

Sleep Inequities Literature Review

Anna Horn

Department of Public Health, University of Illinois, Chicago

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I. Introduction: Establishing the Public Health Context of Sleep Inequity

Poor sleep health and untreated sleep disorders are a largely underrecognized public health challenge that is associated with increased morbidity and mortality (Batoool-Anwar & Quan, 2024). Despite quality sleep being necessary for proper functioning and health, the public health sphere has not yet shifted its mainstream focus to improving sleep health and reducing sleep health disparities. Traditional sleep health education and primary medical advice have stagnated at encouraging eight hours of daily sleep, focusing on quantity rather than quality. Interventions common in other public health sectors, such as developing public policies, expanding access to medical treatments, and comprehensive patient health education, are rare despite the chronic health conditions that have been associated with poor sleep health. Severe health consequences such as cardiovascular disease, obesity, and mental health issues have been associated with poor sleep. Furthermore, poor sleep and sleep disorders have often been viewed as a product of other conditions, but there is a growing body of research that has established the causative role of sleep issues in the development of other health issues (Hale et al., 2020). Although public health professionals work to reduce morbidity and mortality in the population, the connection between poor sleep and adverse chronic health conditions has largely gone unnoticed and unaddressed, creating a significant gap in public health care.

Quality sleep is necessary for proper functioning and is a basic necessity required to maintain a person's health and well-being. It is a fundamental human right much like food or water, but improving uneven access to quality sleep has not received nearly the same amount of attention as other human rights. Access to sufficient sleep is not universal, and systemic and social determinants of health create sleep disparities between different populations (Billings et al., 2021). Certain populations have unique sleep health burdens that are exacerbated by situational and environmental factors, resulting in severe disparities. Research studies have consistently shown that racial and ethnic minorities and people of low socioeconomic status (SES) have increased sleep health concerns, such as disproportionately high rates of shorter sleep duration and obstructive sleep apnea (OSA) (Batoool-Anwar & Quan, 2024). The structural disparities and racism that underlie the poor sleep health outcomes of these groups are an issue of health equity that is rarely discussed.

Six dimensions have been identified as crucial to sleep health: duration, continuity, timing, alertness, satisfaction, and efficiency (Hale et al., 2020). These dimensions offer a more comprehensive insight into the factors influencing sleep, and sleep health disparities can refer to reduced performance in any one of these domains. Uneven access to an ideal sleep environment as well as access to treatment contribute to reduced quality and quantity of sleep. With strong evidence that poor sleep health can play a

causative role in negative health outcomes, the responsibility of public health organizations to start designing and implementing more sleep health–related interventions and policies is crucial to mitigating health inequities.

Public health professionals must shift their scope to include addressing sleep inequities not only through behavioral recommendations to improve sleep behaviors, but also through interventions that target the environments and activity spaces that influence sleep. Sleep does not happen in isolation of our daily activities and socioecological systems; it is shaped by the air we breathe, the temperatures we live in, and the labor conditions we endure. Environmental and occupational determinants such as air quality, indoor temperature regulation, noise exposure, and shift work collectively influence who is most at risk for sleep disruption and its downstream health consequences (Hunter & Hayden, 2018; Lu et al., 2025). Because these determinants are unevenly distributed across lines of race, class, and geography, addressing them requires a systemic public health response rooted in environmental justice.

This review will use a systems thinking approach to examine how environmental and occupational conditions intersect to perpetuate sleep inequities, their relationship to health inequities and structural racism, and policy recommendations to promote sleep health equity.

II. Environmental Determinants of Sleep Inequity

A. Overview of Physical Environmental Factors

Sleep is profoundly shaped by the environments in which individuals live, yet environmental influences on sleep have long been understudied within public health. The physical built environment, including air quality, temperature, and housing conditions, plays a central role in determining sleep quality and duration. The broader built environment also affects sleep opportunity and quality. Noise pollution from highways, railways, and high-density housing has been consistently linked to sleep fragmentation and decreased satisfaction (Hunter & Hayden, 2018). Light pollution from urban areas can delay melatonin onset, particularly for individuals without access to blackout curtains or who live near constant sources of illumination. At the same time, neighborhood green space and walkability have been associated with improved sleep, which is thought to be due to lower stress, reduced ambient noise, and greater exposure to natural light cycles. Communities with greater environmental burdens often experience shorter sleep and higher rates of sleep disorders, underscoring the role of environmental injustice in sleep inequity (Hunter & Hayden, 2018; Attarian et al., 2024).

B. Air Quality and Indoor Pollution

Air quality is one of the most consistent environmental predictors of sleep disturbance. Exposure to fine particulate matter (PM_{2.5}), nitrogen dioxide (NO₂), and volatile organic compounds (VOCs) has been associated with sleep-disordered breathing, reduced sleep efficiency, and systemic inflammation during sleep (Carandina et al., 2024; Lu et al., 2025). Evidence increasingly shows that indoor air quality, often more relevant to actual sleep exposure than outdoor measures, plays a critical role in shaping sleep outcomes. A recent study by Lu et al. (2025) demonstrated that personal exposure to PM_{2.5} within children's sleeping environments was more strongly associated with the severity of obstructive sleep apnea (OSA) than ambient outdoor measurements. Factors such as ventilation design, supply air temperature, and even body position during sleep influenced pollutant concentration in the breathing zone, revealing that exposure is highly individualized and dependent on the indoor environment. Similarly, Carandina et al. (2024) found that adults exposed to higher indoor VOC levels experienced increased markers of sympathetic activation and cardiovascular strain during sleep, suggesting that pollution exposures can disrupt autonomic functioning and sleep continuity.

Indoor allergen exposure can compound these effects. Murkey et al. (2025) analyzed data from a nationally representative U.S. adult sample and found that elevated exposure to pet and fungal allergens in bedrooms was associated with poor sleep health, particularly among women and racially minoritized groups. These findings highlight how physiological and social vulnerabilities converge: low-income renters and racial/ethnic minorities are more likely to live in older or poorly ventilated housing where indoor allergens and pollutants accumulate, amplifying disparities in sleep quality.

C. Indoor Temperature Regulation and Thermal Comfort

Thermal comfort is another key determinant of restorative sleep. Both excessive heat and inadequate warmth disrupt the body's thermoregulatory processes, leading to difficulties falling and staying asleep. However, the challenge extends beyond climate exposure to include inequitable access to adequate indoor temperature regulation. Poor-quality housing, lack of insulation, malfunctioning heating or cooling systems, and high energy costs all constrain an individual's ability to maintain a sleep-conducive environment (Hunter & Hayden, 2018). Indoor temperatures that remain too warm or too cold impair the initiation and maintenance of sleep by affecting core body temperature and circadian rhythm alignment. These problems are often most severe in multifamily units or older rental buildings, where residents have limited control over building-wide heating and ventilation systems. Inadequate cooling and ventilation not only disturb sleep but also exacerbate the effects of indoor air pollution by trapping particulate matter and allergens. Research increasingly suggests that thermal inequity mirrors broader

socioeconomic disparities. Low-income and racially minoritized populations are disproportionately burdened by energy insecurity, spending higher proportions of income on utilities and often sacrificing thermal comfort to reduce costs (Attarian et al., 2024). This leads to chronic exposure to suboptimal indoor temperatures, compounding other environmental risks that undermine sleep health. These thermal challenges are not randomly distributed, but instead reflect systemic discrimination: redlining, historical disinvestment, and discriminatory housing policies have concentrated poor quality housing in lower income and racial minority communities, resulting in higher thermal burdens tied to political and structural racism. Additionally, segregation and discriminatory housing policies have historically concentrated low-income and nonwhite populations in areas with higher traffic density and industrial pollution, conditions directly linked to worse sleep outcomes (Attarian et al., 2024; Hunter & Hayden, 2018). This puts these communities at a disproportionately high risk of developing chronic health conditions related to poor sleep health. Structurally disadvantaged neighborhoods often experience multiple overlapping hazards, while wealthier areas enjoy environmental conditions conducive to rest. As a result, the built environment functions as an ecological driver of sleep health inequity.

The implications of these environmental exposures extend far beyond nightly rest. Reduced sleep quality and duration caused by poor air quality, unstable indoor temperatures, and other environmental stressors contribute directly to an increased risk of chronic diseases such as hypertension, cardiovascular disease, obesity, and diabetes (Hale et al., 2020; Batool-Anwar & Quan, 2024). Sleep fragmentation and short sleep duration disrupt hormonal regulation, impair glucose metabolism, and elevate systemic inflammation. These pathways link environmental inequities to the chronic disease burden observed in disadvantaged and oppressed populations. In this way, environmental sleep deprivation functions as both a symptom and a driver of broader health inequities, reinforcing cycles of illness and social disadvantage.

III. Occupational Determinants and Sleep Insecurity

A. Occupational Conditions as a Determinant of Sleep Health

The workplace environment is a critical but frequently overlooked determinant of sleep health. Occupational factors such as work hours, shift patterns, physical and psychosocial stressors, and economic precarity profoundly influence both the duration and quality of sleep. In the United States, nearly one in five workers engage in some form of shift work, and millions more experience irregular or extended hours due to economic need, employer demands, or multiple job holdings (Billings et al., 2021). These conditions contribute to widespread *sleep insecurity*, which is defined as limited or uncertain access to adequate sleep due to environmental or social constraints (Dunietz et al., 2022). Sleep insecurity

in the workplace context manifests through circadian misalignment, chronic sleep deprivation, and heightened risk of sleep disorders. For example, workers in manufacturing, healthcare, transportation, and emergency response often experience rotating or overnight shifts that disrupt the body's natural sleep–wake cycle. The misalignment between biological and occupational timing not only leads to short sleep duration and daytime fatigue but also increases the risk for cardiovascular and metabolic diseases over time (Hale et al., 2020).

Occupational sleep disparities mirror broader social and economic inequities. Racial and ethnic minority workers and those of lower socioeconomic status are overrepresented in industries that require night or rotating shifts and physically demanding labor (Billings et al., 2021). These positions frequently lack predictable scheduling, paid leave, and workplace accommodations that would enable recovery. As a result, the burden of work-related sleep loss falls disproportionately on these groups, reinforcing cycles of health inequity.

B. Shift Work, Circadian Disruption, and Health Consequences

Shift work is among the most studied occupational causes of sleep deprivation and circadian disruption. The body's circadian rhythm is optimized for nighttime sleep and daytime wakefulness; when individuals must remain awake during biological night hours, melatonin secretion and temperature regulation become misaligned. This misalignment leads to *circadian rhythm sleep–wake disorders*, characterized by chronic fatigue, insomnia, and impaired alertness (StatPearls, 2025). Irregular or rotating schedules are particularly harmful because the body rarely has time to adjust before the shift pattern changes again. Sleep obtained during the day is often shorter and less restorative due to ambient light, noise, and competing social or family responsibilities. Over time, the cumulative effect of insufficient or fragmented sleep contributes to a heightened risk of hypertension, obesity, type 2 diabetes, and mood disorders (Hale et al., 2020; StatPearls, 2025).

Beyond individual health, the public safety implications are considerable. Sleep-deprived workers are more prone to occupational injuries and motor vehicle crashes, particularly in transportation, construction, and healthcare sectors. Frost & Sullivan's (2016) economic analysis of obstructive sleep apnea (OSA) estimated that undiagnosed sleep disorders contribute to billions of dollars in losses annually due to workplace accidents, reduced productivity, and absenteeism. Thus, sleep inequity is not merely a personal health issue, it has measurable implications for workforce safety and national economic stability.

C. Occupational Stress, Psychosocial Factors, and Sleep

In addition to schedule-related sleep loss, psychosocial stressors in the workplace play a critical role in perpetuating sleep insecurity. Workers in precarious employment, such as those facing low wages, job insecurity, or unsafe conditions, report significantly higher rates of insomnia symptoms than those with stable employment (Billings et al., 2021). These stressors are deeply intertwined with structural inequities. Women and racial/ethnic minority workers disproportionately occupy caregiving, service, and shift-based positions that are both physically taxing and undervalued in compensation and benefits. Furthermore, the lack of workplace flexibility exacerbates sleep insecurity for parents who must balance caregiving duties with irregular work schedules. Occupational sleep disparities thus reflect broader systemic inequities rooted in unequal labor market stratification and social/structural determinants of health.

D. Structural Racism in Occupational Sleep Disparities

Structural racism magnifies occupational sleep inequities by shaping who performs the most hazardous or least flexible work. Historically discriminatory labor policies, wage inequities, and hiring practices have concentrated workers of color in industries with the highest exposure to shift work, noise, and air pollution (Attarian et al., 2024). These structural patterns are reinforced by limited access to healthcare benefits and diagnostic services, resulting in delayed detection and treatment of sleep disorders such as OSA. The intersection of environmental and occupational risk is especially apparent in low-income neighborhoods where residents work in pollution-intensive sectors and return to substandard housing environments. In these contexts, the home and the workplace jointly reinforce sleep deprivation. Addressing occupational sleep inequities requires a sociological systems level perspective recognizing them as a product of both economic structures and systemic racism, not simply individual behavior.

E. Economic Implications and Public Health Opportunity

The economic costs of occupational sleep disparities are profound. The *Hidden Health Crisis* report by Frost & Sullivan (2016) estimated that undiagnosed and untreated sleep disorders, including OSA, cost the U.S. economy approximately \$150 billion annually in lost productivity, workplace and motor vehicle accidents, and healthcare expenses. These figures underscore the need for upstream, preventive interventions that address the occupational determinants of sleep. From a public health standpoint, improving workplace sleep health offers a dual benefit of enhancing population well-being while reducing avoidable healthcare costs. Evidence-based strategies such as limiting consecutive night shifts, ensuring adequate rest breaks, and promoting flexible scheduling have been shown to reduce

fatigue-related injuries and improve worker retention. However, these strategies remain under-implemented, particularly in low-wage and minority-dominated industries that already face barriers to regulatory enforcement. As sleep insecurity continues to erode both worker health and community resilience, public health agencies must integrate occupational sleep health into broader environmental and equity frameworks. Doing so reframes sleep not as a private lifestyle issue but as a public good requiring policy action, employer accountability, and systemic reform.

IV. Structural Racism and Systemic Inequities in Sleep Health

A. Structural Racism as a Fundamental Cause of Sleep Disparities

Structural racism operates as a system of interlocking policies, institutional practices, and social norms that allocate resources and risks unequally across racial groups. Its effects are deeply embedded in both the physical and occupational environments that determine sleep health. Research consistently demonstrates that racial and ethnic minorities experience disproportionately high rates of short sleep duration, poor sleep quality, and sleep-disordered breathing, even after adjusting for socioeconomic status (Batoool-Anwar & Quan, 2024; Billings et al., 2021). These inequities are not merely coincidental but reflect the legacy of discriminatory housing, labor, and environmental policies that shape where people live, what jobs they hold, and the exposures they face.

Attarian et al. (2024) describe “sleep deserts” as neighborhoods where social, structural, and environmental conditions are not conducive to healthy sleep. These areas, which are often defined by concentrated poverty, high pollution, and limited access to medical or green space—are products of systemic disinvestment driven by racial segregation and redlining. Such policies historically concentrated Black, Latino, and immigrant communities in zones adjacent to highways and industrial corridors, compounding exposure to noise, traffic, and ambient pollutants that disrupt sleep. The result is a form of environmental sleep injustice, in which the conditions for restorative rest are structurally denied to certain populations.

B. Socioeconomic Disadvantage and Intergenerational Impacts

Socioeconomic disadvantage is a key mechanism through which structural racism perpetuates sleep inequity. Educational and occupational segregation restricts access to stable employment, while wage gaps and housing discrimination limit residential mobility. These constraints force many families into high-density or poorly maintained rental housing with limited control over indoor temperature, ventilation, or lighting (Hunter & Hayden, 2018). The compounding effect is that environmental

exposures, economic insecurity, and psychosocial stress can converge to create chronic sleep deprivation, which in turn contributes to long-term health disparities such as hypertension, diabetes, and depression (Hale et al., 2020). Children in underserved or racially segregated neighborhoods are more likely to experience inconsistent sleep patterns due to environmental noise, suboptimal housing, and parental work schedules involving night or shift work (Lu et al., 2025). Over time, these sleep disturbances can impair cognitive development, emotional regulation, and academic performance.

C. Healthcare Access and Implicit Bias

Structural inequities also extend into the healthcare system itself. Even when sleep disorders are present, racial and ethnic minority groups are significantly less likely to be diagnosed or treated for conditions such as insomnia or OSA (Billings et al., 2021). This diagnostic gap stems partly from unequal access to sleep specialists and equipment, such as continuous positive airway pressure (CPAP) devices, but also from provider bias and limited awareness among both clinicians and patients regarding sleep health.

The underdiagnosis of sleep disorders among minority populations reflects broader systemic neglect of sleep health as a public health priority. Dunietz et al. (2022) argues that this neglect mirrors patterns seen in other social determinants: while access to food and housing insecurity have been institutionalized within public health frameworks, *sleep insecurity* remains largely absent from health surveillance systems and funding priorities. The absence of culturally tailored education and community outreach further reinforces disparities, leaving many individuals unaware that poor sleep is both *preventable and treatable*. The resulting inequities extend beyond individual health to societal costs, including lost productivity, increased chronic disease burden, and reduced life expectancy (Frost & Sullivan, 2016). To dismantle these systemic inequities, policy and intervention responses must target the upstream determinants such as housing, labor, and healthcare access, rather than treating sleep as an individual behavioral issue. Efforts to improve sleep health must therefore be anchored in equity and justice frameworks that acknowledge and correct for the structural conditions that create sleep deserts and perpetuate sleep insecurity.

V. Policy and Structural Interventions and Conclusions from Literature

Achieving sleep health equity requires policies that address the upstream structural and environmental factors shaping how and where people sleep. Sleep inequities are not the result of individual behavior but poor housing conditions, occupational stress, and limited access to medical

resources that constrain the ability to obtain restorative rest. Two policy domains stand out as particularly actionable: improving sleep health literacy and access to care, and strengthening housing and building standards to ensure safe, sleep-conducive environments.

A. Advancing Sleep Health Literacy and Access to Care

Public and professional awareness of sleep health remains profoundly limited, despite decades of evidence linking sleep to chronic disease, productivity, and mental health. Most primary care providers receive little to no formal training on sleep medicine, leading to underdiagnosis and inadequate management of sleep disorders (Hale et al., 2020; Billings et al., 2021). Similarly, the public continues to view sleep as a personal choice rather than a determinant of health influenced by environmental and occupational conditions. To close this knowledge gap, public health systems must integrate sleep health into existing education and prevention programs. Medical and nursing curricula should include evidence-based instruction on screening for sleep disorders and counseling on sleep hygiene, particularly for populations disproportionately affected by poor sleep. Continuing education initiatives and tele-mentoring programs can extend this training to practicing clinicians, especially those in community or safety-net settings. Equally important is improving access to diagnosis and treatment. Expanding community-based sleep clinics, supporting home sleep apnea testing, and leveraging telehealth platforms can help reach populations in medically underserved areas. For patients with financial barriers, subsidized or publicly funded access to diagnostic testing and positive airway pressure therapy would ensure that treatment is not limited to those with private insurance or high income. Strengthening provider capacity and patient access simultaneously creates the infrastructure needed to address sleep as a public health issue rather than an isolated medical specialty.

B. Strengthening Building Codes and Housing Policies

Because sleep occurs primarily within the home, housing conditions are a decisive determinant of sleep quality. Yet, few housing policies explicitly address the environmental factors that influence sleep, such as temperature regulation, ventilation, and noise. Poor-quality or overcrowded housing forces residents to sleep in environments characterized by unstable temperatures, poor air circulation, and chronic noise exposure (Hunter & Hayden, 2018; Attarian et al., 2024). Building codes and rental housing regulations should therefore be revised to include minimum standards for thermal comfort, ventilation, and air quality. Proper insulation, functioning heating and cooling systems, and safe air exchange mechanisms are not only essential for physical health but also for maintaining continuous, restorative sleep. For new housing developments, particularly in multifamily or affordable housing units, policy

incentives should promote the use of materials and designs that minimize noise infiltration and support temperature stability. Such reforms represent a low-cost, high-impact strategy to improve sleep equity. By incorporating sleep health considerations into housing inspections, tenant protections, and building design standards, policymakers can address one of the most pervasive and most preventable sources of sleep disruption.

C. Integrating Sleep into Broader Health and Equity Agendas

Finally, public health agencies should integrate sleep health into existing frameworks for chronic disease prevention, environmental justice, and health equity. Treating sleep as a social and environmental determinant of health aligns with broader federal initiatives such as *Healthy People 2030*, and supports the shift toward health-in-all-policies governance. Coordinated actions across housing, labor, and health sectors can ensure that every individual, regardless of race, income, or occupation, has access to the environmental and social conditions necessary for restorative sleep.

References

- Attarian, H., Dunietz, G. L., Gavidia-Romero, R., Jansen, E., Johnson, D. A., Kelman, A., & Knutson, K. (2024). Addressing sleep deserts: A proposed call for action. *Sleep Health, 10*(1 Suppl), S15–S18. <https://doi.org/10.1016/j.sleh.2023.09.008>
- Batool-Anwar, S., & Quan, S. F. (2024). Sleep health disparity and race/ethnicity, socioeconomic status, and gender: A systematic review. *Sleep Medicine Research, 15*(3), 139–150. <https://doi.org/10.17241/smr.2024.02152>
- Billings, M. E., Cohen, R. T., Baldwin, C. M., Johnson, D. A., Palen, B. N., Parthasarathy, S., Patel, S. R., Russell, M., Tapia, I. E., Williamson, A. A., & Sharma, S. (2021). Disparities in sleep health and potential intervention models: A focused review. *Chest, 159*(3), 1232–1240. <https://doi.org/10.1016/j.chest.2020.09.249>
- Carandina, A., Fanti, G., Carminati, A., Baroni, M., Salafia, G., Arosio, B., Macchi, C., Ruscica, M., Vicenzi, M., Carugo, S., Borghi, F., Spinazzè, A., Cavallo, D. M., Tobaldini, E., Montano, N., & Bonzini, M. (2024). Indoor air pollution impacts cardiovascular autonomic control during sleep and the inflammatory profile. *Environmental Research, 260*, 119783. <https://doi.org/10.1016/j.envres.2024.119783>
- Dunietz, G. L., Braley, T. J., & Jansen, E. C. (2022). Sleep insecurity as a health disparity. *Journal of Clinical Sleep Medicine, 18*(10), 2521.
- Dunietz, G. L., Jansen, E. C., & Chervin, R. D. (2024). What should a public health approach to sleep look like? *AMA Journal of Ethics, 26*(10), E795–E803. <https://doi.org/10.1001/amajethics.2024.795>
- Frost & Sullivan. (2016). *Hidden health crisis costing America billions: Underdiagnosing and undertreating obstructive sleep apnea draining healthcare system* (Report commissioned by the American Academy of Sleep Medicine).

Hale, L., Troxel, W., & Buysse, D. J. (2020). Sleep health: An opportunity for public health to address health equity. *Annual Review of Public Health*, 41, 81–99. <https://doi.org/10.1146/annurev-publhealth-040119-094412>

Hunter, J. C., & Hayden, K. M. (2018). The association of sleep with neighborhood physical and social environment. *Public Health*, 162, 126–134. <https://doi.org/10.1016/j.puhe.2018.05.003>

Johnson, D. A., Billings, M. E., & Hale, L. (2018). Environmental determinants of insufficient sleep and sleep disorders: Implications for population health. *Current Epidemiology Reports*, 5(2), 61–69. <https://doi.org/10.1007/s40471-018-0139-y>

Karna, B., Sankari, A., & Tatikonda, G. (2023). *Sleep disorder*. In *StatPearls [Internet]*. StatPearls Publishing.

Lu, Y., Yan, M., Hoque, S., Tapia, I. E., & Ma, N. (2025). Towards healthy sleep environments: Ambient, indoor, and personal exposure to PM_{2.5} and its implications in children's sleep health. *Environmental Research*, 269, 120860. <https://doi.org/10.1016/j.envres.2025.120860>

Murkey, J. A., Wilkerson, J., Salo, P. M., Thorne, P. S., Zeldin, D. C., & Jackson, C. L. (2025). Indoor allergen exposure in relation to sleep health among US adults. *J Allergy Clin Immunol Global*, 4, 100441. <https://doi.org/10.1016/j.jacig.2025.100441>