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## Sleep and other correlates of high-level health in older adults

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## ABSTRACT

A large sample ( $N = 1139$ ) of adults  $\geq 75$  years from the 2011–2014 NHANES cohorts was used to examine predictors of high-level health. Analyses were done with SAS to control for sample weights and allow results to be reported as population parameters. The majority of participants described their health as high-level (73.6%). Logistic regression found a longer sleep duration, minority status, decreased income, multiple medications, low physical activity, and late stage memory impairment were significant predictors of low-level health ( $p < .05$ ) while sex, education level, marital status, body mass index, and depression symptoms were not. The assessment of sleep should be expanded to cover dimensions such as sleep quality and sleep disorders to help maintain wellness in older adults. This study supports that the majority of older adults have high-level health and identifies several modifiable factors to maintain wellness.

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## Introduction

The population of the United States is rapidly aging, especially in the oldest segment of the population, persons' ages 80 or older. According to the U.S. Census, there was a 16 percent increase in the number of persons ages 80 years and older between the years of 2000 and 2010 with this the fastest growing segment of the United States population of adults older than 65 years.<sup>1</sup> The concept of high-level wellness, defined as maximizing functional capacity, was first discussed over fifty years ago; unfortunately, most healthcare remains disease oriented.<sup>2,3</sup> For older adults, increasing the number of years of healthy aging is especially important because increased lifespan can negate high-level wellness through increased functional limitations and chronic comorbidities. Therefore, it is important to identify potentially modifiable factors associated with high-level wellness in older adults to optimize health aging. A large epidemiological study in Australia ( $N = 231,048$ ) suggested that low-level wellness was exemplified by maladaptive lifestyle/wellness behaviors including smoking, excessive consumption of alcohol, poor diet, lack of physical activity, and short or long sleep duration were significant risk factors for all-cause mortality in middle-aged and older adults.<sup>4</sup>

Obtaining "good sleep," a basic human need for health and well-being, has been well recognized as one of key factors associated with

healthy aging.<sup>5</sup> One aspect of "good sleep" is obtaining adequate sleep duration. Although the optimal amount of sleep necessary for an individual's well-being varies, it is estimated that most older adults require 7 to 9 hours of sleep each night.<sup>6–8</sup> Previous studies suggest there is a U-shaped pattern of worse clinical outcomes with both short and long sleep duration. A recent systematic review of 5,172,710 participants from 153 studies reported a linear dose response to short sleep duration less than six hours that included an increased relative risk (RR) for obesity (1.38 and 95% confidence interval [95% CI] 1.25–1.53), hypertension (RR = 1.17, 95% CI = 1.09–1.26), coronary heart disease (RR = 1.26, 95% CI = 1.15–1.38), diabetes (RR = 1.27, 95% CI = 1.22–1.53) and mortality (RR = 1.12, 95% CI = 1.08–1.16).<sup>9</sup> Several studies found long sleep duration, greater than 10 hours, was associated with an increased risk for multiple comorbid diseases and an increased risk of mortality.<sup>10–14</sup> However, other than the increased risk for depression that was associated with long sleep duration,<sup>14</sup> it remains unclear whether long sleep duration was an independent risk factor for morbidity or whether it was a consequence secondary to poor health.<sup>15</sup>

The increased number of adults surviving into old age and the need to promote wellness to "compress morbidity" in older adults suggests that it is especially timely to identify modifiable factors associated with high-level wellness.<sup>16</sup> The research question asked in this study was "which factors are associated with high-level health in older adults?" The purpose of this study was to determine potential predictors, including sleep duration, that are associated with high-level health in a representative sample of adults ages 75 years and older who participated in the National Health and Nutritional Examination Survey (NHANES).

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## Methods

Data from the 2011–2012 and the 2013–2014 NHANES cohorts were used for this analysis.<sup>17,18</sup> The goals of NHANES include estimating the number and percentage of individuals with selected diseases and risk factors, monitoring prevalence, treatment, and control trends for selected diseases, risk behaviors, and environmental exposures, and studying the relationship between nutrition and health while exploring emerging public health issues. The overall target population of NHANES was the non-institutionalized, civilian residents of the United States. The 2011–2012 and 2013–2014 NHANES oversampled several specific subgroups including Hispanics, Non-Hispanic blacks, Non-Hispanic Asians, individuals at or below 130 percent of the poverty level, and individuals aged 80 years and older. Of the 13,431 persons selected for the 2011–2012 surveys there were 9,756 persons that completed the interview and 9,338 persons that were examined. The 2013–2014 survey started with 14,332 persons selected, 10,175 completed the interview and 9,813 were examined. For both surveys, the interviews occurred in the person's home and the examinations occurred in a mobile examination center. Participants were allowed proxies or interpreters, if needed or desired, to provide information.

The exact wording of each question and the possible responses was documented on the NHANES website. NHANES employs a multistage, probability sampling methodology to select participants and then provides sampling weights to provide estimates of the US population. Further information on NHANES can be obtained on the website <https://www.cdc.gov/nchs/nhanes/index.htm>. The sample for this analysis included 1,139 older adults ( $\geq 75$  years) recruited from as a nationally representative sample from 30 different study locations across the United States.

## Measures

### Primary outcome and predictor

#### Self-reported health

Self-reported health was queried from participants twice during NHANES evaluations. The question on self-rated health that was conducted during the home interview was chosen for the analysis because there were more responses ( $n = 1137$ ) compared to the exactly worded question on self-rated health obtained during the NHANES mobile clinic interview ( $n = 974$ ). Potential responses ranged on a five-point Likert scale from "excellent" to "poor". The variable was dichotomized with responses of "excellent," "very good," and "good" categorized as "high-level" health and those of "fair" or "poor" categorized as "low-level" health.

#### Sleep duration

Sleep duration was measured by a single question that asked "How much sleep do you usually get at night on weekdays or workdays?" with potential responses allowed from 1 to 24 hours. Sleep duration was analyzed as both a continuous variable and as a categorical variables of *short* sleep duration (less than 7 hours/night), *normal* sleep duration (7 to 9 hours/night), and *long* sleep duration (more than 9 hours/night).

Other sleep questions in the NHANES questionnaires included, "Have you ever been told by a doctor or other health professional disorder that you have trouble sleeping?" and, "Have you ever been told by a doctor or other health professional that you have a sleep disorder?" The NHANES study does not include information on the diagnosis or treatment for any specific sleep disorder.

#### Sample characteristics and covariates

The demographic variables of age, sex, race, marital status, education, and financial status were included in the analyses. In the

original NHANES dataset, age was truncated with persons 80 years or older coded as "80". Sex had two options "male" or "female." Race was self-categorized as "non-Hispanic white," "non-Hispanic African American," "Hispanic," or "Asian." Marital status was recoded as "married/partnered" and "single"; educational level was recoded as "high school graduate or less" and "post high school education." Financial status was defined by the Federal Poverty Level (FPL) that compares household income to family size with a ratio of 1.0 referenced as an income at the poverty level. For example, for 2017 this translates as an annual income of \$12,060 for an individual and \$16,240 for a couple.<sup>19</sup> The NHANES sample included older adults with a FPL ranged from 0 to 5. Financial status was recoded to a FPL's of <1.30 (low income), 1.30 to 1.85 (considered for government assistance such as Medicaid, depending on the state), and  $\geq 1.85$ .

#### Medications

During the household interview, participants were asked about their prescription medication use during the past 30 days. If the participant endorsed using prescription medication during that timeframe, the interviewer asked to see the medication containers. The complete name for the medications was entered into a computer. When a medication container was not available, the participant reported the medication name. It was noted in the computer if the participant did not know the name of medication or if the participant refused to provide the name. Therefore, the medication variable included the total number of medications taken in the past 30 days including prescription dietary supplements and medications in which the participant did not know the name of or refused to provide the name. For the analyses, the total number of prescription medications was transformed into three categories: few (0–2 prescription medications), moderate (3–5 prescription medications), and large ( $\geq 6$  prescription medications).

#### Physical activity

Physical activity was calculated using the Global Physical Activity Questionnaire.<sup>20</sup> Participants were asked questions to calculate their minutes of vigorous-intensity and moderate-intensity physical activity in their activities at work, travel to and from places, and recreational activities during a typical week. This information was used to calculate metabolic equivalent (MET) minutes per week. Total weekly activity of at least 600 MET-minutes is the equivalent to at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity.<sup>21</sup> For the analyses, physical activity was dichotomized into "Meets the Physical Activity Guidelines – Yes ( $\geq 600$  MET-minutes per week)" and "Meets the Physical Activity Guidelines – No (<600 MET-minutes per week)."

#### Memory difficulty

To assess difficulties in thinking or remembering, participants were asked, "During the past 7 days, how often have you (the significant person) had trouble remember where (you/he/she) put things, like (your/his/her) wallet? Participants were given the options of responding on a 5 point Likert scale from "never" to "several times a day" or "refused" and "don't know." Memory impairment was grouped with *never* as "no memory impairment"; *about once or 2 or 3 times* as "early stage memory impairment"; and *nearly every day or several times a day* as "late stage memory impairment." This classification was done by Aigogun et al. who used this question from the 2011 to 2014 NHANES in examining the severity of subjective memory impairment in older adults.<sup>22</sup>

#### Depression symptoms

Depression symptoms was measured using the Patient Health Questionnaire 9 items (PHQ-9).<sup>23</sup> Participants were asked to rate

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