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DEMENTIA RISK REDUCTION

Sleep and Dementia:

Sleep is Important for a Healthy Brain

What Is Already Known

As people age, sleep disturbances increase and sleep quality decreases. Just over half (54%) of older adults report that they sometimes or most of the time wake too early without being able to fall back to sleep, and just under half (44%) report that they rarely or never sleep through the night without waking for more than a few minutes. People with advanced dementia experience increased sundowning, fragmented nighttime sleep, changes in the sleep cycle and REM sleep, increased napping, and a high prevalence of sleep apnea. The relationship between such sleep disturbances and cognitive decline is now understood to be bidirectional, with disturbed sleep having a causal relationship with neurodegenerative disease and neurodegeneration leading to an increase in sleep disturbances.

Background and Evidence Base

A bidirectional association between disturbed sleep and cognitive decline is supported by evidence from several studies. In a study of women with normal cognitive function, cognitive decline over a 15-year period was associated with subsequent poor sleep quality (measured as poor sleep efficiency, taking longer to fall asleep, and waking up after falling asleep). Another study reported an association between current poor sleep quality and subsequent clinically significant cognitive decline, after adjustment for potential confounders (e.g., demographics, lifestyle factors, comorbidities, and medication use). Also, less efficient sleep and taking longer to fall asleep have been associated with an increased risk of mild cognitive impairment and dementia. And, a study of adults with European ancestry who did not have dementia showed that sleep duration was significantly reduced (by 1.9 hours) in those with a genetic predisposition to Alzheimer's disease, suggesting that sleep duration might be useful as a marker for future cognitive decline.

Findings from animal studies suggest a potential mechanism for explaining the relationship between sleep and cognitive function. Two studies in mice showed that, during sleep, the brain cleared harmful substances (such as amyloid-β, a peptide found in the brains of people with Alzheimer's disease) through the lymphatic system. Sleep deprivation resulted in significant accumulation of amyloid-β in one study, and another study showed that sleeping mice cleared twice as much amyloid-β from their brains as awake mice did. Together, these findings suggest that when sleep is poor, the brain is not able to clear accumulated toxins that have been associated with Alzheimer's disease.

In addition to impaired sleep at night, napping during the day is also common in older adults. The relationship between napping and cognitive function is complex. Overall, older people who reported more frequent napping and taking naps longer than two hours in duration demonstrated a significantly greater risk of cognitive decline compared with those who napped less frequently. However, when napping was considered in the context of recent sleep quality at night (measured by sleep duration and sleep efficiency), it was found that napping during the day after a person experienced a poor night's sleep was not associated with this increased risk of cognitive decline. After adjusting for possible confounding variables, this risk appeared to be greater only for those who napped during the day after experiencing good sleep quality at night.

Changes in circadian rhythm (mental and physical behaviors over a 24-hour period associated with the light-dark cycle) have also been shown to be related to cognitive decline and dementia risk. Sleep-disordered breathing (e.g., sleep apnea) increases with age, and estimates suggest about 25% of older adults will experience it by the age of 75. It is associated with an increased risk of dementia, possibly by reducing the brain's oxygen supply. Interestingly, it has also been associated with a reduced clearance of amyloid-β in cerebrospinal fluid over a two-year period.

Some studies have examined the effect of treating sleep disruptions as a means of reducing a person's risk of developing cognitive impairment. A study that evaluated the effect of continuous positive airway pressure (CPAP) therapy on cognitive function found no difference in cognitive function after six months between the group that used CPAP therapy and the group that used a fake CPAP therapy. In contrast, a study that included one group receiving six weeks of CPAP therapy and another group receiving three weeks of CPAP therapy showed improvement in both groups on tests of cognitive

function after three weeks of CPAP therapy, suggesting that improvement can be seen in a very short period of time. A small study showed that CPAP therapy reduced amyloid-β accumulation. Other potential therapies for improving sleep (such as cognitive-behavioral therapy and light therapy) have been insufficiently studied to assess any effects on cognitive outcomes. Thus, it is not yet known whether targeting sleep is an effective method for reducing a person's risk of developing cognitive impairment and/or dementia.

Implications for Public Health

There is currently a lack of strong evidence that treating sleep issues can reduce the risk of cognitive decline and dementia. However, it is known that improving sleep has beneficial effects on other health outcomes (including mortality, cardiovascular disease, inflammation, obesity, and others), some of which are themselves risk factors for cognitive decline and dementia. Standard sleep hygiene practices should be recommended for individuals wanting to improve their sleep. Such practices include daytime exercise; avoiding afternoon caffeine intake; avoiding fluid, food, nicotine, and alcohol intake before bed; keeping the bedroom dark and cool; and avoiding using electronics in the bedroom. Additionally, low-cost mobile health technology focused on behavioral interventions to improve sleep quality is increasingly available. Such technology can monitor sleep remotely and may be included in public health initiatives in the coming years.

Discussion

While the evidence is clear that sleep and cognitive function are interrelated, it is less clear whether treating disordered sleep can reduce a person's risk of cognitive decline. Accurate measurement of sleep quality is difficult, as it cannot rely on self-report but requires performance-based measurement of sleep. New technology-based tools permit more precise measurement of sleep quality outside of the laboratory setting which may improve the identification of individuals more likely to benefit from specific treatments to improve sleep. Additionally, research addressing underlying problems that contribute to poor sleep (such as sleep apnea, diabetes, and cardiovascular disease) is in its early stages. This research is examining whether improved treatments for the sleep-related disorders associated with these underlying conditions may secondarily reduce the risk for dementia.

Until the evidence is clearer on whether targeting sleep disruptions is effective at reducing the risk of cognitive impairment, individuals experiencing sleep issues should be encouraged to use standard sleep hygiene practices and/or current mobile health technologies (such as smart phone apps), as these practices are noninvasive and inexpensive. While it is not clear if improving sleep quality affects the risk of cognitive decline, improving sleep has been shown to improve other health outcomes, such as cardiovascular diseases, mortality, and inflammation.

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