

Today's Research on Aging

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Sleep, Health, and Aging

Sleep may be as important to health in old age as diet and exercise. Numerous studies have shown that sleeping too little or too much is associated with mortality among older adults. A growing body of research indicates that not getting enough sleep may also increase the risk of several conditions and chronic diseases including diabetes, cardiovascular disease, obesity, and depression.

This report explores National Institute on Aging-supported research on sleep and aging, reviewing new evidence indicating that poor sleep may be both a sign of ill health and a trigger for processes related to disease and biological aging. This report also examines how family relationships influence the quality of sleep for older people and the unique risks some U.S. minorities face related to poor sleep.

While sleep often tends to become more challenging for older people, insomnia—trouble falling asleep and staying asleep—is not a given with old age. The research reviewed here underscores the importance of screening for poor sleep and interventions that improve the sleep of older people.

New Evidence on the Role of Sleep in Aging and Chronic Disease

Investigators are looking more deeply into the role of sleep in chronic disease and the aging process. Most studies on the relationship between sleep duration and health have been based on self-reported time spent asleep. These studies provide evidence of a U-shaped relationship between sleep duration and mortality. Regularly sleeping less than five hours daily or more than nine hours raises the risk of death (Cappuccio et al. 2010).

However, analysis of electronic sleep assessment data—gathered over multiple nights using wrist bands (actigraphy)—offers a more nuanced view (see Box 1). Lauderdale and colleagues (2016) find ***sleeping less than six hours per night is associated with poor or fair health among older people, but sleeping longer than average is not linked to any negative health consequences***. Their study is based on sleep data for more than 700 adults ages 62 to 90 participating in the nationally representative National Social Life, Health, and Aging Project (NSHAP). As use of “actigraphy matures, our understanding of how sleep affects health may change,” they write.

A University of California, Los Angeles team (Carroll et al. 2016) finds that ***one night of partial sleep deprivation activates genes related to biological aging in older adults***. For the study, 29 older adults between ages 61 and 86 spent four nights in a sleep laboratory. Following two uninterrupted nights of sleep, participants were not allowed to sleep between 11 p.m. and 3 a.m. and later awakened at 7 a.m. Researchers monitored their sleep and drew blood daily.

BOX 1

Most Older Adults Get Enough Sleep, Electronic Measures Indicate

Older adults’ perception of sleep does not always match what is actually happening when a more objective assessment is used to monitor sleep patterns and behaviors (Chen et al. 2015). Although reports of insomnia are common among older adults, the study finds that sleep problems may stem from the quality of rest and other health concerns more than the overall amount of sleep that older people get.

The study used data from 727 participants in the National Social Life, Health, and Aging Project who were randomly invited to participate in an “Activity and Sleep Study.” The activity and sleep study had two components: a self-administered sleep booklet, which included questions about the person’s sleep experience, (for example, “How often do you feel really rested when you wake up in the morning?”) and 72 hours of wrist actigraphy, which is a wristwatch-like sensor that monitors sleep patterns and movements.

The actigraph measurements showed that most of the older adults got sufficient amounts of sleep. “Older adults may complain of waking up too early and not feeling rested despite accumulating substantial hours of sleep,” said Linda Waite, one of the study authors.

Even though reported sleep problems are common among older individuals, according to the survey only about 13 percent of older adults in the study said that they rarely or never feel rested when waking up in the morning. About 12 percent reported often having trouble falling asleep, 30 percent indicated they regularly had problems with waking up during the night, and 13 percent reported problems with waking up too early and not being able to fall asleep again most of the time.

The average duration of sleep period among the study participants was 7.9 hours, and the average total sleep time was 7.25 hours, indicating most older adults are getting the recommended amount of sleep and usually not having common sleep problems.

One other unexpected finding for the researchers was that respondents who reported waking up more frequently during the night had more total sleep time. “This suggests that a question about feeling rested may tap into other aspects of older adults’ everyday health or psychological experience,” said Waite.

“Our findings suggest that reports of what seem like specific sleep problems from survey questions may be more accurately viewed as indicators of general problems or dissatisfaction with sleep that may be due to other issues in their lives affecting their overall well-being. These survey questions and actigraphy may measure different aspects of sleep experience.”

Adapted from “Insomnia Among Older Adults May Be Tied to Sleep Quality, Not Duration,” by Jann Ingmire, University of Chicago News, Oct. 2014; reprinted with permission.

Reference

Jen-Hao Chen et al., “Insomnia Symptoms and Actigraph-Estimated Sleep Characteristics in a Nationally Representative Sample of Older Adults,” *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 70, no. 2 (2015): 185-92.

After a night partially deprived of sleep, participants' blood showed signs of deterioration in the cell's growth and division cycle. The researchers report that these findings "causally link sleep deprivation to the molecular processes associated with biological aging," suggesting that insufficient sleep may increase the risk of chronic disease by "activating the molecular pathways that drive biological aging."

Irwin, Olmstead, and Carroll (2016) find further evidence of the effect of sleep on the aging process by analyzing results from 72 distinct studies. This body of research—involving 50,000 participants in both clinical settings and the wider population—suggests that **sleep disturbances (poor sleep or insomnia complaints) and long sleep duration (sleeping more than eight hours regularly) are related to increases in blood markers of inflammation.**

Specifically, disturbed sleep and too much sleep are associated with the inflammation markers C-reactive protein (CRP) and interleukin-6 (IL-6). These markers tend to be related to chronic conditions such as diabetes and cardiovascular disease. Previous research shows that treating insomnia can reduce inflammation. The researchers argue that sleep disturbance and long sleep duration should be viewed as additional risk factors for inflammation that can be modified, like high-fat diets and sedentary lifestyles. For example, several studies show that insomnia treatments can reduce inflammation markers, offering evidence that sleep problems can be a cause of inflammation (Irwin et al. 2015; Irwin et al. 2016).



Disturbed sleep increases blood markers for inflammation, which tend to be related to chronic conditions such as diabetes and cardiovascular disease.

Poor sleep is also related to depression in old age, according to several studies (Lee et al. 2013). A University of Michigan team (Leggett et al. 2017) finds disturbed sleep is associated with depression, regardless of the number of chronic medical conditions a participant has. The study tracked more than 3,500 older adults participating in the nationally representative Americans' Changing Lives Study, which surveyed participants five times over 25 years.

The researchers show that older adults diagnosed with a higher number of chronic medical conditions—such as high blood pressure, diabetes, chronic lung disease, heart attack or other heart trouble, stroke, cancer, and arthritis—have higher levels of depressive symptoms. People sleeping poorly who also have heart trouble face a particularly high risk of having depressive symptoms.

In the researchers' view, detecting sleep problems early and intervening with medications or behavioral change is crucial, and can have long-term benefits for physical and mental health. They point out that people with depression tend to use more health care services than average, and given high medical costs, early screening and treatment of disturbed sleep may reduce costs and have "enduring public health benefits."



Dementia disrupts the sleep-wake cycle and leaves people highly active at night, which is often a burden for family caregivers.

Severely disturbed sleep may be an early signal of impending dementia, Sterniczuk and colleagues (2013) show. Otherwise healthy older people may experience disturbed sleep, including severe insomnia and daytime sleepiness, prior to displaying other dementia-related symptoms, such as memory loss (see Box 2). For the study, the researchers examined the survey responses of more than 28,000 adults ages 50 and older collected through the Survey of Health, Ageing, and Retirement (SHARE) in 12 European countries.

Using data for participants with no symptoms of Alzheimer's disease or dementia at the beginning of the study, researchers created a sleep disturbance index (based on measures of sleep problems, fatigue, use of sleep medication, trouble sleeping, and changes in sleep patterns). Analysis shows that each separate sleep

measure is independently associated with a greater risk of Alzheimer's disease, dementia, or death within four years. After accounting for overall health, high scores on the sleep disturbance index remain associated with a greater risk of developing dementia.

BOX 2

Napping Among Older Adults

Researching daytime napping is challenging because older people nap for a variety of reasons—poor nighttime sleep, chronic medical conditions, sedating medications, a boost in later-day functioning, or pleasure, reports Spira (2018). Recent studies suggest that long afternoon naps may be related to mental decline and less social engagement, but **whether long naps contribute to declines in mental and physical functioning or indicate other health problems is unclear**.

- Older adults who took afternoon **naps of 90 minutes or longer experienced greater cognitive decline** over two years than non-nappers, short nappers (less than 30 minutes), and moderate nappers (30 to 90 minutes), Li and colleagues (2018) report. This study was based on more than 3,000 adults ages 60 and older in the China Health and Retirement Longitudinal Study. **Short naps may offer some benefits:** Those who regularly napped for less than 90 minutes were more likely to retain their cognitive abilities over the two years than non-nappers and long nappers, they find.
- Older adults who took **frequent naps or longer naps were more likely to restrict their participation in one or more valued activities** as a result of problems with their health or physical function, Owusu and colleagues (2018) show. This study was based on a nationally representative sample of more than 2,700 Medicare beneficiaries ages 65 and older in the National Health and Aging Trends Study.
- Napping is common at older ages: **Nearly one-third of women ages 79 to 96 nap for an hour or more per day**, Leng and colleagues (2018) find in a study that used self-reporting and electronic assessment. Women were more likely to nap for an hour or more if they were older, obese, current smokers, or heavy alcohol drinkers; or had depressive symptoms, diabetes, dementia, or Parkinson's disease.

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Jocelynn Owusu et al., "Napping Characteristics and Restricted Participation in Valued Activities Among Older Adults," *Journals of Gerontology, Series A: Biological Sciences and Medical Sciences* 73, no. 3 (2018): 367-73.

Adam P. Spira, "Sleep and Health in Older Adulthood: Recent Advances and the Path Forward," *Journals of Gerontology, Series A: Biological Sciences and Medical Sciences* 73, no. 3 (2018): 357-9.

Dementia is known to profoundly disrupt the sleep-wake cycle of people with the disease and leave them highly active at night, creating a burden for their family caregivers. The researchers recommend that health care providers screen for sleep problems in older people, in order to detect dementia earlier and initiate interventions to potentially prevent or delay institutionalization.

Similarly, Mander and colleagues (2016) show that disrupted sleep related to Alzheimer's disease may be different from or significantly more severe than typical age-related sleep impairment. Evaluating older people for sleep changes linked to Alzheimer's, such as declines in non-rapid eye movement sleep, could be a potentially non-invasive way to identify individuals at risk for Alzheimer's disease. They suggest that sleep impairment is both "a consequence and cause of the progression of Alzheimer's disease; one that is modifiable, offering preventative and therapeutic treatment potential."

Dementia-related brain changes may be linked to regularly sleeping less than six hours per night and may begin in middle age, Yaffe and colleagues (2016) find. More than 600 black and white adults (mean age 45) in the Coronary Artery Risk Development in Young Adults (CARDIA) study reported their typical sleep duration and then had brain MRIs five years later. Compared with those who slept between six and eight hours per night, the brains of short sleepers had a greater concentration of white matter hyperintensities (a hardening of arteries in the brain), which have been linked to stroke and vascular dementia.

Family Relationships and Sleep

Studies tend to approach sleep at the individual level, but ***sleep is a "social and interpersonal process" for couples that can affect their health and well-being***, argues Chen (2018). To examine couples' sleep routines, he analyzed 24-hour time diaries of more than 800 older adults participating in the Panel Study of Income Dynamics' Supplement on Disability and Use of Time for 2009 and 2013. The data included measures of participants' levels of psychological distress, marital quality, and self-reported sleep quality based on their responses to a questionnaire.

Chen found a great deal of discordance in older couples' bedtimes and morning waking times, with most individuals going to bed or getting up more than 20 minutes before or after their partner. After controlling for social and demographic characteristics (such as work schedules and disability), marital quality, and individual sleep measures, he finds individuals whose bedtime was more than 20



The quality of a couple's relationship affects their sleep.

minutes earlier or later than their partners' bedtime were more likely to also have high psychological distress scores. Individuals who woke 20 minutes earlier than their spouse tended to report poor sleep quality, likely because of shortened sleep duration.

Chen argues that couples' lives are linked, and their couple-level sleep patterns may affect individual sleep and mental health. Programs that are designed to improve sleep in old age should consider couples' interdependence, he recommends.

Chen, Waite, and Lauderdale (2015) take this line of research further, examining the role of marriage on older adults' sleep quality using both subjective individual self-reports and objective electronic assessments. Their study is based on the more than 700 adults ages 62 to 90 participating in the NSHAP. **Compared with unmarried adults, married adults had better electronically measured sleep**, but their self-reports were similar, they find. The electronic assessment shows that married people slept longer, had less fragmented sleep, spent more time in deep sleep, and spent less time awake after initially falling asleep. Older people may be unaware of these sleep differences that may be affecting their health, they suggest.

Among married people, those who report more negative aspects of their marriages also report more insomnia symptoms, even when the researchers account for individual psychosocial characteristics. Self-reports of troubled sleep are more prevalent among married couples reporting more negative relationships, but less prevalent among those who identify more positive and supportive aspects of their marriages. Interventions designed to improve marital quality among older people also may improve sleep and health, they hypothesize. In another article based on these data, Lauderdale and Chen (2017) suggest that sleep may play a role in explaining health disparities by marital status (that is, why older adults who are married tend to be healthier than their unmarried peers).

Extended family relationships appear to influence sleep quality, according to a study by Ailshire and Burgard (2012). Strained family relationships are associated with more troubled sleep, while supportive relationships are associated with better sleep, they show.



Family caregivers for older people risk high levels of nighttime waking

The stress of family conflict and expectations may be slightly offset by supportive interactions with family members. However, family strain has more impact on sleep than support, they find. In addition, strain takes a bigger toll on sleep when contact with a difficult family member is frequent.

This study is based on the responses of 3,000 participants in the National Survey of Midlife Development in the United States (MIDUS). The survey included adults ages 25 to 74, but oversampled older adults. Participants reported how frequently they had difficulty getting to sleep or staying asleep. The researchers measured the frequency and

quality of family interaction, including supportiveness, concern, demands, and criticism. They suggest that “social relationships may be a key factor contributing to sleep problems among U.S. adults.”

“Whether social contact promotes health largely depends on the content of the social exchange,” they argue. “There are limits to the health benefits of social ties. Family relationships may be beneficial or harmful to sleep.”

Caring for an older family member with dementia or other profound needs can take a toll on sleep. A University of Michigan team (Leggett et al. 2018) examined the results of phone interviews with 451 caregivers for individuals with dementia, collected as part of the nationally representative National Health and Aging Trends Study (NHATS) and the National Study of Caregiving (NSOC). They find that 16 percent of caregivers experience nighttime waking (waking and not being able to return to sleep) almost every night, and 10 percent report that the care recipient interrupts their sleep most nights.

Analysis shows that individuals caring for people with a high risk of falling are more likely to report high levels of nighttime waking. In addition, caregivers with several chronic medical conditions and those who reported having emotional difficulty with their caregiving role are also more likely to experience regularly disturbed sleep.

Further analysis shows that emotional difficulties related to caregiving continue to be associated with frequent nighttime waking, even after accounting for caregivers' health and care receivers' disability levels. The researchers argue that interventions designed to improve caregivers' emotional distress may contribute to improved sleep and potentially better health. They recommend that health care professionals "screen caregivers for nighttime awakenings so that evidence-based interventions and treatments can be implemented to prevent persistent sleep disturbances."

The same University of Michigan team (Polenick et al. 2018) also finds that ***spouses caring for partners with dementia report more frequent care-related sleep disturbances when they perform a higher number of medical or nursing tasks***. This study examined the responses of more than 100 individuals caring for spouses with dementia from the NHATS and NCOS telephone survey. More than half of the caregivers performed two or more medical or nursing tasks, such as tracking medications; managing ostomy care (pouch collecting urine or stool), intravenous lines, or blood testing; giving shots/injections; and caring for skin wounds or sores. About one in five (18 percent) undertook at least three medical-related care tasks.

Their analysis links care for a dementia patient with a wound or sore to more frequent care-related sleep disturbances, after accounting for the care situation and the type of medical tasks. The researchers recommend that health care providers directly address caregivers' needs and concerns about providing medical or nursing care tasks, offering instruction and support.

African Americans and Sleep-Related Health Risks

Numerous studies show that African Americans are more likely than non-Hispanic white Americans to sleep poorly; these differences may emerge in early adulthood (Walsemann et al. 2017). Recent research offers insight into the potential causes and implications of these sleep differences.



African Americans who report high levels of discrimination also tend to sleep poorly, one study shows.

Owens and colleagues (2017) use subjective and objective measures to show that ***interpersonal discrimination acts as a stressor disrupting sleep***. Their analysis is based on 361 older adults living in the Midwest in the nationally representative Midlife in the United States (MIDUS) study, which includes an added sample of 600 African Americans from highly segregated Milwaukee. The study gathered data measuring sleep using electronic assessment over seven nights, and perceived sleep quality and discrimination using surveys. Each participant received a discrimination score based on questions—validated by earlier research—that examine how frequently they experience unfair treatment. For example, respondents were asked how often they were treated with less respect than other people, others acted as if they were dishonest or not smart, or others acted afraid of them.

Participants who receive higher discrimination scores are significantly more likely to sleep inefficiently (spend a larger share of time in bed not sleeping) based on the electronic assessment, even after accounting for other characteristics. Also, those with higher discrimination scores were more likely to report poor sleep quality and sleep difficulties. The researchers conclude that discrimination explains some of the sleep differences between African Americans and whites.

Another study based on the MIDUS participants (including African Americans predominantly living in Milwaukee) suggests that ***living in a disadvantaged neighborhood contributes to racial differences in sleep*** (Fuller-Rowell et al. 2016). Researchers examined sleep minutes, difficulty falling asleep, and waking after falling sleep using electronic assessment. They classified the quality of participants' neighborhoods by linking their home addresses to 2000 Census tract-level data. African Americans slept for less time, took longer to fall asleep, and woke after falling asleep more often than white Americans.

Participants living in more disadvantaged neighborhoods were significantly more likely to wake after falling asleep, a key component of fragmented sleep that negatively affects health and well-being. When the researchers added measures of depression, health behaviors, and obesity to the analysis, the link between neighborhood disadvantage and waking after falling asleep remained statistically significant.

Neighborhood quality explained about one-quarter of the racial difference in waking episodes, the researchers report. "Racial differences in neighborhood environments must be viewed as essential for addressing and mitigating racial health disparities," they write.

Poor sleep among African American participants in the MIDUS study contributes to racial disparities in health, argue Curtis and colleagues (2017). They show that sleep differences explain more than one-half of the racial differences in the risk of cardiovascular disease and diabetes between black and white Americans. Specifically, they find that African Americans are more likely to spend insufficient time sleeping and experience fragmented sleep.

Using results of electronic assessment over seven nights, they measured the total sleep time and sleep efficiency among 426 MIDUS participants. They assessed participants' risk of cardiovascular disease and diabetes using an index of seven biomarkers (blood pressure, waist circumference, hemoglobin A1c, insulin resistance, triglycerides, HDL cholesterol, and c-reactive protein). Their analysis took sociodemographic characteristics and health behaviors into account.

The study results underscore the "importance of eliminating racial differences in sleep as part of efforts to reduce racial health disparities," the researchers conclude. "Sleep is a malleable health behavior that can be improved through behavioral and educational interventions," they write.



Poor sleep may explain part of the health gap between black and white Americans.

Conclusion

Growing evidence suggests that adequate sleep is a key component of healthy aging. Poor sleep is linked to chronic disease, depression, and obesity. Family relationships, particularly marriage, appear to influence sleep quality. Taking on the caregiver role for someone with dementia or who requires nursing-type care at home can take a toll on sleep. Some groups of African Americans face heightened risks of sleep problems related to the stress of discrimination and living in disadvantaged neighborhoods—contributing to racial disparities in health. These findings should alert health care providers to the necessity of screening for sleep problems among older people and providing support for interventions to address sleep difficulties. ■

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This issue was written by Paola Scommegna, senior writer in U.S. Programs at PRB.

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1875 Connecticut Ave, NW, Suite 520
Washington, DC 20009
800-877-9881