Sleep Duration and Mortality in Women
Effect of Aging and Menopause

Michael Ji, MD, PhD[a], Kelsie M. Full, PhD, MPH[b], Cheryl R. Laratta, MD, MSc[c], Atul Malhotra, MD[d,*]

KEYWORDS

• Sleep • Sleep in women • Sleep duration • Sleep and mortality • Aging • Menopause

KEY POINTS

- Recognize sleep as a modifiable risk factor and view both short and long sleep as potential indicators of underlying health concerns.
- Evaluate for sleep disorders in women across different age groups reporting abnormal sleep patterns, recognizing their connection to cardiometabolic, cognitive, and mental health outcomes.
- Integrate sleep into preventive women's care by routinely assessing sleep duration, quality, and disorders in women.
- Treat sleep as a core component of women's health alongside mental health, metabolic, and chronic disease care.

INTRODUCTION

Sleep is increasingly recognized as an essential factor for overall health and well-being. Growing evidence links both insufficient and excessive sleep with adverse health outcomes, including higher risk of various chronic diseases and mortality.[1,2] The American Heart Association recommends adults should sleep 7 to 9 hours per night for optimal health.[3] These recommendations are based on consistent epidemiologic evidence that has connected deviations in sleep duration, including either short sleep (<7 hours) or long sleep (>9–10 hours), to greater incidence of cardiovascular disease, certain cancers, and all-cause mortality.[4,5] The association between sleep duration and mortality is often described as U-shaped, meaning that both ends of the sleep duration spectrum carry increased risk compared to the optimal 7 to 9 hours.[2,6] Women warrant particular attention in discussions on sleep duration and mortality, as they frequently report shorter sleep duration and more sleep disturbances than men, with these disturbances increasing further with age.[1,2,7]

This review synthesizes the current understanding of how sleep duration relates to mortality in women, documented subgroup variations in risk among women, mechanistic pathways including the influence of sleep disorders, and implications for clinical guidance.

SLEEP IN WOMEN

Women face unique challenges to healthy sleep across the life course. First, women have been

[a] Division of Pulmonary Medicine, Department of Medicine, Faculty of Medicine & Dentistry, University of Alberta, Edmonton, Alberta, Canada; [b] Division of Epidemiology, Department of Medicine, Vanderbilt University Medical Center, 2525 West End Avenue, Suite 1430, Nashville, TN 37203, USA; [c] Division of Pulmonary Medicine, Department of Medicine, Faculty of Medicine & Dentistry, University of Alberta, 3-134 Clinical Sciences Building, 11304 - 83 Avenue, Edmonton, Alberta T6G 2G3, Canada; [d] Division of Pulmonary, Critical Care, Sleep Medicine, and Physiology, Department of Medicine, University of California San Diego, San Diego, CA, USA

* Corresponding author. University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92037.
E-mail address: amalhotra@health.ucsd.edu

Sleep Med Clin 21 (2026) 241–250
https://doi.org/10.1016/j.jsmc.2026.02.008

Abbreviations

CRP	C-reactive protein
IL	interleukin
OSA	obstructive sleep apnea

traditionally understudied in sleep research, in part, due to the male predominance of obstructive sleep apnea (OSA).[7,8] Second, although OSA is more commonly diagnosed in men, many women remain undiagnosed—partly due to gender-based diagnostic biases and potentially even greater with likely missed diagnosis.[9,10] Research indicates that the stereotypical phenotype of OSA leads to disproportionate diagnosis of OSA in men, above and beyond the epidemiologic differences in occurrence.[10] Third women often shoulder disproportionate household and family responsibilities alongside career demands—including childcare and meal planning.[8] This increased burden frequently reduces the opportunity for sleep, resulting in chronic sleep deprivation and poor sleep quality.[11–13] Fourth, women are more likely than men to have sleep disorders such as insomnia, mood disturbance, and restless legs syndrome.[8,9] Lastly, as women age, they increasingly report difficulty obtaining sufficient sleep—particularly during menopausal transition, when sleep disturbances like night awakenings and insomnia become more prevalent.[10,14]

On a broader societal level, with the demands of work, caregiving, and household responsibilities, sleep is often viewed as a luxury by women and US population estimates indicate the proportion of adult women with short sleep durations has been increasing over recent decades.[2,15] Overall, attaining adequate healthy sleep presents unique challenges for aging women.

SLEEP DURATION AND MORTALITY IN WOMEN

A robust body of evidence supports a U-shaped association between sleep duration and all-cause mortality in women. Studies have consistently shown both short sleep (typically <6–7 hours/night) and long sleep (>9–10 hours) are associated with greater mortality risk compared to sleeping the recommended 7 to 8 hours.[16] A large 2024 meta-analysis of 79 cohort studies reported that short sleep (<7 h) was linked to a pooled hazard ratio (HR) for mortality of 1.14, while long sleep (≥9 h) corresponded to HR of 1.34, with the long-sleep effect especially pronounced in women.[1] Similarly, in a cohort of low-income adults, women whose sleep patterns transitioned between short and long sleep over 5 years had significantly higher all-cause mortality compared to maintaining optimal sleep of 7 to 9 hours.[17] Using objectively measured sleep data from polysomnography, Lin and colleagues found in a study of older adults with OSA (36.8% women) that shorter habitual sleep (<7 h) independently increased mortality risk, even after adjusting for apnea severity.[18] Furthermore, sex-stratified analyses revealed that while both sexes exhibit the U-shaped pattern, women tend to experience a greater mortality risk associated with long sleep.[1,19]

Taken together, the overwhelming evidence suggests that short sleep significantly increases mortality risk in women. Conversely, some evidence indicates that long sleep durations may be particularly harmful for females.[20,21] More research is needed to explore mechanisms explaining these differences; nonetheless, the overarching U-shaped pattern is consistent for women: both insufficient and excessive sleep compromise longevity.

SPECIFIC RISK PATTERNS

Young and Middle-aged Women

In younger, premenopausal women, adequate sleep is essential to healthy trajectories, although risk patterns may differ from those seen in older women. Women of reproductive age frequently face competing demands from careers, childcare, and social pressures that truncate sleep duration, resulting in a high prevalence of chronic short sleep.[22,23] Indeed, young women in their 20s to 40s habitually report sleeping under 7 hours and on average report shorter sleep than men.[24] Lifestyle and psychosocial stressors—including pregnancy, caring for small children, and maintaining work responsibilities—render chronic sleep deprivation common in reproductive-age women, potentially raising long-term health risks.[25,26] While OSA is less diagnosed in younger women, emerging research suggests underdiagnosis is common even in this group,[27,28] and thus a significant proportion of young women may be affected by sleep disordered breathing contributing to shortened sleep durations.

The impact of extreme sleep durations on mortality in younger women appears consistent with the U-shaped model, but age may moderate effect size. For example, Åkerstedt and colleagues found that mortality risk linked to very short or very long sleep was stronger among individuals under the age of 65 years compared to those over 65 years of age.[29] Interpretation of such findings may suggest that for younger women—even more than older ones—deviation from 7 to 8 hours may be particularly harmful, possibly because

younger adults are generally healthier and an abnormal sleep duration might indicate a more severe perturbation from the norm. Additionally, perimenopausal women (late 40s to early 50s) report especially poor sleep: in a CDC-backed survey, 56% of perimenopausal women slept under 7 hours compared with 32.5% of premenopausal women,[30] implying that midlife sleep deficits may compound health risks later in life. Likewise, among middle-aged women (ages 45–60 years) studies show consistent mortality increases with sleep durations less than 6 or 9 hours or greater, mirroring findings in older cohorts.[20,21]

Although research focused on sleep health in younger women remains sparse, available data indicate that maintaining optimal sleep duration is as vital in reproductive-age women as it is for older women. Short sleep in early to mid-adulthood may predispose to chronic disease, while unusually long sleep in younger women may signal underlying health conditions that require medical attention.

Postmenopausal Women

Women's sleep patterns and associated health risks evolve importantly across the lifespan, with menopause representing a critical transition. Postmenopausal women frequently encounter sleep disruptions—such as insomnia and fragmented sleep—driven by hormonal changes, hot flashes, mood fluctuations, and a heightened prevalence of conditions like OSA.[31,32] Large observational cohorts of older women further affirm that the U-shaped relationship between sleep duration and mortality persists in this population: both short ($\leq$5 h) and long ($\geq$9 h) sleep durations are associated with increased all-cause and cardiovascular mortality among postmenopausal women.[33,34] Additionally, European cohort study reported HRs of 1.3 to 1.5 for long sleepers compared to those sleeping 7 hours.[20]

Biologically, the menopause transition may amplify sleep problems that indirectly contribute to mortality risk. Recent cohort research using NHANES data shows that 53% of postmenopausal women exhibit OSA symptoms—a substantial rise compared to 36% of premenopausal women—and visceral fat accounts for nearly 30% of the mediating effect.[35] The loss of estrogen and progesterone has been linked to reduced respiratory drive and increased OSA vulnerability, with longitudinal evidence that hormone replacement therapy reduces apnea prevalence.[36,37] This elevation in sleep-disordered breathing, alongside insomnia symptoms, may partly explain why long sleep in older women often reflects fragmented sleep and increased health risk.

At the same time, many postmenopausal women with chronic health conditions, that is, arthritis and depression, may spend more time in bed due to fatigue,[38,39] confounding long sleep with poor health rather than protective rest. In contrast, studies in midlife and older adults, maintaining a good sleep (~7–9 hours) is associated with lower cardiovascular disease risk,[17,34] reinforcing the proposition that maintaining healthy sleep is a vital component of healthy aging in women.

Race and Ethic Disparities

Given enduring disparities in sleep health, significant attention has focused on racial/ethnic and socioeconomic differences in sleep duration and its health implications. Sleep behaviors and associated health consequences among women are not uniform, and there are well-established disparities across racial and ethnic groups.[8,40]

Large-scale evidence shows that historically marginalized groups, such as non-Hispanic Black and Hispanic women in the United States, experience disproportionately high rates of short sleep, a pattern linked to health disparities. A prospective study of over 270,000 US adults found Black Americans consistently had the highest prevalence of short sleep from 2004 to 2018, with Black women having the single highest short-sleep rates.[40] Stressors like workforce inequities, caregiving burdens, and racial discrimination likely contribute to chronic sleep debt in Black women, elevating risks for hypertension, diabetes, and other cardiometabolic conditions.[41,42] In addition, a cross-sectional study in older women also demonstrated a U-shaped relationship with future cardiovascular risk, with particularly prominent association observed for longer sleep duration among Black women.[43]

Disparities in sleep are further linked to socioeconomic status, racism/discrimination, acculturative stress, neighborhood environment, and cultural sleep beliefs.[8] Anwar and Quan reported that compared to White women, Black women were more likely to experience short sleep (37% vs 27%) and less likely to meet recommended sleep duration (52% vs 64%).[44] NHANES data reveal that US-born Mexican-American women are more prone to report short habitual sleep durations than Mexico-born Hispanic women, possibly reflecting cultural differences in sleep values and acculturation stress.[45] Regarding whether race/ethnicity modifies the sleep mortality association, investigators have observed that while extreme sleep durations (<5 h and > 9 h) were linked to elevated mortality across all groups, the strength of these associations was often higher in White

adults than in Black or Hispanic groups.[17,40] Nevertheless, the disproportionately high prevalence of unhealthy sleep among Black and Hispanic women would suggest a substantial population-level impact even if hazard ratios are modest.

Overall, significant racial and ethnic differences in sleep duration, shaped by various social determinants, highlight the importance of continued research on the links between sleep health and mortality in diverse and representative cohorts of women.

MECHANISTIC PATHWAYS

Abnormal sleep duration has been linked to a range of biological pathways that may negatively impact health and increase mortality risk. These mechanisms span multiple physiologic systems, including cardiometabolic, respiratory, immune/inflammatory, hormonal, and neurocognitive domains, underscoring the widespread influence of sleep on the body.

Cardiometabolic and Obesity

One of the clearest connections between sleep duration and mortality is through cardiovascular and metabolic health. Evidence from large cohort and experimental studies shows that abnormal sleep duration elevates the risk of chronic cardiovascular conditions and increases mortality. In recognition of this, in 2022 the American Heart Association added sleep health to the Life's Essential 8, as a core component to maintaining optimal cardiovascular health.[46]

Some of the earliest evidence on sleep duration and cardiovascular disease in women comes from the Nurses' Health Study, which followed over 71,000 women and found that abnormal sleep duration was linked with increased risk of coronary heart disease.[47] Specifically, they reported that women sleeping 5 hours or less per night had an 82% increased risk of coronary heart disease compared to those sleeping 8 hours. Subclinical disease evidence comes from King and colleagues who found that actigraphy-measured short sleep predicted coronary artery calcification in women over 5 years.[48] Similarly, the Multiple Ethnic Study of Atherosclerosis found that inconsistent sleep duration was linked to multiple indicators of subclinical atherosclerosis and that sleep regularity may represent a modifiable approach to lowering the risk of atherosclerosis.[49]

On the metabolic front, insufficient sleep impairs glucose and appetite regulation. In the Massachusetts Male Aging Study, short sleepers were twice as likely to develop type 2 diabetes over 15 years.[50] In controlled physiology trials, Spiegel and investigators showed that 2 nights of 4 h sleep reduced leptin and increased ghrelin to stimulate appetite.[51,52] In the Nurses' Health Study, women sleeping less than 5 hours gained more weight and had higher incident obesity risk over 16 years.[53] Sleep deprivation also negatively affects lipid metabolism, leading to less favorable cholesterol profiles,[54] particularly in women undergoing hormonal changes related to pregnancy or menopause. These findings point to a cycle of short sleep raises appetite, promotes insulin resistance and leads to obesity and metabolic dysfunction contributing to cardiometabolic disease and mortality.

While long sleep is more challenging to interpret mechanistically, several large cohort studies link long sleep to poorer cardiometabolic outcomes including obesity and increased risk of depression, certain inflammatory disorders, and diabetes.[43,47,50,53,55,56] Contributing factors may include undiagnosed sleep disorders, poor sleep quality, irregular sleep patterns, and unhealthy lifestyle behaviors like physical inactivity, poor quality diet, inconsistent employment, and social isolation.[8] Some long sleepers may also have underlying chronic conditions like subclinical cardiovascular disease, autoimmune disorders or chronic infections; thus, it is important to differentiate primary effects of long sleep from the secondary effects of illness. Like short sleep, prolonged sleep duration is linked to increased cardiovascular and all-cause mortality.[17,21,55,57–59]

In summary, a large body of evidence supports the role of abnormal sleep—both short and long—in contributing to cardiovascular and metabolic dysfunction, leading to higher risk of obesity, hypertension, diabetes, heart disease, stroke, and ultimately mortality.

Sleep Apnea and Sleep Disorders

When evaluating the relationship between sleep duration and mortality, it is imperative to consider sleep disorders, particularly OSA, which can mediate or confound this association. OSA is common, especially among postmenopausal, overweight, or older women, with prevalence rates reaching approximately 50% in postmenopausal women.[25,60] OSA may lead individuals to report long durations of time in bed as they attempt to compensate for inefficient sleep or conversely result in short actual sleep due to frequent arousals. Both scenarios are linked to elevated risks of hypertension, coronary artery disease, arrhythmias, and stroke, driven by chronic intermittent hypoxia and sympathetic overactivation.[18,25,61]

In community-based cohorts, moderate-to-severe OSA has been shown to increase all-cause mortality (HR ≈ 6.2) independently after adjusting for age, body mass index, cholesterol, and comorbidities.[62,63] The presence of OSA among individuals with long or short sleep may partly explain why extreme sleep durations correlate with elevated mortality. Importantly, women are historically underdiagnosed with OSA because they often present atypically—complaining of insomnia or fatigue rather than witnessed apneas—leading to missed diagnosis and hidden mortality risk in short-sleeping women.[64,65] Encouragingly, treatment of OSA improves blood pressure and lowers cardiovascular event risk in long-term observational follow up.[63]

Beyond OSA, insomnia is prevalent among women, particularly under stress or during menopause. Insomnia has been linked to a modest but significant increase in both cardiovascular and all-cause mortality. For instance, studies of older adults found persistent insomnia was associated with elevated risks, especially when coupled with short objective sleep duration.[34,66,67] The underlying mechanism likely involves chronic hyperarousal and stress system activation, resembling the effects of short sleep.[68] Many individuals with insomnia obtain a normal amount of sleep by duration but still suffer poor sleep quality, rendering duration alone is insufficient as an indicator.[69] Medical treatments like cognitive behavioral therapy for insomnia (CBT-I) could improve both sleep time and quality and potentially reduce cardiovascular and mortality risk.[70,71]

Other disorders including restless legs syndrome and related movement disorders which fragment sleep could lead to poor sleep quality and abnormal sleep duration.[72,73] Moreover, circadian rhythm disorders like advanced or delayed sleep phase which might not change total sleep amount, but affect the quality and efficiency of sleep, may also have an impact on overall cardiovascular and morality outcomes.[74,75]

Taken together, sleep disorders appear to be critical mediators of the link between sleep duration and mortality despite being frequently unmeasured or unaccounted for in large cohort studies. Addressing sleep disorders would be a pivotal part of mitigating the negative health outcomes associated with extreme sleep durations in women.

Inflammatory and Immune

A growing body of research identifies chronic inflammation as a fundamental pathway linking sleep disturbances and mortality. Both short and long sleep have been associated with a state of persistent low-grade systemic inflammation. For instance, acute sleep deprivation elevates inflammatory cytokines such as interleukin (IL)-6 and C-reactive protein (CRP).[76,77] Epidemiologic studies similarly show that individuals habitually sleeping fewer hours exhibit higher CRP, fibrinogen, and other inflammatory markers.[78,79] In an experimental study by Yang and colleagues, with 3 consecutive nights of 4 h or less sleep, female participants demonstrated significantly greater IL-6 elevation than males, despite no disruption in macrocirculation or microvascular parameters.[80]

Inadequate sleep activates stress pathways that drive pro-inflammatory mediator production. Persistently elevated inflammation can damage tissues over time and contributes to age-related diseases.[81,82] Additionally, inflammation plays a key role in the development of atherosclerosis, linking short sleep to cardiovascular risk.[83] Inflammation is also implicated in insulin resistance, metabolic dysfunction, and may contribute to carcinogenesis,[84,85] reinforcing concerns about cancer risk in individuals with abnormal sleep duration. Beyond cytokine changes, sleep deprivation impairs the immune system: natural killer cell cytotoxic activity declines, T-cell function diminishes, and vaccine response is reduced.[85,86] These immune deficits could increase mortality risk via infections or impaired tumor surveillance.

While mechanistic data on long sleep are less developed, some researchers propose that prolonged sleep may in part reflect underlying inflammatory or immune dysregulation,[85,87] such as chronic infections, autoimmune disease, or systemic illness, that increases both sleep need and mortality risk. Thus, inflammation appears to be a common mechanistic pathway by which sleep duration in both short and prolonged forms influence mortality.

Hormonal and Endocrine

Disrupted sleep duration can lead to dysregulated secretion of hormones that govern metabolism, stress responses and cell growth—processes closely linked to mortality risk. A key hormone in this pathway is cortisol, the body's primary stress mediator. Chronic short or poor sleep blunts the normal overnight decrease in cortisol and elevates evening levels, creating a persistent stress state.[88,89] Elevated cortisol promotes hypertension, insulin resistance, and central adiposity, which are features of metabolic syndrome that increase mortality risk.[90,91] Another critical hormone is melatonin, produced nocturnally by the pineal gland and helps regulate sleep. Beyond regulating circadian rhythms, melatonin has antioxidant and

may help suppress tumor development.[92] Short sleep and night-shift work, both of which disrupt melatonin, have been associated epidemiologically with increased risks of hormone-sensitive cancers, particularly breast cancer in women.[93] The International Agency for Research on Cancer has classified long-term night-shift work as a probable carcinogen, with melatonin suppression proposed as a key mechanism.[94] Accordingly, hormonal dysregulation via elevated cortisol and reduced melatonin forms a biological basis for the sleep and mortality link, in which sleep deprivation disturbs stress and circadian-regulated hormones in ways that damage health over time.

Neurologic and Cognitive

Short sleep substantially impairs cognitive performance, reaction time and mood, directly raising the risk of accidents and injuries particularly in younger adults. For instance, driving after just 5 hours of sleep produces reaction-time impairment comparable to being legally intoxicated.[95,96] The American Automobile Association Foundation reports that individuals sleeping less than 7 hours per night face twice the crash risk, further increasing to fourfold for those under 5 hours.[97] Similarly, self-reported study of shift workers revealed that female nurses sleeping less than 6 hours were significantly more likely to report drowsy driving and workplace accidents.[98] These accidents contribute to elevated all-cause mortality, especially among those under 50 years of age.[97,99]

Chronic sleep deprivation also increases vulnerability to mental health disorders including depression, which carry heightened suicide risk and overall morbidity. Women have higher baseline rates of depression than men, and insomnia is a well-known precipitant of depressive episodes.[100] Prospective research among US adult women (ages 20–40) found that those reporting frequent sleep difficulties had a threefold higher risk of depressive symptoms 6 months later.[101] A cross-sectional study of menopausal women found a U-shaped association between sleep duration both short and long and risk of depression.[102]

Taken together, a bidirectional relationship is evident: poor sleep can precipitate or worsen depression, while depression in turn disrupts sleep thereby amplifying risk of mortality. Maintaining sufficient and regular sleep is therefore increasingly recognized as a pillar of brain and mental health with implications for longevity.

SUMMARY

A substantial body of evidence provides consistent support for a U-shaped association of sleep duration and mortality. Women who consistently sleep 7 to 8 hours per night have the lowest risk of death, while sleeping significantly more or less is tied to greater risk. This pattern has been observed across various populations and demographic subgroups of females, although specific risk profiles may differ depending on factors like age, menopausal status, and racial/ethnic background, influenced by both biological and social determinants. The mechanisms underlying these observations are likely multifactorial, including cardiometabolic stress, sleep disorders, chronic inflammation, hormonal dysregulation, and neurocognitive impairment—all of which can lead to increased disease burden and mortality across multiple organ systems. Thus accordingly, integrating sleep health into routine care and equipping women with the knowledge and resources to prioritize restorative sleep should be a cornerstone of clinical care and guidance for women.

CLINICS CARE POINTS

- Make sleep a core part of women's preventive care: routinely assess sleep duration, quality, and disorders in women to support overall mental and chronic disease health.
- View sleep duration as a modifiable risk factor: treat both short and long sleep in women as potential signs of underlying health issues needing further evaluation.
- Investigate extreme sleep durations in women across all age groups: very short or long sleep in premenopausal, perimenopausal, and postmenopausal women should prompt screening for sleep and/or chronic health conditions.
- Screen marginalized women for sleep disorders: use culturally sensitive tools to identify undiagnosed sleep issues in Black and Hispanic women and reduce disparities.
- Include sleep in cardiometabolic, endocrine, and cognitive health: consider sleep and its impact in patients with metabolic syndrome, neurocognitive/mood disorders, and other chronic health conditions as part optimal care.

DISCLOSURES

M. Ji, K.M. Full, C.R. Laratta, and A. Malhotra report no conflicts of interest. No funding was received to support the preparation of this article.

REFERENCES

1. Ungvari Z, Fekete M, Varga P, et al. Imbalanced sleep increases mortality risk by 14–34%: a meta-analysis.

GeroScience 2025. https://doi.org/10.1007/s11357-025-01592-y.
2. Gu J, Wu H, Diao W, et al. Association of sleep duration with risk of all-cause and cause-specific mortality among American adults: a population-based cohort study. Nat Sci Sleep 2024;16:949–62.
3. American Heart Association. Life's essential 8™ – updated cardiovascular health checklist includes sleep: 7-9 hours daily for adults. American Heart Association 2022. Available at: https://newsroom.heart.org/news/american-heart-association-adds-sleep-to-cardiovascular-health-checklist. Accessed September 22, 2025.
4. Gallicchio L, Kalesan B. Sleep duration and mortality: a systematic review and meta-analysis. J Sleep Res 2009;18(2):148–58.
5. Yin J, Jin X, Shan Z, et al. Relationship of sleep duration with all-cause mortality and cardiovascular events: a systematic review and dose-response meta-analysis of prospective cohort studies. J Am Heart Assoc 2017;6(9):e005947.
6. Shah AS, Pant MR, Bommasamudram T, et al. Effects of sleep deprivation on physical and mental health outcomes: an umbrella review. Am J Lifestyle Med 2025.
7. Mallampalli MP, Carter CL. Exploring sex and gender differences in sleep health: a Society for Women's Health Research Report. J Womens Health (Larchmt) 2014;23(7):553–62.
8. Full KM, Johnson DA, Kaufmann CN, et al. An update on sleep duration, obesity, and mortality risk in women. Sleep Med Clin 2023;18(4):415–22.
9. Mallampalli MP. Shining the spotlight on women and sleep. American Academy of Sleep Medicine; 2025. Available at: https://aasm.org/shining-the-spotlight-on-women-and-sleep/. Accessed September 22, 2025.
10. Carden K, Malhotra A. The debate about gender differences in obstructive sleep apnea. Sleep Med 2003;4(6):485–7.
11. Johnson DA, Knutson K, Colangelo LA, et al. Associations of chronic burden, sleep characteristics, and metabolic syndrome in the coronary artery risk development in young adults study. Psychosom Med 2022;84(6):711–8.
12. Johnson DA, Lisabeth L, Lewis TT, et al. Contribution of psychosocial stressors to sleep among African Americans in the Jackson heart study. Sleep 2016;39(7):1411–9.
13. Maki PM, Panay N, Simon JA. Sleep disturbance associated with the menopause. Menopause 2024;31(8):724–33.
14. Edwards BA, O'Driscoll DM, Ali A, et al. Aging and sleep: physiology and pathophysiology. Semin Respir Crit Care Med 2010;31(5):618–33.
15. Bin YS, Marshall NS, Glozier N. Secular trends in adult sleep duration: a systematic review. Sleep Med Rev 2012;16(3):223–30.
16. Shah AS, Pant MR, Bommasamudram T, et al. Effects of sleep deprivation on physical and mental health outcomes: an umbrella review. Am J Lifestyle Med 2025. https://doi.org/10.1177/15598276251346752.
17. Full KM, Malhotra A, Johnson DA, et al. Sleep trajectories and all-cause mortality among low-income adults. JAMA Netw Open 2025;8(2):e202462127.
18. Lin Y, Wu Y, Lin Q, et al. Objective sleep duration and all-cause mortality among people with obstructive sleep apnea. JAMA Netw Open 2023;6(12):e2346085.
19. Åkerstedt T, Ghilotti F, Grotta A, et al. The association of short and long sleep with mortality in men and women: all-cause, cardiovascular disease, and cancer mortality. J Sleep Res 2024;33:e13931.
20. Kabat GC, Kim MY, Rohan TE. The association of sleep duration and quality with all-cause and cause-specific mortality in the Women's health initiative. J Clin Sleep Med 2018;14(9):1507–16.
21. Patel SR, Ayas NT, Malhotra M, et al. A prospective study of sleep duration and mortality risk in women. Sleep 2004;27(3):440–4.
22. Redeker NS, Falk NL, Himsworth HP, et al. Sleep health in women of childbearing age. Curr Sleep Med Rep 2020;6(3):85–94.
23. Kim M, Wiener LE, Gilbert J, et al. Persistent short sleep duration from pregnancy to 2 to 7 years after delivery and metabolic health. JAMA Netw Open 2024;7(12):e2452204.
24. Wu X, Chen Y, Li Y, et al. Correlates of multidimensional sleep in premenopausal women: a community-based study. Sleep Health 2024;10(2):123–31.
25. Haufe A, Leeners B. Sleep disturbances across a woman's lifespan: what is the role of reproductive hormones? J Endocr Soc 2023;7(5):bvad036.
26. Beroukhim G, Esencan E, Seifer DB. Impact of sleep patterns upon female neuroendocrinology and reproductive outcomes: a comprehensive review. Reprod Biol Endocrinol 2022;20:16.
27. Wimms A, Edwards BA, Sands SA, et al. Obstructive sleep apnea in women: specific issues and interventions. Sleep Med Clin 2016;11(2):191–200.
28. Geer JH, Berry RB, Im K. Gender issues in obstructive sleep apnea. J Clin Sleep Med 2021;17(9):1753–61.
29. Åkerstedt T, Discacciati A, Westerlund H, et al. Sleep duration, mortality and the influence of age: a prospective cohort study. J Sleep Res 2017;26(6):744–51.
30. Vahratian A. Sleep duration and quality among women aged 40–59, by menopausal status (NCHS data brief no. 286). National Center for Health Statistics; 2017. Available at: https://www.cdc.gov/nchs/data/databriefs/db286.pdf. Accessed September 22, 2025.

31. Baker FC, Goldstein I, Zhang B. Sleep and sleep disorders in the menopausal transition. Sleep Med Clin 2018;13(3):469–81.
32. Salari N, Hasheminezhad R, Hosseinian-Far A, et al. Global prevalence of sleep disorders during menopause: a meta-analysis. Sleep Breath 2023; 27(5):1883–97.
33. Sands Lincoln M, Bairey Merz CN, Daviglus ML, et al. Sleep duration, insomnia, and coronary heart disease among postmenopausal women in the Women's health initiative. J Womens Health (Larchmt) 2013; 22(6):477–86.
34. Thurston RC, Chang Y, Kline CE, et al. Trajectories of sleep over midlife and incident cardiovascular disease in women. Circulation 2024;149(7):545–55.
35. Wang Y, Liu H, Zhou B, et al. Menopausal status and prevalence of obstructive sleep apnea symptoms: NHANES 2015–2016 analysis. BMC Endocr Disord 2025;25:1850.
36. Zhou P, Li L, Chen Y, et al. Regulatory role of estrogen in postmenopausal obstructive sleep apnea syndrome: implications for cardiovascular risk. Front Med 2025;12:1369393.
37. Mirer AG, Young T, Palta M, et al. Menopause, hormone replacement therapy, and sleep disordered breathing: evidence from the Wisconsin sleep cohort. Ann Epidemiol 2020;30(4):223–30.
38. Zhang F, Cheng L. Association between sleep duration and depression in menopausal women: a population-based study. Front Endocrinol (Lausanne) 2024;15:1301775.
39. Soares CN, Bajbouj M, Schoof N, et al. Impact of sleep disturbances on health-related quality of life in postmenopausal women: a systematic review. Menopause 2025. https://doi.org/10.1097/GME.0000000000002633.
40. Denney JT, Zamora Kapoor A, Hansen DA, et al. Race/ethnicity, sleep duration, and mortality risk in the United States. SSM Popul Health 2023;21: 101350.
41. Covassin N, Greene EL, Somers VK, et al. Disparities in hypertension among African-Americans: implications of insufficient sleep. Curr Hypertens Rep 2018;20(7):57.
42. Jackson CL, Powell-Wiley T, Gaston SM, et al. Experiences with everyday and major forms of racial/ethnic discrimination are associated with higher risk of type 2 diabetes in black women. J Racial Ethn Health Disparities 2021;8:1609–17.
43. Full KM, Malhotra A, Gallo LC, et al. Accelerometer-measured sleep duration and clinical cardiovascular risk factor scores in older women. J Gerontol A Biol Sci Med Sci 2020;75(9):1771–8.
44. Anwar SB, Quan SF. Sleep health disparities by race/ethnicity, gender, and socioeconomic status: a U.S. perspective. Sleep Med Res 2024;15(3): 139–50.
45. Seicean S, Ramos AR, Redline S, et al. Sleep duration disparities between U.S.-born Mexican Americans and Mexico-born Hispanic adults: NHANES analysis. Sleep Health 2022;8(3):234–41.
46. American Heart Association. Life's essential 8™: updating and enhancing the American Heart Association's construct of cardiovascular health. 2022. Available at: https://www.heart.org/en/healthy-living/healthy-lifestyle/lifes-essential-8. Accessed September 22, 2025.
47. Ayas NT, White DP, Al-Delaimy WK, et al. A prospective study of sleep duration and coronary heart disease in women. Arch Intern Med 2003; 163(2):205–9.
48. King CR, Knutson KL, Rathouz PJ, et al. Short sleep duration measured by actigraphy and coronary artery calcification. J Am Coll Cardiol 2021; 77(2):180–9.
49. Full KM, Huang T, Shah NA, et al. Sleep irregularity and subclinical markers of cardiovascular disease: the multi-ethnic study of atherosclerosis. J Am Heart Assoc 2023;12(4):e027361.
50. Yaggi HK, Araujo AB, McKinlay JB. Sleep duration as a risk factor for the development of type 2 diabetes. Arch Intern Med 2006;166(16):1768–74.
51. Spiegel K, Tasali E, Penev P, et al. Brief sleep curtailment in healthy young men is associated with decreased leptin and increased ghrelin. Ann Intern Med 2004;141(11):846–50.
52. Nedeltcheva AT, Kilkus JM, Imperial J, et al. Sleep restriction impairs weight loss and fat-free mass preservation. Obesity 2010;18(2):306–11.
53. Patel SR, Malhotra A, White DP, et al. Association between reduced sleep and weight gain in women. Am J Epidemiol 2006;164(10):947–54.
54. Singh S, Natarajan P, O'Donnell CJ. Sleep duration and lipid profiles in middle-aged women: a population-based study. Sleep Health 2024; 10(1):14–21.
55. Chen Y, Jin Y, Feng S, et al. Sleep duration and risk of cardiovascular disease and mortality in 0.5 million adults: a cohort study. BMC Med 2023;21:170.
56. Patel SR, Malhotra A, Gottlieb DJ, et al. Correlates of long sleep duration. Sleep 2006;29(7):881–9.
57. Wallace ML, Buysse DJ, Redline S, et al. Multidimensional sleep and mortality in older adults: a machine-learning comparison with other risk factors. J Gerontol A Biol Sci Med Sci 2019;74(12):1903–9.
58. Silva AAD, Mello RGBD, Schaan CW, et al. Sleep duration and mortality in the elderly: a systematic review with meta-analysis. BMJ Open 2016;6(2): e008119.
59. Wang C, Bangdiwala SI, Rangarajan S, et al. Association of estimated sleep duration and naps with mortality and cardiovascular events: a study of 116,632 people from 21 countries. Eur Heart J 2019;40(20):1620–9.

60. Salari N, Hasheminezhad R, Hosseinian-Far A, et al. Prevalence of sleep-disordered breathing in postmenopausal women: a systematic review and meta-analysis. Sleep Breath 2023;27(5):1883–97.
61. Kendzerska T, Leung RS, Hawker G, et al. Cardiovascular consequences of obstructive sleep apnea: a sex-specific meta-analysis. Sleep Med 2020;72:68–75.
62. Marshall NS, Wong KKH, Liu PY, et al. Sleep apnea as an independent risk factor for all-cause mortality: the Busselton health study. Sleep 2008;31(8):1079–85.
63. Dodds S, Williams LJ, Roguski A, et al. Mortality and morbidity in obstructive sleep apnoea: long-term survival benefit with CPAP. Eur Respir J 2020;56(3):200057.
64. Antonaglia C, Citton GM, Siciliano M, et al. Obstructive sleep apnea syndrome in women: gender in sleep respiratory medicine is a first step towards personalized medicine. Sleep Breath 2025;29(4):250.
65. BaHammam AS. The gender gap in obstructive sleep apnea: unmasking the disproportionate costs on women. Sleep 2025;48(7):zsaf068.
66. Sawadogo W, Adera T. Insomnia symptoms and increased risk of all-cause mortality by age and sex. J Clin Sleep Med 2024;20(10):1585–93.
67. Ali E, Shaikh A, Yasmin F, et al. Incidence of adverse cardiovascular events in patients with insomnia: a systematic review and meta-analysis of real-world data. PLoS One 2023;18(9):e0291859.
68. Kalmbach DA, Arnedt JT, Swanson LM, et al. Hyperarousal and sleep reactivity in insomnia: current insights. Nat Sci Sleep 2018;10:193–209.
69. Shafazand S, Arjomandi M, Quan SF, et al. Insomnia, sleep quality, and quality of life in mild to moderately symptomatic obstructive sleep apnea. Ann Am Thorac Soc 2017;14(4):611–8.
70. Savin KL, Olmstead R, Carlson LE, et al. The effect of cognitive behavioral therapy for insomnia on daytime functioning and inflammatory markers: a systematic review and meta-analysis. Sleep Med Rev 2022;66:101–24.
71. Javaheri S, Redeker NS. Cognitive behavioural therapy for insomnia effectively treats insomnia in patients with cardiovascular disease: now what? J Clin Sleep Med 2025;21(7):1153–4.
72. Afshari Saleh LA, Asadpour H, Amini M, et al. Investigating mood and sleep disorders in patients with restless legs syndrome: a cross sectional study. Jundishapur J Chronic Dis Care 2025;14(2):e158353.
73. Paredes AR, Copaja Corzo C, Taype Rondan A. Association between restless legs syndrome and sleep quality in Peruvian medical students. PLoS One 2025;20(3):e0320008.
74. Windred DP, Burns AC, Lane JM, et al. Sleep regularity is a stronger predictor of mortality risk than sleep duration: a prospective cohort study. Sleep 2024;47(1):zsad253.
75. Hostler SA, Taylor BJ, Stone KL, et al. Circadian phase misalignment, sleep efficiency, and cardiovascular risk in older adults with advanced sleep phase syndrome. Chronobiol Int 2025;42(3):145–58.
76. Meier-Ewert HK, Ridker PM, Rifai N, et al. Effect of sleep loss on C-reactive protein, an inflammatory marker of cardiovascular risk. J Am Coll Cardiol 2004;43(4):678–83.
77. Yeh MSL, Tsai MJ, Chang ET, et al. Acute sleep deprivation elevates inflammatory biomarkers in healthy adults. BMC Psychiatry 2023;23:476.
78. Irwin MR, Olmstead R, Carroll JE. Sleep disturbance, sleep duration, and inflammation: a systematic review and pooled analysis. Biol Psychiatry 2016;80(1):40–52.
79. Dzierzewski JM, Fung CH, Jouldjian S, et al. Sleep inconsistency and markers of inflammation in older adults. Front Neurol 2020;11:1042.
80. Yang H, Baltzis D, Bhatt V, et al. Macro- and microvascular reactivity during repetitive exposure to shortened sleep: sex differences. Sleep 2021;44(5):zsaa257.
81. Li Q, Xiao N, Zhang H, et al. Systemic aging and aging-related diseases. FASEB J 2025;39(5):e70430.
82. Tong Y, Li W, Zhang H, et al. Systemic inflammation in midlife is associated with late-life functional impairments across multiple organ systems. Sci Rep 2024;14:68724.
83. Gupta K, Nagalli S, Kalra R, et al. Sleep duration, baseline cardiovascular risk, and inflammation: a prospective cohort study. Sleep Health 2021;7(5):715–22.
84. Berbudi A, Khairani S, Tjahjadi AI. Interplay between insulin resistance and immune dysregulation in type 2 diabetes mellitus: implications for therapeutic interventions. ImmunoTargets Ther 2025;14:359–82.
85. Garbarino S, Lanteri P, Bragazzi NL, et al. Role of sleep deprivation in immune-related disease risk and outcomes. Commun Biol 2021;4(1):1304.
86. Irwin M, McClintick J, Costlow C, et al. Partial night sleep deprivation reduces natural killer and cellular immune responses in humans. FASEB J 1996;10:643–53.
87. Dowd JB, Goldman N, Weinstein M. Sleep duration, sleep quality, and biomarkers of inflammation in a Taiwanese population. Ann Epidemiol 2011;21-(11):799–806.
88. O'Byrne NA, Walsh CM, O'Connor N, et al. Sleep and circadian regulation of cortisol: a short review. J Neuroendocrinol 2021;33(4):e12900.
89. Guyon A, Balbo M, Morselli LL, et al. Effects of acute sleep restriction on ACTH and cortisol levels in healthy young adults. Sleep 2014;37(8):1281–8.

90. Rao R, McKenna BS, Cho K, et al. Modeling the influence of chronic sleep restriction on HPA axis dynamic hormonal regulation. Metabolites 2021;11(8):483.
91. Nollet M, Walker FR. Sleep deprivation and stress: a reciprocal relationship. Interface Focus 2020;10(4):20200092.
92. Fernández-Lázaro D, Miguel AM, Celorrio San E, et al. The role of melatonin as an adjuvant therapeutic strategy in the modulation of carcinogenesis: a narrative review. J Cancer Metastasis Treat 2024;10:51.
93. Hong J, He Y, Fu R, et al. The relationship between night shift work and breast cancer incidence: a systematic review and meta-analysis of observational studies. Open Med (Wars) 2022;17(1):712–31.
94. International Agency for Research on Cancer. IARC monographs on the identification of carcinogenic hazards to humans. Volume 124: night shift work. Lyon, France: World Health Organization, International Agency for Research on Cancer; 2020. Available at: https://publications.iarc.fr/601.
95. Banks S, Dinges DF. Behavioral and physiological consequences of sleep restriction. J Clin Sleep Med 2007;3(5):519–28.
96. Lowrie JL, Curtis AM, Conway LG, et al. The impact of sleep deprivation and alcohol on driving performance. Sleep 2020;43(6):zsz206.
97. Tefft BC. Acute sleep deprivation and risk of motor vehicle crash involvement. Washington, DC: AAA Foundation for Traffic Safety; 2016. Available at: https://aaafoundation.org/acute-sleep-deprivation-risk-motor-vehicle-crash-involvement/.
98. Scott LD, Arslanian-Engoren C, Engoren M. The relationship between nurse work schedules, sleep, and drowsy driving. Sleep 2007;30(12):1801–7.
99. Czeisler CA. Sleep-deprived motor vehicle operators are unfit to drive. Accid Anal Prev 2016;92:525–6.
100. Li L, Wu C, Gan Y, et al. Insomnia and the risk of depression: a meta-analysis of prospective cohort studies. BMC Psychiatry 2016;16:375.
101. Barsha RAA, Rahman A, Hossain M, et al. Trouble sleeping and depression among U.S. women aged 20–40: a prospective study. Prev Chronic Dis 2020;17:E61.
102. Zhang F, Cheng L. Association between sleep duration and depression in menopausal women: a population-based study. Front Endocrinol 2024;15:1301775.