia (Bixler et al. 2001). The National Health Interview Surveys reported that individuals who work in manufacturing, warehousing, and health care had the highest prevalence of short-term sleep (Luckhaupt et al. 2010). However, the average duration of sleep in the entire working population has declined over the last 20 years.

Risk factors

Many factors increase the risk for somnipathy. Obesity, history of being overweight, hypertension, diabetes, being a male over 40 years old, smoking, and consuming alcohol have been associated with an increased risk for sleep disturbances (Harman et al. 1981; US Department of Transportation 2013; Schwartz et al. 2008). Many other factors also play a role in affecting sleep quality including occupation, beliefs, age, living environment, and social factors (Grandner 2014). When these factors were controlled, no differences between race and ethnicity were reported (Gamaldo et al. 2015). It is important to understand populations at high risk of sleep deprivation in order to intervene before health consequences arise. In addition to understanding their need for intervention, it is important to recognize what type of intervention may be most suited for that population.

Poor sleep hygiene is another risk factor for disturbed sleep and includes behaviors that worsen the quality and quantity of sleep. These behaviors include using electronics and watching television soon before bed and drinking caffeine within 3 h of sleep (Lemola et al. 2015; Cain and Gradisar 2010). By improving upon these behaviors, sleep should improve and protect patients from the health consequences associated with disturbed sleep.

Associated consequences

Sleep deficiency is an important predisposing factor for the development of chronic diseases such as cardiovascular disease, hypertension, diabetes, obesity, depression, cancer, stroke, and a reduced quality of life (Grandner 2014; El-Solh et al. 2001; Piroddi et al. 2015). Disordered sleep has been frequently associated with various forms of cardiovascular and cerebrovascular diseases, which increase mortality and morbidity rates. The Center on Sleep Disorders Research estimates that there are approximately 38,000 cardiovascular deaths per year due to disordered sleep (Dement 1994). While cardiovascular and cerebrovascular diseases are common comorbidities of symnopathy, they also become possible consequences of untreated or insufficiently treated sleep problems. When treated, mortality from cardiovascular-associated health consequences decreases (Campos-Rodriguez et al. 2012; Martínez-García et al. 2009).

Mental health is also affected by disturbed sleep. Ballard et al. (2016) reported that short duration sleep, less than 5 h per day, is associated with higher rates of depression, stress, and suicidal thoughts after controlling for confounding factors. Baum et al. (2014) further report that sleep deficiency is associated with negative mood and reduced emotional regulation. Children with sleep deficiency and increased sleep latency are at risk for negative daily mood and behavioral problems expressed as internalizing and externalizing symptoms (Kouros and El-Sheikh 2015). Internalizing behaviors reported by parents include anxiety, depressive symptoms, excessive worry, and psychosomatic symptoms. Externalizing behaviors are expressed as aggression, impulsive behaviors, disruptive behaviors, delinquency, and non-compliance (El-Sheikh et al. 2007; Gregory and O'Conner 2002; Astill et al. 2012; Ivanenko et al. 2005; Gregory and Sadeh 2012). Furthermore, of adolescents with depression, 73% also have a sleep disorder or sleep dysfunction

that preceded their depressive symptoms (Lovato and Gradisar 2014; Liu et al. 2007).

Cognitive functioning and memory are also affected by symnopathy. Kaida et al.(2015) report a direct relationship between sleep duration and memory encoding. The CDC (2015) reports that sleep deficiency is associated with impaired concentration and difficulties with driving, finances, work, and hobbies. Malik et al. (2015) support these claims and reports that psychomotor performance and immediate recall are impaired. Daytime sleepiness is yet another consequence of sleep deficiency. Tired drivers can be just as dangerous as drunk drivers (Malik 2015). Approximately 56,000 motor vehicle accidents occur annually as a result of sleep-deficient drivers. The National Highway Traffic Safety Administration (NHTSA) reported that 40,000 injuries and 1550 deaths occur yearly due to drowsy driving (2013). Continuous and chronic abnormal sleep patterns affect job performance as well, increasing the incidence of workplace accidents (Dement 1994). Raising awareness of medical consequences, mental health consequences, and traumatic results of sleep deficiency may help prevent much distress and improve public health.

Disordered sleep as a public health issue

Sleep has been recognized only recently as an important public health concern. In a study conducted by the CDC (2011) involving 74,571 individuals, 35.3% reported sleeping fewer than 7 h a night, 48.0% noted snoring in their partners, 37.9% reported unintentionally falling asleep at least once in the last month, and 4.7% admitted to having fallen asleep while driving in the past (Lau et al. 2013). While sufficient sleep is necessary, more than 25% of the US population reports feeling like they are not getting enough sleep and 10% suffer from chronic insomnia (CDC 2015). Hossain and Shapiro (2002) report 40% of the general population is affected by insufficient nighttime sleep and daytime sleepiness. However, the problem remains underdiagnosed and underreported. Individuals with excessive daytime sleepiness seek help from health care providers only when their sleep problem interferes with their work or social performance. Issues that prevent patients from seeking help include expectations that treatment will be inefficient, that a psychiatric diagnosis carries a stigma, or that they would be perceived as drug-seekers (Guilleminault and Brooks 2001).

Associated medical consequences in persons with somnipathies are a financial burden on the healthcare system. Annual costs of treating moderate to severe disordered sleep and its consequences in the US are $165 billion, significantly greater than for other non-communicable diseases such as heart failure, stroke, hypertension, and asthma ($20–$80 billion) (American Sleep Apnea Association 2013). The costs of increased medical errors by healthcare professionals resulting from a lack of sleep are also important to consider (Gold et al. 1992; Samkoff and Jacques 1991).

There is a lack of awareness among the general public, healthcare professionals, and the legislature concerning the consequences of somnipathy. This public health issue can be addressed by implementing educational media campaigns, by discussing somnipathy in healthcare curriculums, and by improving surveillance of the population's sleep (Altevogt and Colten 2006). Multiple educational campaigns have been launched to raise awareness of somnipathy, signs of sleep deficiency, and risk factors associated with reduced sleep. Some progress has been made in the last few years by introducing sleep and chronobiology for undergraduate and graduate nursing programs. Educating healthcare professionals may increase the number of referrals to sleep centers, which have been underutilized, and improve both the diagnosis and treatment of sleep deficiency.

Strategies to improve awareness and sleep health

Efforts to increase awareness about sleep hygiene and disordered sleep are important in promoting public health and preventing the dire consequences of symnopathy. Education is incredibly important in this effort. Many studies have documented a positive correlation between proper sleep hygiene practices and better quality of sleep (Bootzin and Perlis 1992; Brown et al. 2002; McCurry et al. 1998; Morin et al. 1994; Murtagh and Greenwood 1995). Awareness of proper sleep hygiene is the first step in changing behavior for improved sleep quality.

Strategies to improve sleep hygiene first require knowledge of desired behaviors and the effects of both behavioral and environmental influences for proper sleep hygiene. The National Sleep Foundation (2016) recommends the following behaviors to improve sleep: (1) a consistent sleep-wake schedule, (2) exercise in the morning and early afternoon, (3) relaxing exercise in the evening, (4) exposure to natural daylight, (5) a bedtime routine, and (6) avoidance of alcohol, nicotine, caffeine, and food right before bed. In addition to these interventions, the American Sleep Association (2007) recommends minimizing or avoiding naps as they interfere with the amount of sleep needed the following night. Shift workers who work overnight, however, often benefit from napping for 2 h prior to their shift or for at least 20 min during their shift (Malik 2015). Other recommendations include recognizing severe fatigue, sleeping when tired, avoiding driving after midnight and before dawn, and avoiding alcohol before bedtime. Individualizing healthy sleep hygiene is important in order to effect a change toward improving public health.

Irish et al. (2015) thoroughly investigated specific sleep hygiene behaviors for their validity and applicability. Caffeine use disrupts sleep in those who are sensitive to its

effects, but may not need to be avoided in someone who is more resistant to it (Irish et al. 2015). On the other hand, nicotine and alcohol use negatively affects sleep universally. Certain sleep hygiene behaviors have been called into question; napping and exercise before bedtime may have no relationship with disordered sleep.

The Sleep Hygiene Awareness and Practice Scale (SHAPS) has been used in several studies to assess whether awareness of proper sleep hygiene leads to changes in behavior. Several studies found a direct relationship between knowledge of good sleep hygiene and good sleep practices (Bootzin and Perlis 1992; Brown et al. 2002; McCurry et al. 1998; Morin et al. 1994; Murtagh and Greenwood 1995). Two studies, however, found a weak relationship (Hicks et al. 1999; Lacks and Rotert 1986). Brown et al. (2002) assessed psychometric properties of SHAPS to address the discrepancies reported by the aforementioned studies. They compared the two sections of SHAPS, one regarding how sleep is related to behavior and the other regarding knowledge of caffeine-containing products. Interestingly, the former resulted in appropriate test-retest reliability, whereas the latter resulted in poor test-retest reliability. When focusing on the portion of SHAPS that assessed a subject's knowledge of proper sleep hygiene and the practice of behaviors to improve sleep, Buboltz et al. (2002) documented a direct relationship between the two. They also reported certain behaviors are more difficult to change and may require greater emphasis when teaching and raising awareness of appropriate sleep hygiene strategies.

Healthcare practitioners represent an accessible group of educators for raising awareness for proper sleep hygiene and the dangers of disordered sleep. Educating patients and encouraging a change in behavior is crucial to create a change in the sleep quality of the greater public. Being aware of proper sleep hygiene is the first step in promoting healthy sleep. By raising awareness of good sleep behaviors and of the consequences of insufficient sleep, healthcare providers may affect not only a change in their patients, but also make changes that improve their own quality of life, reduce the prevalence of disordered sleep, and reduce medical errors in clinical practice (Lockley et al. 2005).

Summary

The purpose of this review was to emphasize that disordered sleep is a global issue that requires greater awareness among the general public and healthcare providers. Disordered sleep is frequently unrecognized or underreported. Insufficient sleep is a public health epidemic, which has only recently been recognized as an important public health concern. Many occupational traumas, medical errors, and motor vehicle accidents have been linked to sleep deficiency. With increasing age, sleep behavior changes and difficulties among adults increase. Somnipathies are common in the general population, and the consequences and under-diagnosis reduce quality of life. Undiagnosed, untreated, or inefficiently treated somnipathies have tremendous health consequences that increase mortality and morbidity rates in many chronic conditions including cardiovascular diseases, cerebrovascular diseases, and diabetes. Multiple educational campaigns have been launched that target the general population in better addressing disordered sleep. Future research is needed in the area of assessing the outcomes and influences of these campaigns in improving the diagnosis, education, and treatment of somnipathies and in reducing the onset and severity of the comorbidities associated with disordered sleep.

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Compliance with ethical standards

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