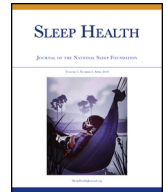




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The association between food deserts and short sleep duration among young adults in the United States: variation by race and ethnicity

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ABSTRACT

Background: Both food deserts and short sleep duration are serious public health problems that affect the lives of millions of Americans. Although recent research has begun to link community characteristics to sleep problems, the relationship between living in a food desert and sleep behavior has gone largely unexplored.

Methods: Using data from the National Longitudinal Study from Adolescent to Adult Health and data on food retailers from the Modified Retail Food Environment Index, this study applies multivariable logistic regression to assess the association between living in a food desert and short sleep duration. Models were stratified by race and ethnicity to examine potential moderating effects. Supplemental analyses are conducted where the comparison category is restricted to respondents who live in census tracts with low access to healthy food retailers but do not live in food deserts.

Results: In adjusted logistic regression models, living in a food desert is not associated with short sleep duration. When the sample is stratified, living in a food desert has a positive and significant association with short sleep duration among Hispanic respondents in both the main analysis (odds ratio = 1.7; 95% confidence interval = 1.0–2.7) and supplemental models (odds ratio = 1.9; 95% confidence interval = 1.2–3.2).

Conclusions: Living in a food desert is not associated with short sleep duration among young adults. Study results indicate that living in a food desert is associated with increased odds for short sleep duration among Hispanics. Potential explanations for this finding are discussed in the context of extant research.

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Introduction

Environmental conditions are recognized as an important contributing factor to disparities in health behavior.¹ In recent years, scholars have increasingly focused on the relationship between local food environments and health.² Of notable interest is the role of food deserts in shaping health.³ Food deserts are geographic areas where access to nutritious food is limited. Approximately 23.5 million individuals live in food deserts across the United States.⁴ Because dietary decisions are often made based on locally available food outlets, residents of food deserts tend to consume more energy-dense, nutrient-poor foods.³ Moreover, living in a food desert is associated with adverse health conditions including obesity and cardiovascular disease.^{5,6}

An important component of the relationship between food deserts and health that remains overlooked is sleep behavior. Current

estimates suggest that approximately 1 in 3 US adults does not get the recommended 7 hours of sleep or more per night.⁷ Like food deserts, inadequate sleep is a serious public health concern that is related to a host of physical and psychosocial health problems including hypertension, dyslipidemia, cardiovascular disease, metabolic syndrome, mortality, depression, anxiety disorders, and inhibited cognitive functioning.^{8,9} Notably, research finds that neighborhood conditions are associated with lower sleep quality and shortened sleep duration in adults.^{10–14}

Although past research has not investigated the association between living in a food desert and sleep, there are several reasons to expect that living in a food desert may be associated with sleep behavior. First, persons living in food deserts spend longer time accessing food items on average.^{4,15} Accordingly, living in a food desert can make obtaining food on a daily basis a more difficult and time-consuming task, which in turn may lead to reductions in sleep as a means to compensate for lost time. Second, living in a food desert is associated with several socioeconomic, health, and lifestyle factors that may increase the likelihood for short

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sleep duration. For instance, living in a food desert is associated with poor dietary behavior.³ Healthier diets, marked by a higher consumption of nutrient-rich foods, are associated with reduced odds of short sleep duration, potentially by supporting the release of hormones such as insulin, ghrelin, and cholecystokinin that promote sleep patterns.¹⁶ Likewise, sleep curtailment can influence metabolism and satiety regulation, leading to frequent snacking and increased consumption of high-energy, nutrient-poor foods.¹⁷ Residence in food deserts is linked to obesity,⁵ which has been shown to increase the likelihood of short sleep duration.¹⁸ Experiencing food hardships is also stressful life circumstance¹⁹ that can lead to reductions in sleep quality by making it difficult to fall or stay asleep.^{10,20} Living in a food desert also co-occurs with other poor health behaviors aside from diet, including smoking, alcohol consumption, and reductions in exercise and physical activity, each of which is a lifestyle factor linked to sleep behavior.^{10,20–25} Finally, food deserts are often located in economically disadvantaged neighborhoods,³ which are found in prior research to inhibit sleep quality.¹³

In sum, there are multiple reasons to believe that living in a food desert will be positively associated with likelihood of short sleep duration. The current study extends research on the built environment and sleep behavior by providing the first assessment of the association between living in a food desert and short sleep duration. Moreover, because both the composition of food retail environments²⁶ and sleep patterns vary by race and ethnicity,¹⁰ this study stratifies the sample and conducts exploratory analysis of whether the association between living in a food desert and short sleep duration differs across Black, White, and Hispanic individuals.

Methods

Data

Data for this study are drawn from 2 sources. The primary data are from waves I and IV of the National Longitudinal Study of Adolescent to Adult Health (Add Health). Add Health is a nationally representative survey that sampled 90,000 students in grades 7–12 from 132 schools in the 1993–1994 academic year.²⁷ Since the initial survey, 20,000 individuals were selected to participate in 3 follow-up interviews. Wave II was administered in 1996, wave III was administered in 2001–2002, and wave IV was conducted in 2008. A total of 15,701 respondents participated in the wave IV interview. Data for Add Health are collected through in-home interviews that last approximately 1 to 2 hours and cover an array of topics including the respondents' physical and mental health, family dynamics, socioeconomic status, and decision-making processes. Additionally, Add Health collects contextual data on communities to understand ways social environments influence health and behavior. To date, Add Health has been used by an extensive network of researchers, resulting in over 2000 peer-reviewed research articles.²⁷

Data on food retailers are drawn from the Modified Retail Food Environment Index (mRFEI), which was created by the Centers for Disease Control and Prevention. The mRFEI measures over 1 million food retailers from 65,345 US census tracts in 2008–2009. The mRFEI provides the ratio of healthy to unhealthy food retailers within a census tract and the 0.5-mile buffer surrounding the tract. Food retailers are measured using the North American Industry Classification System (NAICS). Healthy food retailers are defined as supermarkets (NAICS 445100), larger grocery stores (NAICS 445100), fruit and vegetable markets (NAICS 445230), and warehouse clubs (NAICS 452910). Unhealthy food retailers include fast-food restaurants (NAICS 722211), small grocery stores (NAICS 44511), and

convenience stores (NAICS 445120). The mRFEI score is calculated using the following formula:

$$\text{mRFEI} = 100 \times \frac{\text{\#Healthy food retailers}}{\text{\#Healthy food retailers} + \text{\#less healthy food retailers}}$$

The mRFEI data were linked to 15,696 census tracts at Wave IV of the Add Health survey through the ancillary studies in Add Health program. Given that prior research finds that the Centers for Disease Control and Prevention definition of access to food retailers (census tract and 0.5-mile buffer) is valid for urban areas,²⁸ this analysis restricts the sample to respondents living in urban census tracts (N = 11,509). Finally, as a result of missing data from nonresponse, the analytic sample is 9617. Missing data were addressed using listwise deletion, which may be less problematic than imputation, particularly because the loss of cases does not generate issues regarding statistical power in the current study.²⁹ Figure 1 provides a description of how the final sample was obtained.

Measures

Dependent variable

At wave IV, participants were asked what time they usually go to bed and wake up on (1) days when you have to go to work, school, or similar activities and (2) on days when you do not have to get up at a certain time. Sleep time was calculated using a weighted average where weekday (ie, wake up for work or school) items count for 5 of the 7 days and the weekend items (ie, do not have to get up) count for 2 of the 7 days. Short sleep is coded as a binary variable where 1 equals sleeping less than 7 hours per night on average, which is the recommended minimum amount of sleep made by the National Sleep Foundation.³⁰ The most common reason for missing data regarding sleep duration is the result of respondents providing sleep times that seemed either implausible or impossible through reporting errors such as mistakenly switching their sleep and wake-up times, resulting in negative values.

Independent variable

The focal independent variable is living in a food desert. Consistent with the definition of the Centers for Disease Control and Prevention,³¹ food deserts are coded as a binary variable indicating whether a respondent lives in a census tract with an mRFEI score of zero (ie, census tracts with no healthy food retailers).

Moderating variables

Race/ethnicity is coded as a categorical variable based on whether a respondent identifies as White, Black, Hispanic, or other race.

Control variables

The current study controls for several demographic and background characteristics (age, sex, high school degree, child abuse victim, fatalism, prior short sleep, hard drug use, parent education). This analysis also controls for several variables measuring lifestyle, socioeconomic status, and contextual characteristics (concentrated disadvantage, material hardship, anxiety symptoms, obesity, fast-food consumption, exercise, smoking, and alcohol use). A detailed description of each of these variables appears in Table 1.

Statistical procedures

The analyses are performed in Stata version 15.0. Estimates apply survey weights using the SVY command in Stata to adjust for the multistage cluster design of the Add Health Survey. The analysis uses multivariable logistic regression and adjusts for individual and

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