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# Socioeconomic status in childhood predicts sleep continuity in adult Black and White men

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### ABSTRACT

**Objectives:** Low socioeconomic status (SES) in childhood may be associated with sleep in adulthood. We evaluated the relationships between SES in childhood through adolescence and into adulthood and sleep in midlife men.

**Design:** Prospective assessment of SES in childhood and adulthood.

**Setting:** Population-based study of 139 Black and 105 White men enrolled since age 7 and evaluated for sleep characteristics at age 32.

**Measurements:** Actigraphy and diary measures of sleep duration, continuity, and quality for 1 week. Their parents reported their SES (a combination of educational attainment and occupational status) annually when the boys were ages 7 to 16. We estimated SES intercept (age 7) and slope (age 7 to 16) using M-Plus and conducted linear regression analyses using those values to predict adult sleep measures, adjusting for covariates.

**Results:** Men who had lower SES families at age 7, smaller increases in SES from ages 7 to 16, and lower SES in adulthood had more minutes awake after sleep onset. White men with greater increases in SES from ages 7 to 16 had shorter sleep.

**Conclusions:** SES in childhood and improvement in SES through adolescence are related to sleep continuity in midlife men. To our knowledge, this is the first report using prospectively measured SES in childhood in relation to adult sleep.

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Sleep health is multidimensional and includes sleep duration, continuity, timing, perceived sleep quality, and daytime sleepiness.<sup>1</sup> For the first time in 5 decades of public health priorities set by the US Government, sleep health is in its 2020 plans. Specifically, the 2020 Healthy People goal is to “increase public knowledge of how adequate sleep improves health, productivity, wellness, quality of life, and safety on roads and in the workplace.”<sup>2</sup> The report also notes that poor sleep health is a common problem, with 25% of US adults reporting insufficient sleep or rest at least 15 of every 30 days.

Socioeconomic status (SES), defined by indices of access to resources and relative prestige, is considered to be one of the key contextual factors that contribute to disparities in sleep health.<sup>3</sup> This assertion makes sense, given that SES impacts a number of factors that may impact dimensions of sleep health. For example, adverse health behaviors, including smoking, excessive alcohol,

and lack of exercise, are more common among individuals from lower SES backgrounds and may impact sleep duration, continuity, and quality.<sup>4–6</sup> SES is correlated with depressive symptoms.<sup>7</sup> Sleep complaints often precede onset of depression, although some data suggest that the relationship may be bidirectional.<sup>8–10</sup> Shift work affects sleep timing and may be associated with some low SES occupations.<sup>11,12</sup> Furthermore, low-SES environments may be more crowded, noisy, and less temperature regulated, all of which can impact sleep. Finally, SES effects on sleep may reflect in part that SES tends to be lower in Blacks. As a group, Blacks have shorter sleep and more evidence of sleep disordered breathing, whereas whites have more or similar levels of sleep complaints and insomnia symptoms (see reviews<sup>13–16</sup>). Thus, understanding the impact of SES must consider the racial/ethnic makeup of the study sample.

The evidence on associations of SES and sleep health primarily comes from cross-sectional survey studies. In general, lower SES is related to concurrent self-reported sleep disturbances and insomnia symptoms, with some evidence showing a relationship to very short or long sleep.<sup>17–20</sup> Relatively few studies have examined SES

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in relation to other dimensions of sleep health, especially as assessed by objective measures. In a study of Black and White middle-aged adults enrolled in The Coronary Artery Risk Development in Young Adults (CARDIA) study, those with lower income had longer sleep latency and poorer sleep efficiency as assessed by actigraphy, with associations stronger for Blacks than Whites.<sup>21</sup> Among women enrolled in the Study of Women's Health Across the Nation sleep study, reports of financial strain were associated with longer sleep latency and more minutes awake after sleep onset (WASO) but not with sleep duration.<sup>22</sup> Similarly, a composite measure of SES based on education and income was related to greater polysomnography-assessed WASO but not to sleep duration in Black and White middle-aged adults.<sup>23</sup> Taken together, cross-sectional evidence suggests that low SES is related to perceived low sleep quality and may be related to objective indices of sleep continuity in adulthood, with possible differences due to ethnicity.

The association between lower SES and worse adult sleep characteristics may emerge early in the life span. Children from lower-income families have shorter sleep duration and worse efficiency measured by actigraphy and more sleep problems than those raised in higher-income families.<sup>24</sup> Lower SES is associated with actigraphy-assessed shorter sleep duration during the school week and more variability in sleep onset among young adolescents.<sup>25</sup> Retrospective reports of lower parental education are related to more sleep time in stage 2 and less time in slow wave sleep but are unrelated to total sleep time or WASO in Black and White adults.<sup>26</sup> However, no longitudinal data are available about whether lower SES earlier in childhood precedes poor sleep in adulthood.

The primary objectives of the present report are to evaluate (a) whether family SES in childhood measured annually is related longitudinally to sleep duration and continuity measured by actigraphy, and perceived sleep quality measured by diary across 1 week in men; (b) whether the relationships differ between Blacks and Whites; and (c) whether the associations are independent of concurrent adult SES. Parents of the men in the present study reported annually their parental occupation and education when the men were ages 7 through 16. Thus, not only initial family SES but also change in family SES from ages 7 through 16 could be evaluated. Our primary hypotheses are that men who grew up in lower-SES families and experienced declines or smaller increases in family SES in childhood through adolescence would have worse sleep as adults. We did not anticipate any differences by race. A secondary objective is to evaluate whether the SES associations remain significant after adjusting for concurrent health behaviors, depressive symptoms, shift work, and other factors that may correlate with sleep health. The study contributes to the existing literature in a number of unique ways: its longitudinal design; repeated assessment of SES from childhood to adulthood; measurement of health behaviors reported daily and concurrent with the actigraphy measures; and inclusion of both Black and White men from a population-based urban sample.

## Method

### Participants

Participants were recruited from the youngest cohort of the Pittsburgh Youth Study (PYS<sup>27</sup>), a longitudinal study of 503 boys initially recruited from Pittsburgh public schools in 1987–1988 when they were in the first grade. A total of 849 boys were randomly chosen to undergo a multi-informant (ie, parent, teacher, child report) screening that assessed early behavior problems, with half the sample from the top 30% of the screening measure scores and the rest randomly selected from the remainder, hereafter called *early behavior problem group*. The boys' mean age at screening was 6.9, and racial composition was predominately White (40.6%) and Black (55.7%). Nearly all primary caregivers were biological mothers

(92%), with 45.3% cohabiting with a partner and 16.9% completing less than 12 years of schooling. More than half of the families (61.3%) were receiving public financial assistance (eg, food stamps).

In adulthood (mean age = 32 years; range, 30–34 years), PYS participants were contacted to participate in a study examining early developmental factors associated with risk for cardiovascular disease (see Fig. 1 for diagram of men in sleep study analytic sample beginning with the 503 boys who were enrolled in PYS). Eligibility criteria were still enrolled in PYS, not mentally disabled, not incarcerated, and alive. Of the 395 eligible men, 312 (79%) participated in some or all of the protocol. Of the 312, those who were in the Pittsburgh vicinity or planning on returning to Pittsburgh for holidays were invited to participate in the sleep study provided that they were not being treated for apnea; 267 enrolled in the sleep study. Of the 267, data from 23 men were not included, usually because of lost or malfunctioning equipment (see Fig. 1 for specifics). The analytic sample of 244 men did not differ from the 259 nonparticipants on race, early behavior problem group, SES, sleep, or number of health problems reported by parents at study entry,  $P_s > .22$  (Supplement Table 1). This study was approved by the Institutional Review Board at the University of Pittsburgh, and all men provided written, informed consent.

### Overview of the protocol

Upon arrival at the university, they signed consent institutional review board forms, fasting blood draw was taken, and anthropometrics were measured. After resting for 10 minutes, they performed a series of challenging tasks while cardiovascular measures were taken and answered questions regarding sociodemographic characteristics, health history, health behaviors, stress, and personal characteristics. At the conclusion of the laboratory portion, those who reported that they did not have apnea were invited to wear an actigraph and to complete daily diaries for a week. When they completed the study, they were paid for their time and were provided a personalized set of information regarding their sleep characteristics.

### Sleep measures

The Mini-Mitter Actiwatch model AW-16 (Philips Respironics, Bend, OR) was used to collect sleep/wake activity continuously over 7 days and nights. Men were instructed to wear the watch on the nondominant arm and to press an event marker when they tried to go to sleep. Actiwatches were configured to collect data during 1-minute epochs. Stored data were downloaded into the Actiware software program (version 5.57) for processing and analysis. The medium threshold (default) was selected to detect sleep periods of at least 3 hours in duration based upon sleep onset and offset using the 10-minute criterion of quiescence, that is, less 40 activity counts. Sleep duration was calculated as actual sleep time from initial sleep onset to final sleep offset based on the actigraph records, excluding periods of wakefulness throughout the sleep interval. WASO was the total number of minutes between initial sleep onset and final sleep offset that were spent awake. Sleep quality was assessed in their diary after awakening on a 5-point scale from very poor sleep quality (0) to very good sleep quality (4) and averaged across study period; these data were available for 225 men. The distribution of WASO had a kurtosis of 1.398, so it was square root transformed, which improved the kurtosis to .165; sleep duration and quality were normally distributed. The 3 sleep measures—duration, WASO, and quality—were not correlated with one another in the full sample or within Blacks and Whites separately.

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