ELSEVIER

Alzheimer's & Dementia ■ (2017) 1-8

Alzheimer's & Dementia

Featured Article

Neighborhoods, sleep quality, and cognitive decline: Does where you live and how well you sleep matter?

Jaimie C. Hunter[a], Elizabeth P. Handing[b], Ramon Casanova[c], Maragatha Kuchibhatla[d], Michael W. Lutz[e], Santiago Saldana[c], Brenda L. Plassman[e,f], Kathleen M. Hayden[a,f,*]

[a]*Department of Social Sciences and Health Policy, Wake Forest School of Medicine, Winston-Salem, NC, USA*
[b]*Department of Internal Medicine, Section on Geriatrics and Gerontology, Wake Forest School of Medicine, Winston-Salem, NC, USA*
[c]*Department of Biostatistical Sciences, Wake Forest School of Medicine, Winston-Salem, NC, USA*
[d]*Department of Biostatistics and Bioinformatics, Duke University Medical Center, Durham, NC, USA*
[e]*Department of Neurology, Duke University Medical Center, Durham, NC, USA*
[f]*Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC, USA*

Abstract

Introduction: We evaluated the association between neighborhood socioeconomic status (NSES) and sleep quality on cognitive decline in the Health and Retirement Study.
Methods: Health and Retirement Study participants (n = 8090), aged 65+ with DNA and multiple biennial cognitive observations (abbreviated Telephone Interview for Cognitive Status), were included. Participants were grouped into quartiles of NSES and sleep quality scores. We adjusted for apolipoprotein E ε4, demographic, and cardiovascular risk factors. Random effects modeling evaluated cognitive change over time.
Results: NSES and sleep were significantly associated with cognitive decline, and there was a significant interaction between them ($P = .02$). Significant differences between high/low NSES and high/low sleep quality ($P < .0001$) were found.
Discussion: Sleep and NSES were associated with cognitive decline; the association between sleep and cognition appeared stronger among those with low NSES. The association between low NSES, poor sleep quality, and cognitive decline was roughly equivalent to the association between apolipoprotein E ε4 and cognitive decline.

Keywords: Sleep hygiene; Socioeconomic factors; Cognitive dysfunction; Cognitive decline; Cohort study; *APOE*

1. Introduction

The past decade has witnessed growing interest in the effects of sleep on cognitive functioning. Sleep, a critical factor in overall health and well-being, allows for the consolidation of memory and integration of learning [1,2] as well as maintenance of brain plasticity [1]. Conversely, sleep disruption or deprivation is associated not only with impaired hippocampal functioning [2] but also greater amyloid β burden [3–6] and subsequent risk for cognitive decline and dementia [3–7]. For instance, one study found that waking after falling asleep and having long episodes of wakefulness were each associated with approximately 40% higher odds of cognitive decline [8]. Prospective data show that not obtaining enough sleep increases a person's odds for dementia or mild cognitive impairment by 36% [9]. Cognitive decline may be attenuated through better sleep consolidation [10]. Sleep disturbance is also a symptom of cognitive impairment, suggesting a bidirectional relationship [11,12].

Evidence also documents the relationship between neighborhood socioeconomic status (NSES) and sleep outcomes.

The authors have declared that no conflict of interest exists.
*Corresponding author. Tel.: 336-716-2918; Fax: 336-716-7554.
E-mail address: khayden@wakehealth.edu

https://doi.org/10.1016/j.jalz.2017.10.007
1552-5260/

NSES describes the relative advantage of a community based on factors like the education, employment status, and financial status of its constituents. Living in a disadvantaged neighborhood versus a privileged one has been associated with increased daytime sleepiness [13], higher odds of restless sleep [14], worse sleep quality [15], and greater likelihood of waking after sleep onset [16].

Older adults are more likely to be impacted by their local environments [17–19], and thus are more vulnerable to environmental challenges [17,20]. The relationship between neighborhoods and health has been demonstrated in a number of studies [19,21] as has the relationship between neighborhood characteristics, cognitive function [22], and cognitive decline [23–25].

The body of empirical knowledge connects sleep disturbance and neighborhood disadvantage, independently, to cognitive decline. The further association between neighborhood disadvantage and poor sleep outcomes suggests that these factors may act synchronously in the etiology of cognitive decline. To date, no research has tested this compelling argument. The present manuscript uses data from the Health and Retirement Study (HRS) to estimate the combined contribution of NSES and sleep quality to cognitive function.

2. Methods

HRS [26] was established in 1990 to understand the health-related challenges and successes of Americans aged 50 and older. In 1998, the HRS was merged with the Asset and Health Dynamics Among the Oldest Old study, which began in 1993. The War Baby Study and the Children of the Depression study were also added to the HRS, producing a large (>37,000 person) cohort representative of the United States population aged ≥50. The Survey Research Center at the University of Michigan conducts the biennial, in-depth interviews with this cohort. Once participants reach 65 years of age, cognitive tests are included in the biennial interviews. The Survey Research Center obtains informed consent from all participants: oral consent for telephone interviews and written consent for those providing biological samples. Returns of mailed surveys infer consent. The University of Michigan Institutional Review Board approved the HRS study protocol. Institutional review board approvals for the current project were obtained from the Wake Forest School of Medicine and the Duke University Medical Center. The following inclusion criteria were applied, participants must be aged 65 and older, must have cognitive data available, and must have provided DNA samples for genotyping in either 2006 or 2008.

2.1. Cognitive assessment

Cognitive function was assessed with a modified version of the Telephone Interview for Cognitive Status (TICS) [27], adapted for use in the HRS (range 0–35 points). The TICS correlates strongly with the Mini-Mental State Examination [28], and the sensitivity and specificity of the TICS for identifying cases of dementia have been well-documented [29].

2.2. Neighborhood socioeconomic status

We used a NSES index that was produced by the RAND Corporation [30], using six key neighborhood factors including the percentage of adults aged 25 or older without a high school diploma, percentage of male unemployment, percentage of households with income below the poverty line, percentage of households on public assistance, percentage of female heads of household, and median household income. The index was derived at the level of census tract, generating values from 0 to 100 that are applied to each participant. It has been used in numerous prior studies on the association between NSES and health and cognition [22,31,32].

2.3. Sleep assessment

In 2006, the HRS administered a set of questions on sleep quality that were closely aligned with the previously validated Women's Health Initiative Insomnia Rating Scale [33,34] (Table 1). Questions were focused on whether participants had trouble falling asleep, staying asleep, waking too early, and feeling well rested on waking. These four questions were coded such that the higher scores indicated better sleep and lower scores indicated more impaired sleep. Participants who did not complete all four questions were excluded (n = 114). Sleep scores and NSES scores were transformed to z-scores so that they were both on a standard deviation unit scale.

2.4. APOE genotyping

In 2006 and 2008, HRS investigators requested DNA samples from the cohort. Saliva samples were collected from participants who agreed, and Genome-Wide Association Study (GWAS) analyses continued through 2013. Full details of the genotyping methods used have been reported [35]. DNA analysis was performed using Human610-Quad BeadChip (Illumina, Inc., San Diego, CA). The database of Genotypes and Phenotypes (dbGaP) houses the study's

Table 1
Sleep scale

1. How often do you have trouble falling asleep?
2. How often do you have trouble with waking up during the night?
3. How often do you have trouble with waking up too early and not being able to fall asleep again?
4. How often do you feel really rested when you wake up in the morning?*

Responses: most of time, sometimes, rarely, don't know/blank

*Item#4 was reverse coded so that higher numbers indicated better sleep.