



## Review Article

## Sleep disparity, race/ethnicity, and socioeconomic position

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## ABSTRACT

Sleep represents a set of biological functions necessary for the maintenance of life. Performing these functions, though, requires that an individual engage in behaviors, which are affected by social and environmental factors. Race/ethnicity and socioeconomic position represent categories of factors that likely play a role in the experience of sleep in the community. Previous studies have suggested that racial/ethnic minorities and the socioeconomically disadvantaged may be more likely to experience sleep patterns that are associated with adverse health outcomes. It is possible that disparities in sleep represent a pathway by which larger disparities in health emerge. This review (1) contextualizes the concept of race/ethnicity in biomedical research, (2) summarizes previous studies that describe patterns of sleep attainment across race/ethnicity groups, (3) discusses several pathways by which race/ethnicity may be associated with sleep, (4) introduces the potential role of socioeconomic position in the patterning of sleep, and (5) proposes future research directions to address this issue.

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## 1. Introduction

Despite remarkable improvements in health and health care over the last century, striking and well-documented racial, ethnic, and socioeconomic health disparities persist in inequitably determining the welfare of social groups in the United States [1–3]. Both non-white and other socioeconomically disadvantaged populations have worse outcomes across a range of health conditions. Cardiovascular disease, diabetes, asthma, HIV/AIDS, and tuberculosis are all significantly more common among Blacks/African Americans and Hispanics than among non-Hispanic Whites [1,3,4]. Racial and ethnic disparities persist even after stratification by education or household income [1,3]. Such pervasive health disparities at the individual and societal level are likely mediated by a combination of structural, physiological, psychological, and behavioral differences across populations [2,3,5–7]. In addition, neighborhood factors play a significant role in perpetuating health disparities. Neighborhoods affect health through differential exposures to social (eg, cultural norms

about health behaviors), psychological (eg, neighborhood safety and experience of discrimination), and physical (eg, exposure to toxins, air or noise pollution, access to healthy food) factors [8,9]. All of these differential neighborhood experiences are shaped by structural/institutional forces that determine both vulnerability to harmful exposures and access to helpful resources. Understanding and reducing health disparities is an important public health goal.

Understanding the population burden of insufficient sleep and poor sleep quality is also an important public health goal. A recent report from the Institute of Medicine identified “sleep deprivation and sleep disorders” as a major unmet public health problem [10]. Another recent Institute of Medicine report, which discussed medical resident duty hours, also identified inadequate sleep as a major risk factor for iatrogenic problems [11]. Adequate sleep has been highlighted as a public health priority by Healthy People 2020, the document that guides federal health-related funding across the US Department of Health and Human Services [12]. In a statement of a joint task force of the American Academy of Sleep Medicine and the Sleep Research Society that identifies the most pressing goals of the sleep research field, the first noted goal was to gain better understanding of the public health implications of insufficient sleep and circadian disruption [13].

Insufficient sleep, operationalized as habitual short sleep duration in epidemiologic studies or enforced sleep restriction in

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laboratory studies, has been associated with weight gain and obesity [14], hypertension [15–17], hyperlipidemia [15,16], inflammation [18], diabetes [15,19–21], stroke [16,22], heart attack [16,23], and mortality [24–28]. In addition, relationships with neurocognitive impairment [29–31] and other systems have been explored [32–34]. A number of studies have also documented adverse health outcomes associated with poor sleep quality [35]. Sleep is an important domain of health and functioning, and it is possible that sleep represents not only a modifiable risk factor for cardiometabolic disease in general, but also an important moderator in the relationship among minority status, socioeconomic disadvantage, and health.

## 2. The problematic definition of “race” in biomedical research

Race has been used as a research variable in the social and biological sciences for centuries [36,37]. Despite the acceptance of “race” in scientific research, there is no clear, agreed-upon definition of what “race” is [38]. Some researchers define race as a biological category [36,37]. For example, some definitions of race rely on modern concepts of population genomics to describe groups of humans with shared genetic features. This definition assumes that since race groups are defined by shared genetic characteristics, genetic characteristics should be able to define who is and is not a member of a race. But there are no known combinations of genetic markers that reliably distinguish members of large population group from one another in order for them to qualify as biological races. There is more variability within groups identified as races than between them [39]. Despite the circular nature of this biological definition of race and the inconsistency with which it is applied, it remains the most common way to appropriate race in biomedical research. In reality, however, researchers typically apply socially constructed concepts of race, such as the “one-drop” rule, whereby a single ancestor of a particular race rather than an individual’s complete ancestry confers group membership. (For example, a person with a single Black grandparent and three White grandparents is commonly considered “Black” by this social definition.) Thus, researchers often confuse the prevailing social conceptualizations of race with biological definitions.

If race cannot be reliably defined biologically, is it a relevant variable for use in biomedical research [40]? Understanding the causes of and solutions to stark racial inequities in health – how racism affects the body – requires using racial categories in research. Researchers disagree, however, about the function race can serve in identifying the reasons for these gaps – as a social grouping, as a proxy for other correlated genetic or nongenetic variables, or as a biologically distinctive category. Race is relevant if treated as a social category that may capture variance in outcomes of interest. If race is a social and not a biological category, though, what does it represent? It could represent a proxy for other social, environmental, and cultural factors that may tend to aggregate in social groups but do not define those groups. As an important example, race may serve as a proxy for exposure to (and/or perception of) racial discrimination, especially when studies are restricted to socio-geographic strata for which discrimination across group lines is more homogeneous [41]. Race is an important category to document and record health disparities, and to study the impact of racism on health. Therefore, race represents a relevant variable if whatever race is standing in for reliably determines outcomes. It is then incumbent on researchers, though, to “unpack” the significance of race to the research question and to determine which factors actually play a causal role.

Ethnicity is sometimes used as an alternative to race. Ethnicity refers to a group that shares history, culture, and (usually) geographic ancestry. Many people who share an ethnicity may also identify as the same race, but this concept more fully recognizes the fluidity of characteristics within and between groups and the role of social factors in defining group membership. Although “race”

is usually restricted to a few categories, “ethnicity” can be much more varied.

If the definitions of race and ethnicity vary and overlap, how can researchers use these categories? Certainly, any operationalization comes with limitations [42]. The concept of race/ethnicity has emerged as a research variable and research subjects are typically grouped by self-identification, avoiding thorny definitional issues. The acceptance of self-identification essentially recognizes that “race/ethnicity” is a social category, based on whatever factors research subjects consider appropriate.

Because health disparities among racial/ethnic groups exist, there is good reason for biomedical researchers and practitioners to try to define and use these groupings. However, as discussed here, these groups are socially determined, heterogeneous, dynamic, and socioculturally complex. If we are to truly understand these health disparities, we must more carefully consider how to appropriately use race/ethnicity in biomedical, epidemiological, and public health research in order to understand the development, persistence, and elimination of health disparities.

## 3. Studies of sleep by race/ethnicity

Traditionally, sleep research did not consider race, ethnicity, or other such social stratifications. Most laboratory-based studies did not report race/ethnicity. In more recent years, laboratory studies still infrequently report the race/ethnicity of subjects. However, many studies, especially those that attempt to generalize to the general population, now attempt to measure race/ethnicity to some degree. There has been a growing recognition that race/ethnicity represents a factor (or set of factors) that are relevant to the study of sleep.

### 3.1. Studies measuring sleep across race/ethnicity groups

Several studies have attempted to understand whether habitual sleep patterns differ according to race/ethnicity group. Studies of polysomnographic (PSG) sleep have the benefit of using an objective, gold-standard measure of sleep. However, PSG sleep does not accurately reflect habitual sleep, as it is in an artificial situation. There is a well-documented literature casting doubt on the generalizability of one night of PSG [43,44]. PSG is the only way to assess sleep architecture; however, despite the Hawthorne effect, PSG will continue to be used. As such, several studies have explored group differences using PSG [45–48], and these studies were summarized in a meta-analysis by Rutter and colleagues [49]. Of the eight studies found, the meta-analysis found that Blacks/African Americans obtained approximately 28 min less PSG sleep than Whites. This translated to an effect size of approximately 0.48 standard deviations ( $p < 0.05$ ). There were also significant differences in stage 2 and slow-wave sleep (stages 3 and 4), such that Blacks/African Americans obtained less slow-wave sleep, which seems to be made up for by an increased stage 2 sleep. These findings are consistent with those of other studies, who found that Blacks/African Americans obtained less slow-wave sleep [50–54] and had a poorer sleep efficiency [52,54] than non-Hispanic Whites. This suggests that, on average, for Blacks/African Americans, sleep is less deep and restful.

Similarly, this meta-analysis evaluated six studies of subjective sleep duration [49]. This included two studies that used sleep diaries, as well as four studies that used a (non-validated) retrospective sleep questionnaire. When combined, a similar effect was found, with Blacks/African Americans reporting less sleep on average than Whites (15.1 min less,  $p < 0.05$ ) [49].

Another objective estimate of sleep duration and quality is wrist actigraphy, and a few studies compared sleep among racial/ethnic groups using this methodology. A study in San Diego reported significantly shorter mean sleep duration (5.9 vs. 6.3 h) and lower sleep

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