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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 ≥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.

Keywords

Older Adult; Wellness; Sleep Duration; NHANES

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 fasting growing segment of the United States population of adults older than 65 years.[1] The concept of high-level wellness, defined as maximizing functional capacity, was first discussed over fifty years ago; unfortunately, most healthcare remains disease oriented.[2,3] 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

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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.[4]

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.[5] 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.[6–8] 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).[9] 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.[10–14] However, other than the increased risk for depression that was associated with long sleep duration,[14] it remains unclear whether long sleep duration was an independent risk factor for morbidity or whether it was a consequence secondary to poor health.[15]

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.[16] 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).

Methods

Data from the 2011–2012 and the 2013–2014 NHANES cohorts were used for this analysis.[17,18] 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 (≥ 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.[19] 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 ≥ 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 (≥ 6 prescription medications).

Physical Activity: Physical activity was calculated using the Global Physical Activity Questionnaire.[20] 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.[21] For the analyses, physical activity was dichotomized into “Meets the Physical Activity Guidelines – Yes (≥ 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.[22]

Depression Symptoms: Depression symptoms was measured using the Patient Health Questionnaire 9 items (PHQ-9).[23] Participants were asked to rate the frequency of each symptom (e.g., “little interest or pleasure in doing things”) over the past 2 weeks by choosing one of the following options: 0 (“not at all”), 1 (“several days”), 2 (“more than half of the days”) and 3 (“nearly every day”). Total score on the PHQ-9 ranges from 0 to 27 and scores of 5, 10, 15 and 20 are used to represent mild, moderate, moderately severe and severe depression, respectively.[23] For the analysis, PHQ-9 total score was dichotomized into “none or minimal (PHQ-9 total score < 5)” and “mild-severe” (PHQ-9 total score ≥ 5).

Body Mass Index: Height and weight were performed according to a standardized protocol to calculate body mass index (BMI kg/m^2). A healthy adult body weight, according to the World Health Organization (WHO),[21] was defined as a BMI kg/m^2 of 18.5 to 24.9. Geriatric BMI cutoff levels were chosen because a meta-analysis of BMI and all-cause mortality in older adults (32 studies, *N*= 197,940; age ≥ 65 years) suggested that being overweight was not associated with increased mortality until older adults had a BMI > 33 kg/m^2. However, this study also suggested that older adults were at increased risk for morality even with a "low normal" BMI.[24] Therefore, BMI was analyzed as a categorical variable based on geriatric groups with "underweight" a BMI<22.5 kg/m^2, "normal" a BMI 22.5–24.9 kg/m^2, "overweight" a BMI 25–29.9 kg/m^2, "obese class 1" a BMI 30–34.9 kg/m^2, and "obese class 2" a BMI ≥ 35.0 kg/m^2.

Statistical Analysis: The data were analyzed using SAS (version 9.4, SAS Institute Inc., Cary, NC) to be able to control for the sample weights (i.e., the 4-year weight) that allow results to be reported as population parameters. There was minimal missing data (≥ 99.5% complete) for all of the interview variables (age, gender, race, marital status, education) except for income level (*n* = 93; 8.2% missing) and on the questions that query symptoms of depression (*n* = 222; 19.5% missing). There were 78 cases that consisted of interview data only. There was 10.3% (*n* = 117) missing data on BMI. Fifty-six participants (4.9%) used a proxy in interview. Descriptive statistics for the total sample included weighted percentages using the Surveyfreg Procedures. Comparisons between the oldest age group and the younger age group were examined using the Surveyfreq Procedures with Wald chi-squared tests. Binary logistic regression using Surveylogistics was used to determine predictors of high-level health with odds ratios and 95% confidence intervals. Statistical significance was set a priori as $p<.05$.

Results

Description of the Sample

Most participants (63.6%) described their health as either "excellent" (11.2%), "very good" (26.7%), or "good" (35.7%). Self-reported health status had a high correlation when queried in the home compared to when asked in the NHANES mobile clinic setting ($r_s = .65$, $p < .0001$). Table 1 presents the demographic characteristics for the total sample and a comparison of the sample by sleep duration. The present analysis included all participants 75 years old and older with data on the in-home interview (*N*= 1,139). The sample was primarily (58.8%) female, non-Hispanic white (83.5%), married or partnered (51.8%), and had a monthly income above poverty index (65.8%). The oldest segment of the sample, participants 80 years or older, made up over 60.3% of the sample although the exact ages are not known because of the coding of "80" for these participants.

Significantly more participants with late-stage memory difficulty used a proxy for their interview than those with no or early stage memory impairment (20.3% vs. 3.1%), X^2 (1, *N*=1135) = 66.6, $p<.001$. Almost three out of ten respondents (30.5%) reported that they complained about poor sleep to their primary care provider, while only 9.3% reported that they were told by their doctor that they had a sleep disorder. There was no significant

difference (p<.05) by sex, BMI categories or memory difficulty when compared by sleep duration. The majority of the participants reported no or few symptoms of depression (77.6%), while 16.6% reported mild depression, 4.7% reported moderate depression, 1.5% reported moderately-severe depression, and 0.8% reported severe depression. There were significant differences by the number of prescription medications, depression symptoms and physical activity levels when compared by sleep duration. In the long sleep duration group, greater proportion of participants were on 3 or more medications (87.1%) and not meeting physical activity guidelines (<600 MET-minutes per week, 83.2%), compared to the proportion reported in other two sleep duration groups. Proportion of the participants with mild to severe depression (PHQ-9 ≥ 5) were higher in the short sleep (35.3%) and long sleep (20.3%) group.

Comparison of Sample by Health Status

Characteristics of the sample by health status (high-level vs. low-level) are summarized in Table 2. There was no significant difference in health status by sex, marital status, or BMI. However, the demographic characteristics of participants reporting high-level health tended to be non-Hispanic White who had a higher education and income. In addition, participants who reported high-level health were more likely to take fewer prescription medications, were more physically active, had fewer memory problems, and were more likely to obtain 7 to 9 hours of sleep a night (all p values < .01).

Predictors of Self-Reported Health in Older Adults

Ten hours or more sleep duration significantly predicted a lower likelihood to high-level health (OR: .41; 95% CI: .21–.80). According to logistic regression analyses (see Table 2), long sleep duration race, poverty income ratio, the number of prescribed medications, physical activity status, and late stage memory impairment significantly predicted low-level health in older adults while sex, education, marital status, BMI, and depression symptoms did not. Compared to Non-Hispanic White, other ethnic groups were about 54% to 66% percent less likely to report high-level health (range of 95% CI: 0.16 to 0.76). Older adults in poverty (≤ 185%) were about 50% less likely to report high-level health than those above 185% poverty line. Older adults who were taking more than 6 prescribed medications were 86% less likely to report high-level health than those with 0–2 prescribed medications. Meeting PA guidelines was a significant predictor to health status: those who did not meet PA guidelines had less than half the likelihood to report high-level health than their counterparts. While education and depression symptoms significant in the unadjusted models, after controlling for the other variables both became insignificant in predicting high-health status. Those who showed late stage memory impairment were 66% less likely to report high-level health than those with no memory impairment.

Discussion

This study is significant because in debunks the myth that aging is invariably associated with poor health using a representative sample of older adults. In the current study, almost 75% of the participants ages 75 year or older described their health from “good” to “excellent.”

Furthermore, Non-White participants had a higher risk for low health; it is unclear how much of this disparity is secondary to socioeconomic factors that are amenable to change.

Previous studies suggest that the prevalence of chronic disease increases with age and was associated with worse health. Because NHANES does not include detailed medical records, the severity of acute and chronic disease in the sample population is not known. However, it may be hypothesized that increased medication use is associated with worse physical and/or mental well-being. Data from our analysis found that polypharmacy in older adults was a risk factor for low-level health.

While data from the meta-analysis of adults 65 years and older found an increase in all-cause mortality in underweight and very obese older adults over a 12 year period,[24] the current study found no statistically significant likelihood for higher or lower subjective health by weight category. These results are not consistent with data from a study by Leigh and colleagues that found that although total life expectancy was similar in normal and overweight women at age 75, those who had a normal weight experienced more “healthy” years and fewer “unhealthy” years compare those who were overweight.[25] This suggests that more information is needed to elucidate what is the optimal weight goal for older adult’s for well-being.

The results of this study support the CDC statement that depression is not a part of normal aging,[26] the majority of older adults who participated in the 2011–2012 and 2013–2014 NHANES had no or only minimal symptoms of impaired mood. However, participants with mild to severe depressive symptoms were about 30% less likely to report high-level health than those with none or minimal depressive symptoms. Data from previous studies found that depression in older adults was associated with socioeconomic factors (e.g. low income and/or low educational level) and had a bidirectional association with multiple co-morbidities including cognitive difficulty, sleep disturbances, increased risk of chronic disease, development of frailty, and mortality.[27–31] A meta-analysis of community dwelling older adults found an inverse relationship between depression and resilience ($r = -0.35$, 95% CI: −0.41 to −0.28).[32] This suggests that resilience, the fortitude to adapt and experience growth with life’s challenges, may be an important factor in health aging, but is frequently understudied.

The majority of older adults reported sleeping the recommended 7 to 9 hours a night, a health behavior that is significantly predictive of high-level wellness in older adults. However, the relationship of sleep duration did not remain significant after accounting for the contributions of the other modifiable risk factors for high-level health such as poverty, depression, and lack of physical activity. This may be explained by the fact that The NHANES question on sleep duration could over-estimate short sleep because the question is limited to sleep obtained “at night.” Many older adults have a biphasic sleep pattern where some of their daily sleep was obtained during naps and therefore was not previously accounted for in the determination of sleep duration.

Importantly, this study measured only one aspect of healthy sleep: sleep duration.[33] According to Buysse, healthy sleep that promotes mental and physical well-being is not just

the absence of sleep disturbances (i.e. insomnia or obstructive sleep apnea) or too short or long a sleep duration. Healthy sleep includes good sleep efficiency where one is awake less than 30 minutes, correct timing of sleep, being awake and alert during the day, subjective satisfaction with the quality of ones sleep in addition to obtaining an adequate quantity of sleep.[33] Healthy sleep is the converse of "sleep deficiency" that includes sleep characterized by either inadequate sleep duration, circadian misalignment, inadequate time in restorative sleep stages (REM and slow wave sleep), or having a sleep disorder.[34] Recently, the National Sleep Foundation proposed that evaluation of sleep health is of such importance that it should be considered by health care practitioners as a "vital sign."[35]

Strengths of this study were the availability of the 2011–2014 NHANES data that provided a large, nationally representative sample with oversampling of population groups that are often underrepresented in research (i.e. Non-White persons, persons with low income) that included a relatively large number of older adults including persons over the age of 80. In addition, the NHANES data collection was designed to maintain fidelity in collection of the objective and subjective data. Another strength to NHANES was that many of the variables were included in each survey period with the same coding scheme, allowing for merging datasets to obtain a larger sample size.

A limitation of NHANES, like all studies with cross-sectional designs, was that one cannot infer causality. There was no indication of actual age in participants older than 80; this is unfortunate because persons surviving into their 90's is no longer unusual. In addition, the use of many of the measures based on self-report may not be reliable. For example, a study by Lauderdale and colleagues found that the associations of sleep duration and health among older adults was not consistent between subjective and objective measures of sleep duration.[36] In Lauderdale's study, while there was an increased risk for worse health with short sleep duration (< 6 hours) measured by single question self-report, a sleep log, and by actigraphy, the association between long sleep duration (> 9 hours) and "fair/poor health" was significance when measured by self-report but not when measured by sleep log or actigraphy.[36]

Conclusions

This study is noteworthy because it affirms that high-level wellness is attainable even in the very old and that many factors associated with low-level health are potentially modifiable highlighting the importance of health promotion strategies. Promoting wellness is a reasonable and advantageous goal in older adults. Increasing wellness in older adults is especially important when extrapolated to the 46 million persons in the United States who were older than 65 years in 2016 especially considering the growing proportion who are over 80 years old.[37] Future studies need to incorporate health promotion interventions that address all of the aspects of health including all aspects of sleep health in older adults.

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Table 1

Characteristics of the total sample (N = 1,139) and comparison by normal sleep duration (7–9 hours), short sleep duration (< 6 hours), and long sleep duration (>9 hours)

Variable	Total Sample (%)	Short Sleep (%)	Normal Sleep (%)	Long Sleep (%)	*p*-value
	100	**22.0**	**70.8**	**7.2**	
Sex					
Female	58.8	60.0	57.8	67.0	.1472
Male	41.2	40.0	42.2	33.0	
Race/ethnicity					
Non-Hispanic White	83.5	72.8	87.1	80.1	<.0001
Non-Hispanic African American	8.2	15.6	5.9	8.0	
Hispanic	5.2	7.6	4.2	6.8	
Asian	3.2	3.9	2.7	5.1	
Education					
Post High School	50.3	40.2	54.9	35.2	<.0001
High School Graduate or Less	49.7	59.8	45.1	64.8	
Marital Status					
Married/Partnered	51.8	42.8	55.4	43.2	.0124
Single/Divorced/Widowed	48.2	57.2	44.6	56.8	
Poverty income ratio (%)					
>1.85	57.9	49.5	62.4	41.0	.0088
1.30-MPI ≤ 1.85	17.9	18.0	17.1	26.2	
≤ 1.30	24.2	32.5	20.5	32.8	
Number of Rx. Medications					
Few (0–2)	25.1	20.2	27.7	13.0	.0037
Moderate (3–5)	39.3	39.3	39.1	43.0	
Large (≥6)	35.5	40.5	33.2	44.1	
Meets Physical Activity Guidelines					

Variable	Total Sample (%)	Short Sleep (%)	Normal Sleep (%)	Long Sleep (%)	*p*-value
	100	**22.0**	**70.8**	**7.2**	
Yes	37.1	36.6	39.2	16.8	.0003
No	62.9	63.4	60.8	83.2	
Depression Symptoms					
None or minimal (PHQ-9 < 5)	77.6	64.7	81.5	79.7	.0003
Mild to Severe (PHQ-9 ≥ 5	22.4	35.3	18.5	20.3	
Geriatric BMI Categories					
Normal (BMI 22.5–24.9)	18.5	16.1	19.1	20.4	.9712
Under-weight (BMI < 22.5 kg/m^2)	14.1	14.3	14.2	12.9	
Overweight (BMI 25.0–29.9 kg/m^2)	38.3	37.5	38.1	42.1	
Obese Class 1 (BMI 30.0–34.9 kg/m^2)	20.1	21.6	20.1	16.3	
Obese Class 2 (BMI ≥ 35 kg/m^2)	9.0	10.6	8.5	8.3	
Memory difficulties (last 7 days)					
No Memory impairment	47.0	44.8	46.6	56.3	.5143
Early stage memory impairment	44.1	46.1	44.5	34.8	
Late stage memory impairment	8.9	9.1	8.9	8.9	
Self-Rated Health					
High	73.6	64.1	78.3	56.9	<.0001
Low	26.4	35.9	21.7	43.1	

Note: Age range truncated with persons ≥ 80 years coded as “80”; “High” self-rated health = response of “excellent”, “very good” or “good”; “Low” self-rated health = response of “poor” or “fair”

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Table 2

Factors associated with high-level health

	Health Status (weighted %)			High-Level Health	
	Low (%)	**High (%)**	***p*-value**	**OR**	**95%CI**
Sex					
Female	26.8	73.2		1	
Male	25.8	74.2	.7008	.85	(.56, 1.28)
Race/ethnicity					
Non-Hispanic White	23.2	76.8		1	
Non-Hispanic African American	41.3	58.7	.0015	.46	(.28, .76)
Hispanic	47.6	52.4		.37	(.20, .68)
Asian	33.4	66.6		.34	(.16, .74)
Education					
Post High School	20.1	79.9	.0007	1	
≤High School Graduate	32.8	67.2		.76	(.44, 1.29)
Marital Status					
Married/Partnered	25.7	74.3	.7397	1	
Single	27.0	73.0		1.22	(.72, 2.07)
Poverty income ratio (%)					
>1.85	18.6	81.4		1	
1.30-MPI ≤ 1.85	35.2	64.8	<.0001	.47	(.29, .76)
≤ 1.30	37.3	62.7		.49	(.30, .79)
Number of Rx. Meds					
Few (0–2)	12.1	87.9		1	
Moderate (3–5)	21.4	78.6	<.0001	.42	(.22, .80)
Large (≥6)	42.0	58.0		.14	(.07, .26)
Meets PA Guidelines					
Yes	15.1	84.9	<.0001	1	

	Health Status (weighted %)			High-Level Health	
	Low (%)	High (%)	*p*-value	OR	95%CI
No	33.0	67.0		.52	(.35, .79)
Depression Symptoms					
None or minimal (PHQ-9 < 5)	20.5	79.5	<.0001	1	
Mild to Severe (PHQ-9 ≥ 5)	39.1	60.9		.73	(.49, 1.09)
Geriatric BMI Categories					
Normal	20.5	79.5		1	
Under-weight	23.3	76.7		1.14	(.45, 2.84)
Overweight	22.5	77.5	.0624	.90	(.51, 1.58)
Obese Class 1	29.3	70.7		.54	(.23, 1.28)
Obese Class 2	40.2	60.0		.62	(.32, 1.19)
Memory difficulties (last 7 days)					
No Memory impairment	22.8	77.2		1	
Early stage memory impairment	25.4	74.6	.0002	.67	(.42, 1.07)
Late stage memory impairment	48.1	51.9		.34	(.17, .67)
Sleep Duration					
Normal (7–9 hours)	21.7	78.3		1	
Short (<7 hours)	35.9	64.1	<.000 1	.79	(.52, 1.22)
Long (≥ 10 hours)	43.1	57.0		.41	(.21, .80)

Note: Age range truncated with persons ≥ 80 years coded as “80”; OR, odds ratio; CL, confidence limit; BMI, BMI; PA, physical activity; Geriatric BMI Categories: Normal = BMI 22.5–24.9 kg/m^2; Under-weight = BMI < 22.5 kg/m^2; Overweight = BMI 25.0–29.9 kg/m^2; Obese Class 1 = BMI 30.0–34.9 kg/m^2; Obese Class 2 = BMI ≥ 35 kg/m^2