Neurologic Diseases and Sleep

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KEYWORDS

• Stroke • Migraine • Chronic pain • Epilepsy • Neurodegenerative disease • Dementia
• Socioeconomic

KEY POINTS

- Sleep disorders are often comorbid with neurologic illness, either of which may negatively impact socioeconomic status.
- Reductions in workplace attendance and productivity, public safety, and personal well-being may occur with either set of conditions, more so when combined.
- The socioeconomic burden of sleep disorders and neurologic illness can be identified, but the real cost of these conditions lies far beyond the financial realm.

INTRODUCTION

Sleep disorders are commonly associated with various comorbid conditions, including general medical, psychiatric, and neurologic disorders,[1] all of which may impact socioeconomic status negatively. Additionally, sustained sleep deprivation results in reduced workplace productivity, public safety,[2] and personal well-being,[3] as well as performance deficits, poor vigilance, excessive daytime sleepiness, depressed mood, and impairments in concentration and memory.[4,5] This review focuses on the relationship that sleep has on the socioeconomic impact of common neurologic illnesses including stroke, migraines and chronic pain, epilepsy, restless legs syndrome (RLS), and neurodegenerative diseases and dementia. Other conditions existing within the neurologic and sleep realms, particularly narcolepsy, will be discussed elsewhere in this issue of *Sleep Medicine Clinics*.

SOCIOECONOMIC IMPACT OF VARIOUS SLEEP DISORDERS

Sleep disorders affect approximately 35% to 40% of the US adult population annually, and are a significant cause of morbidity and mortality. However, there is an underappreciation and undertreatment of these conditions, and the socioeconomic implications may be immense, particularly with regard to obstructive sleep apnea (OSA), insomnia, and sleep deprivation.

Obstructive Sleep Apnea

The socioeconomic burden of OSA is significant, given its high prevalence and its association with increased cardiovascular disease morbidity and mortality.[6] The costliest and the sickest upper one-third of patients with OSA consume 65% to 82% of all medical costs, and untreated OSA may double the medical expenses mainly because of cardiovascular disease.[7] One study, using data from the Danish National Patient Registry (1998–2006), found that snoring, OSA, and obesity hypoventilation syndrome were associated with significantly higher rates of health-related contact, medication use, and unemployment, and accounted for increased socioeconomic costs. It was found that these socioeconomic effects increased proportionally with the severity of OSA, and the consequences were present up to 8 years before diagnosis. It was concluded that despite

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Sleep Med Clin ■ (2016) ■–■
http://dx.doi.org/10.1016/j.jsmc.2016.10.007

treatment with continuous positive airway pressure (CPAP), which does reduce mortality, earlier disease detection could have a greater impact on socioeconomic factors.[8] Furthermore, in an analysis of 82,178 elderly veterans diagnosed with OSA, there was a higher incidence of health care use compared with those without OSA, and veterans with a new diagnosis of OSA had an higher rate of health care use in the year of diagnosis compared with patients with chronic OSA and patients without OSA.[9]

Insomnia

As with OSA, several studies have shown that insomnia affects the workforce. Absenteeism in those with insomnia is a major problem, and the economic impact may be severe. One study demonstrated that, compared with good sleepers, severe insomniacs reported more medical problems, had more physician office visits, were hospitalized twice as often, and used more medication. Furthermore, the severe insomniacs in this study had a higher rate of absenteeism (missing work twice as often as good sleepers), as well as decreased concentration and difficulty performing duties.[10] The impact of insomnia on workers affects their daytime functioning, and many studies have found a higher rate of work accidents in insomniacs.[11]

Sleep Deprivation

Sleep deprivation is associated with a range of metabolic abnormalities,[12] especially regarding glucose metabolism[13]; sleep-deprived patients have increased blood glucose and decreased insulin, contributing to insulin resistance, type 2 diabetes mellitus,[14] obesity,[15] and hypertension,[16] all of which may increase the risk of stroke.[16] Even 1 night of reduced sleep has been reported to increase food intake and to reduce energy expenditure in healthy subjects,[17] and studies using functional MRI have demonstrated acute sleep deprivation enhances hedonic stimulus processing, which may increase the drive to consume food.[18] Thus, an increase in hedonic food consumption combined with a reduction in energy expenditure may contribute to the development of obesity.[16] It has also been demonstrated that sleep deprivation is associated with a moderately increased risk of acute myocardial infarction[19] and other vascular events.[20] Although problems falling asleep or daytime sleepiness affect 35% to 40% of the population,[6] and sleep deprivation may significantly impact socioeconomic status, compared with healthy individuals, individuals suffering from sleep deprivation are less productive, have an increased health care use, and an increased likelihood of accidents. Nearly 20% of all serious car crash injuries are associated with driver sleepiness, independent of alcohol effects.[21] Chronic sleep deprivation, like other sleep disorders, places a significant burden on the health care system through increased use; patients in the highest quartile of the Epworth Sleepiness Scale are associated with an 11% increase in health care use.[22]

NEUROLOGIC DISORDERS, SLEEP DYSFUNCTION, AND SOCIOECONOMIC IMPACT

In this section, we address the bidirectional relationship between sleep and common neurologic illnesses, and how this relationship may increase socioeconomic burden.

Stroke

The worldwide impact of stroke is considerable, and it is estimated that there are 4.5 million deaths per year from stroke and more than 9 million stroke survivors. To this point, approximately 1 in 4 men and nearly 1 in 5 women aged 45 years can expect to have a stroke if they live to 85 years of age. The overall incidence rate of stroke is roughly 2 to 25 per thousand, and the risk of recurrence is 15% to 40% over 5 years; the total prevalence rate is approximately 5 per thousand. After a stroke, 65% of survivors are functionally independent at 1 year, with stroke comprising the major cause of disability.[23] Approximately one-fourth of strokes occur in people less than 65 years of age, which may have tremendous consequences in the socioeconomic realm. In the United States, cost of stroke has been estimated at greater than $65 billion. Direct costs, including that of physicians and other health professionals, acute and long-term care, and medications and other medical supplies, account for 67% of total costs, and the remaining 33% is due to indirect costs, which includes lost productivity.[24,25] A metaanalysis of 70 studies reported data on return to work after a stroke with ranges from 0% to 100%. Additional social consequences reported in this analysis included negative impact on family relationships (5%–54%), deterioration in sexual life (5%–76%), economic difficulties (24%–33%), and deterioration in leisure activities (15%–79%).[26] Although the literature linking stroke with sleep abnormalities has been focused mostly on sleep deprivation/insomnia and OSA (which is reviewed elsewhere in this article), sleep-related movement disorders such as RLS and periodic leg movements in sleep may also increase the risk of