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Is the association between neighborhood characteristics and sleep quality mediated by psychological distress? An analysis of perceived and objective measures of 2 Pittsburgh neighborhoods

Amy DeSantis, PhD [a], Wendy M. Troxel, PhD [a,*], Robin Beckman, MPH [a], Bonnie Ghosh-Dastidar, PhD [a], Gerald P. Hunter, MS [a], Lauren Hale, PhD [b], Daniel J. Buysse, MD [c], Tamara Dubowitz, ScD [a]

[a] RAND Corporation, Health Division, Santa Monica, CA 90401-3208
[b] Stony Brook University, Program in Public Health, Department of Family, Population, and Preventive Medicine, Stony Brook, NY 11794-8338
[c] University of Pittsburgh, Department of Psychiatry, Pittsburgh, PA 15213

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ABSTRACT

Background: Living in disadvantaged neighborhood environments is associated with poorer physical and mental health outcomes and higher overall mortality. However, the specific mechanisms underlying associations of neighborhood characteristics with health are not fully understood. Sleep quality represents an important potential mediator of these associations.
Objectives: The objectives were to investigate associations of perceived and objective neighborhood characteristics with sleep and the extent to which associations are explained by psychological distress.
Design: The sample includes randomly selected households from 2 racially/ethnically and socioeconomically similar Pittsburgh communities.
Methods: Participants included 873 African American adults (77% female) with a median per capita household income of $13,300. Data were collected from in-person household surveys (sociodemographics, psychological distress, perceived neighborhood characteristics), daily sleep diaries, objective neighborhood street segment audits, and city crime data. We analyzed perceived and objective neighborhood characteristics and their association with sleep quality, and the degree to which psychological distress explained observed associations.
Results: Perceived neighborhood characteristics, including perceived safety ($\beta = 0.13$), neighborhood satisfaction ($\beta = 0.14$), social cohesion ($\beta = 0.08$), and perceived infrastructure ($\beta = 0.07$), were significantly associated with sleep quality (P values $< .05$), but objective neighborhood characteristics were not. Once psychological distress was considered, associations with perceived social cohesion and neighborhood infrastructure were fully attenuated. Associations of perceived safety and neighborhood satisfaction with sleep were attenuated by 20%-30% but remained significant.

Neighborhood characteristics have consistently been linked to physical and mental health outcomes and overall mortality.[1,2] Specifically, individuals living in neighborhood environments of lower socioeconomic status and/or with higher levels of adverse characteristics (eg, neighborhood disorder, or lower levels of safety or social cohesion) have been found to have higher body mass index (BMI),[3,4] diabetes,[5] and hypertension,[6,7] among other risk factors. However, the specific mechanisms linking neighborhood characteristics to residents' health outcomes are not fully understood.

In complementary research on sleep quality and duration, the role of sleep has been recognized as an important risk factor for a host of adverse health outcomes including obesity, poor self-reported health, physical limitations, poorer immune functioning, and cardiometabolic dysregulation.[8–11] Because of its influence on metabolic and cardiovascular processes[12] and links to depressive symptoms and suicide,[13,14] sleep could also serve as an important, understudied mechanism through which neighborhood contexts influence poorer physical and mental health.[15–18]

In fact, several recent studies found that more negative assessments of perceived neighborhood characteristics were associated with poorer sleep quality.[15–17,19,20] For example, one 6-country study found that lower perceived neighborhood safety was

* Corresponding author at: RAND Corporation, 4570 Fifth Ave, Pittsburgh, PA 15213.
E-mail address: wtroxel@rand.org (W.M. Troxel).

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associated with poorer sleep quality, insomnia, and sleepiness.[21] Several prior studies have analyzed associations of noise/traffic[22–25] with both subjective and objective sleep measures and exposure to violence[26] as contributors to poorer self-reported sleep quality and/or decreased sleep duration.

Most prior studies have examined a single aspect of neighborhoods (eg, disorder or social cohesion) and have focused on either perceived or objective assessments of neighborhood characteristics, but not both. In addition, the existing literature has used samples with limited racial/ethnic diversity, with scant research focused on the most high-risk populations, such as African Americans in lower–socioeconomic status (SES) neighborhoods. Yet African Americans face disproportionate risk for sleep problems, including obstructive sleep apnea, worse sleep quality, shorter sleep duration, and decreased sleep efficiency,[27–30] as well as cardiometabolic disorders,[31,32] and are at greater risk of residing in impoverished neighborhoods compared with non-Hispanic whites even after accounting for individual-level SES.[33] Finally, the extant literature has not evaluated potential mechanisms that may account for associations between neighborhood characteristics and sleep.

The current analysis addressed several of the limitations in prior literature on associations of neighborhood characteristics and sleep quality by: (1) examining associations of multiple indicators of neighborhood characteristics, including both perceived and objective measures; (2) enrolling a large sample of African Americans in neighborhoods of lower SES; and (3) exploring a potential mechanism that may link neighborhood characteristics to sleep. Specifically, consistent with prevailing theories concerning potential pathways linking neighborhood contexts with sleep,[17] we examined psychological distress as a potential mediator of observed associations.

We hypothesized that lower perceived levels of neighborhood safety, social cohesion, satisfaction, and infrastructure (eg, sidewalks present, streets well-lit at night), as well as more negative objectively measured neighborhood characteristics (eg, crime rates, pedestrian safety measures, land use), are associated with poorer perceived sleep quality (assessed by participant diaries) after adjustment for potential confounders including individual-level SES. We further hypothesized that associations between higher levels of adverse neighborhood characteristics and poorer sleep quality would be mediated by psychological distress.

Methods

The data for the current analyses come from the PHRESH Zzz Study (Pittsburgh Hill/Homewood Research on Neighborhoods, Sleep, and Health), which was designed to investigate to what extent changes in the neighborhood built and social environment result in changes in health behaviors and risk factors relevant to obesity-related morbidity in 2 lower-income neighborhoods in Pittsburgh over time. The sample includes randomly selected households from 2 socioeconomically similar urban neighborhoods, in which more than 90% of residents were African American in the 2000 Census. One neighborhood is scheduled to undergo various neighborhood revitalization initiatives, including increased retail and business development and renovation of green space for recreational activities. Data for the current analyses were collected before major renovations took place and included an in-person household survey (eg, sociodemographics, psychological distress, perceived neighborhood characteristics), sleep diaries, and objective "audits" of neighborhood street segments and crime data from the Pittsburgh Police Department.

Sleep

Participants were asked to complete a paper sleep diary each morning after waking up for a 7-day period in which they rated their sleep quality, our primary outcome of interest, on a 5-point Likert-scale from "very bad" to "very good." These subjective ratings were used to assess sleep quality. Information on use of medications that may affect sleep was also assessed using as part of the sleep diary component of the study and was analyzed in sensitivity analyses which excluded individuals who were using any medications that could affect sleep. Specifically, they were asked, "Did you take any sleep medication to help you fall asleep tonight? (yes or no)." To be included in the analytic sample, participants were required to have at least 4 days of reporting on sleep quality, which were averaged over the total days of recording.

Sociodemographic characteristics

Participants provided information on their individual annual household income, which served as the indicator and included as a covariate in all models. Race/ethnicity was derived from 2 self-reported items, one on race and the other on ethnicity (ie, Hispanic, non-Hispanic). Additional demographic measures included age (date of birth), sex, marital/cohabitation status, and presence of any children in the home. Interviewers measured height to the nearest eighth-inch using a carpenter's square (triangle) and an 8-ft folding wooden ruler marked in inches. Interviewers measured weight to the nearest tenth-pound using a Seca Robusta 813 digital scale. BMI (kg/m^2) was calculated from participants' height and weight.

Psychological distress

The Kessler 6 (K6) is a well-validated self-report instrument to measure psychological distress. It was included in the current study because it is well-validated instrument that assesses general distress symptoms rather than specific clinical symptoms associated with a particular disorder.[34] Moreover, the measure has previously been found to be strongly associated with socioeconomic status and other demographic characteristics, as well as a host of adverse physical and mental health outcomes.[35] The questionnaire asked respondents, "During the last 30 days, about how often did …": "…you feel hopeless?"; "…you feel restless or fidgety?"; "…you feel that everything was an effort?"; "…you feel nervous?"; "… you feel worthless?" Responses included "most of the time," "some of the time," "a little of the time," and "none of the time." K6 scores were added to models to determine the extent to which psychological distress explains observed associations between neighborhood characteristics and sleep quality.

Perceived neighborhood characteristics

We included 4 measures of perceived neighborhood characteristics: social cohesion, perceived safety, neighborhood satisfaction, and neighborhood infrastructure. *Social cohesion* was assessed with a 5-item Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). This scale has been validated previously[36] and is coded such that higher scores reflect greater social cohesion. Participants were asked how strongly they agree or disagree with various statements (eg, "People around here are willing to help their neighbors;" "This is a close-knit neighborhood;" "People in this neighborhood can be trusted;" "People in this neighborhood generally don't get along with each other" [reverse-coded]; "People in this neighborhood do not share the same values" [reverse-coded]) (Cronbach $\alpha = .85$).[36]

Perceived safety was measured using 4 items rated on 5-point Likert scales ranging from 1 (strongly agree) to 5 (strongly disagree). Scores were coded such that higher scores reflected perceptions of greater safety. Questions included "You feel safe walking in your neighborhood during the day," "You feel safe walking in your