J Primary Prevent (2017) 38:495–503
DOI 10.1007/s10935-017-0484-5

ORIGINAL PAPER

Sleep and Mental Health in the General Population of Elderly Women

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Published online: 26 July 2017

Abstract Sleep and mental health complaints are prevalent in the elderly and share common risk factors. We assessed the relationship between sleep and mental health in three representative samples of elderly women while controlling for multiple risk factors common to both. We performed this cross sectional secondary data analysis in 2015 using 2013 data from the Behavioral Risk Factor Surveillance System (BRFSS) for females ages 65 years and older from California ($N = 1912$), Florida ($N = 9120$), and Pennsylvania ($N = 2429$). We conducted multiple logistic regression analysis to assess the relationship between sleep duration group (short, moderate/reference, or long) and mental health issues in the past 30 days (yes or no) in elderly females, while controlling for multiple covariates. About 25% of the elderly females reported mental health issues and 20% reported short or long sleep durations. In adjusted analysis, compared to the elderly females in the moderate sleep duration group (averaging 6–8 h of sleep per day), those in the short and long sleep duration groups had increased prevalence of mental health issues by 66% and 26%, respectively. Mental health was also related to physical health issues including general health status, activity limitations, and chronic health conditions. Overall, sleep was related to mental health in representative samples of elderly females even after controlling for risk factors common to both. Even though we could not determine the direction of influence, the findings indicate a need for clinicians to

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screen their elderly female patients for both sleep and mental health issues, especially in those with physical health comorbidities.

Keywords Elderly · Older adults · Preventive medicine · Sleep · Health comorbidities

Introduction

Sleep and mental health complaints are prevalent in the elderly, of whom up to 70% report some problem with sleep (Reid et al., 2006) and 20% experiencing some type of mental health concern (CDC, 2014). As the elderly population grows in magnitude, so will these issues. The World Health Organization (WHO, 2013) states that the world population of people over 60 will triple by 2050 and that 15% will have a mental health disorder. Accordingly, Healthy People 2020 set forth goals to increase the proportion of adults who get sufficient sleep and to increase the proportion of primary care physician office visits where adults are screened for depression (DHHS, 2014).

Research shows that mental health outcomes in the elderly are related to both sleep quality (Asplund, 2000; Habte-Gabr et al., 1991; Livingston, Blizard, & Mann, 1993) and sleep duration (Benito-León, Louis, Villarejo-Galende, Romero, & Bermejo-Pareja, 2014; Bokenberger et al., 2016; Chiu et al., 2016; Faubel et al., 2009; Liu et al., 2016; van den Berg et al., 2009). In addition, research also indicates that both mental health and sleep share common risk factors. For example, both mental health issues (CDC, 2014; Chiu et al., 2016; Faubel et al., 2009) and sleep issues (Asplund, 2000; CDC, 2014; Chiu et al., 2016; Habte-Gabr et al., 1991; Reid et al., 2006) are more common in elderly females than elderly males. In addition, physical health issues such as general health, chronic disease, disability, obesity, alcohol use, tobacco use, and activity levels are related to both mental health (CDC, 2014; Faubel et al., 2009) and sleep (CDC, 2011; Habte-Gabr et al. 1991; Livingston et al., 1993; Tanaka & Shirakawa, 2004). Moreover, both mental health issues (CDC, 2011) and sleep issues (CDC, 2014; Habte-Gabr et al., 1991; Livingston et al., 1993) differ by race/ethnicity, educational attainment, employment status, and marital status.

While much of the prior research showing relations between sleep and mental health in the elderly was conducted in other countries (Asplund, 2000; Benito-León et al., 2014; Bokenberger et al., 2016; Chiu et al., 2016; Faubel et al., 2009; Livingston et al., 1993; Liu et al., 2016; Tanaka & Shirakawa, 2004; van den Berg et al., 2009), assessing the relationship between sleep and mental health among United States elderly women (Habte-Gabr et al., 1991; Reid et al., 2006) could establish further evidence for the need for patient education and screening for sleep and mental health issues in this population. The purpose of this study was to assess the relationship between sleep and mental health in representative samples of US elderly women, while controlling for risk factors common to both.

Methods

Design

We conducted this cross-sectional secondary data analysis in 2015 using 2013 data from the Behavioral Risk Factor Surveillance System (BRFSS), used by the Centers for Disease Control and Prevention to monitor the health conditions of the United States. BRFSS data are collected from randomly-selected adults in the non-institutionalized adult population who are aged 18 years or older and who reside in a private residence or college housing. The data collection strategy incorporates random-digit dial methods for both landline telephone- and cellular telephone-based surveys across the 50 states and US territories (more information can be obtained from CDC, 2015). The Institutional Review Board of University of North Texas Health Science Center gave this study exempt status.

Sample

Compared to males, females have longer life expectancy (United States Census Bureau, 2014), and elderly females are more likely to have problems with sleep (Asplund, 2000; CDC 2014; Chiu et al., 2016; Habte-Gabr et al., 1991; Reid et al., 2006). Thus, we restricted our sample to females 65 years and older in California ($N = 1912$, $M = 73.55$, $SD = 5.36$, range 65–80), Florida ($N = 9120$, $M = 73.61$, $SD = 5.29$, range 65–80), and Pennsylvania ($N = 2429$, $M = 74.00$, $SD = 5.39$, range 65–80). We chose these states because of their high percentage of elderly (United States Census Bureau, 2014).

Measures

Our outcome, mental health issues, utilizes data from the BRFSS question, "now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" The responses to the number of days of mental health issues in the past 30 days was skewed severely overall ($M = 2.66$, $SD = 6.96$, range 0–30) and in each state: California ($M = 3.02$, $SD = 7.35$, range 0–30), Florida ($M = 2.64$, $SD = 7.01$, range 0–30), and Pennsylvania ($M = 2.44$, $SD = 6.43$, range 0–30). Overall, 75% of respondents ($n = 9800$) reported 0 days in the past 30 days with mental health issues, so we dichotomized mental health issues at the mode (0 days) as "yes" to indicate one or more days with mental health issues in the past 30 days versus "no" to indicate no days of mental health issues in the past 30 days.

Our factor of interest, sleep duration group, was based on data from the BRFSS question: "On average, how many hours of sleep do you get in a 24-hour period?" from which participants' answers are recorded in whole numbers. We categorized sleep duration into three categories: "short" refers to averaging 5 or fewer hours of sleep per day, "moderate" is the referent group for comparison and refers to averaging 6–8 h of sleep per day, and "long" refers to averaging 9 or more hours of

sleep per day. We used this categorization because (1) research shows a U-shaped relationship between sleep hours and health outcomes in older adults (i.e., health outcomes are poorer at the low and high ends versus the middle; Bokenberger et al., 2016; Liu et al., 2016; van der Berg et al., 2009); (2) sleep duration requirements vary from person to person so ranges of sleep time are recommended for each age group (Hirshkowitz et al., 2015; National Heart, Lung, and Blood Institute, 2012); and (3) the categories we are using are commonly used in research related to sleep duration and health outcomes for elderly adults (Benito-León et al., 2014; Bokenberger et al., 2016; Chiu et al., 2016; Faubel et al., 2009; Liu, et al., 2016; van den Berg et al., 2009): short, moderate/reference, and long.

We included as control variables in our analyses risk factors that are common to both mental health and sleep, as specified in the introduction. These included general health, activity level, weight status, activity limitations, and chronic health conditions. For activity limitations, we used data from the following BRFSS question: "Are you limited in any way in any activities because of physical, mental, or emotional problems?" For number of chronic health conditions, we summed the number of "yes" responses to whether participants had been diagnosed with any of the following: high blood pressure, heart attack, CHD, stroke, skin cancer, cancer, COPD, arthritis, depression, kidney disease, diabetes, and asthma. However, the resulting values for number of chronic health conditions were severely skewed, so we categorized chronic health conditions as "*0*," "*1*," "*2*," or "*3 or more*." In addition, we controlled for alcohol use, tobacco use, education level, employment status, income level, marital status, ethnicity/race, and age. Because of sample size issues (i.e., very small *n*'s) in some categories, we recoded the following variables as dichotomous: general health, activity level, weight status, education level, employment status, and ethnicity/race. The categories and the referent groups used for all independent variables used in this study are shown in Table 1.

Statistical Analysis

We used frequency distributions to describe the sample and determine if there were any issues with the distributions of variables, and multiple logistic regression analysis to determine the relationship between sleep duration groups and yes/no mental health issues after controlling for all covariates. We performed all statistical analyses in R version 3.2.0 (Copyright © 2015 The R Foundation for Statistical Computing), and we set all significance levels at $p < 0.05$.

Results

Elderly females in California, Florida, and Pennsylvania reported similar amounts of mental health issues and sleep durations; however, participants' responses for all control variables differed considerably across the states (not shown; contact the corresponding author for tabled information by state). To capture and control for all the diversity, we combined the data for all states for multivariable analysis.

Table 1 Sample characteristics and results of adjusted logistic regression

Predicting mental health issues in the past 30 days (yes vs. no)	Descriptive statistics		Adjusted analysis		
	n	%	*AOR*	95% CI	
				Low	High
Sleep duration group					
Short 5 or fewer hours per day	1266	10	**1.66**	1.40	1.97
Moderate 6–8 h per day	10,395	79	Ref	–	–
Long 9 or more hours per day	1502	11	**1.26**	1.07	1.49
General health					
Good or better	9994	75	Ref	–	–
Fair or poor	3333	25	**1.87**	1.64	2.13
Activity level					
Inactive	4357	38	Ref	–	–
Active	7167	62	1.01	0.90	1.13
Weight status					
Not overweight or obese	5286	41	Ref	–	–
Overweight or obese	7513	59	0.92	0.82	1.03
Chronic health conditions					
None	940	7	Ref	–	–
1	3274	26	1.14	0.87	1.49
2	3676	29	**1.46**	1.12	1.90
3 or more	4862	38	**2.42**	1.87	3.14
Activity limitations					
No	8993	69	Ref	–	–
Yes	4050	31	**1.73**	1.53	1.95
Alcohol use					
Did not	8000	62	Ref	–	–
Drank alcohol in past 30 days	4850	38	**1.18**	1.05	1.33
Tobacco use					
Non-smoker	11,880	92	Ref	–	–
Current smoker	1099	8	1.16	0.97	1.40
Education level					
Did not graduate	10,129	76	Ref	–	–
Graduated college/technical school	3260	24	1.02	0.89	1.17
Employment status					
Other	3939	30	Ref	–	–
Retired	9386	70	**0.77**	0.69	0.87
Income level					
Less than $25,000	4773	45	Ref	–	–
$250,000 to less than $50,000	3299	31	0.88	0.72	1.00
$50,000 or more	2554	24	**0.71**	0.60	0.84
Marital status					

Table 1 continued

Predicting mental health issues in the past 30 days (yes vs. no)	Descriptive statistics		Adjusted analysis		
	n	%	*AOR*	95% CI	
				Low	High
Married	4827	36	Ref	–	–
Divorced	1984	15	0.92	0.78	1.08
Widowed	5890	44	0.91	0.80	1.05
Other	687	5	0.88	0.69	1.13
Age					
65–69	3805	28	Ref	–	–
70–74	3291	24	**0.76**	0.66	0.88
75–79	2665	20	**0.67**	0.57	0.78
80 and older	3700	27	**0.50**	0.42	0.59
Race/ethnicity					
Other	1691	13	Ref	–	–
White, non-Hispanic	11,527	87	0.92	0.78	1.08
State					
California	1912	14	Ref	–	–
Florida	9120	68	**0.77**	0.67	0.88
Pennsylvania	2429	18	0.88	0.73	1.05

Boldface indicates significance (*AOR*s with 95% CI that do not include 1.00 are significant)

AOR adjusted odds ratio, *95% CI* 95% confidence intervals, *ref* referent category

Overall, 25% of participants ($n = 3194$) reported that they had mental health issues during the past month, and as shown in Table 1, most reported averaging 6–8 h of sleep per day. Also indicated in Table 1, 25–40% of the elderly female participants reported fair or poor health, inactivity, being overweight or obese, having activity limitations, and having three or more health conditions. Almost 70% reported two or more health conditions.

The results of multiple logistic regression analysis using yes/no mental health issues as the outcome (see Table 1) indicated that after controlling for all other variables in the model, sleep duration group showed independent effects. Compared to elderly females in the referent group who reported getting an average of 6–8 h of sleep per day, mental health issues were 66% more prevalent in those in the short sleep duration group who reported averaging 5 or fewer hours of sleep per day, and 26% more prevalent in those in the long sleep duration group who reported averaging 9 or more hours of sleep per day.

For the control variables, compared to their referent groups, the following participants were *more likely* to report having mental health issues in the past 30 days: those who reported being in fair or poor general health, having two or more chronic health conditions, having activity limitations, and having drank alcohol in the past 30 days. In addition, compared to their referent groups, the following participants were *less likely* to report having mental health issues in the past

30 days: those who reported being retired, having an annual income of $50,000 or higher, being 70 years or older, and living in Florida.

Discussion

We sought to examine the relationship between mental health and sleep in representative samples of elderly females from California, Florida, and Pennsylvania, while controlling for risk factors common to both mental health and sleep. The results indicated that about 25% of the elderly female participants reported potential mental health issues and about 20% reported potential sleep issues. Although sleep requirements vary from person to person and can change as people age, the National Sleep Foundation and the National Heart, Lung, and Blood Institute recommend 7–8 h of sleep for older adults, using research to show that this range relates to healthy functioning. As such, sleep durations habitually outside of a recommended range may relate to having health problems or compromising one's health (Hirshkowitz et al., 2015; National Heart, Lung, and Blood Institute, 2012). In this study, elderly females in short and long sleep duration groups showed 66% and 26% increased prevalence of reporting mental health issues, respectively, after controlling for the effects of a variety of contextual variables related to both mental health and sleep. Our findings are similar to those of other studies using national datasets around the world (Asplund, 2000; Benito-León et al., 2014; Bokenberger et al., 2016; Chiu et al., 2016; Faubel et al., 2009; Livingston et al., 1993; Liu et al., 2016; Tanaka & Shirakawa, 2004; van den Berg et al., 2009) that found that sleep may play an important role in mental health.

In addition, and similar to the results of previous studies, our findings indicate that mental health issues among elderly females are also related to physical health issues (CDC, 2014; Faubel et al., 2009), including having fair to poor general health, activity limitations, and/or multiple chronic conditions. The prevalence of mental health issues increased by 87% when reporting fair or poor general health; by 73% when reporting activity limitations; by 46% when reporting two chronic health conditions; and by 142% when reporting three or more chronic health conditions. Because elderly females are a common group seen in general practice and sleep issues and physical health conditions are common in elderly females, practitioners should be aware of the relationship between sleep, physical health conditions, and mental health for elderly women (Reid et al., 2006) and assess all three areas when a patient presents with one or more of these issues.

Limitations of the Study

In this cross-sectional study, no data were available to assess the development or interaction of sleep, physical health, and mental health over time, so the direction of causality is not known. Further, our measure of mental health did not include the type, frequency, or duration of any specific mental health issues or problems. In addition, our measurement for sleep did not indicate types of sleep disorders

(Rodriguez, Dzierzewski, & Alessi, 2015; Tanaka & Shirakawa, 2004) or whether participants were taking any medications that could affect sleep (Faubel et al., 2009; Habte-Gabr et al., 1991; Rodriguez et al., 2015).

Conclusions

The purpose of our study was to examine the relationship between mental health and sleep in representative samples of elderly females while controlling for risk factors common to both. Our results indicated that mental health and sleep issues may be common in the general elderly female population, with about 25% reporting mental health issues and 20% reporting sleep duration issues. Given that mental health issues may be under-identified by healthcare practitioners and older adults (WHO, 2013), Healthy People 2020 established goals to increase the proportion of primary care physician office visits in which adults are screened for depression (DHHS, 2014). Thus, practitioners should be aware of the relations among mental health and sleep and assess any issues related to both of these during office visits. In addition, almost 70% of elderly females reported having two or more chronic health conditions and about 25% reported having activity limitations or fair to poor general health. Given that these physical health issues were also related to mental health, practitioners should assess sleep and mental health issues in elderly female patients with known physical health comorbidities, and provide patient education and proper referral to mental health specialists, sleep specialists, or both. Furthermore, given that the majority of elderly female patients have multiple chronic health conditions for which they are probably taking various medications, practitioners should consider the side effects of prescription drugs as they relate to sleep and mental health issues for elderly female patients.

Compliance With Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval This was a secondary data analysis of BRFSS data collected by the Center for Disease Control and Prevention (CDC, 2015). The CDC provides de-identified data for public utilization and this study was exempted by the Institutional Review Board of the University of North Texas Health Science Center.

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