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Insomnia and Health Services Utilization in Middle-Aged and Older Adults: Results From the Health and Retirement Study

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Background. Complaints of poor sleep are common among older adults. We investigated the prospective association between insomnia symptoms and hospitalization, use of home health care services, use of nursing homes, and use of any of these services in a population-based study of middle-aged and older adults.

Methods. We studied 14,355 adults aged 55 and older enrolled in the 2006 and 2008 waves of the Health and Retirement Study. Logistic regression was used to study the association between insomnia symptoms (0, 1, or ≥2) in 2006 and reports of health service utilization in 2008, after adjustment for demographic and clinical characteristics.

Results. Compared with respondents reporting no insomnia symptoms, those reporting one symptom had a greater odds of hospitalization (adjusted odds ratio [AOR] = 1.28, 95% confidence interval [CI] = 1.15–1.43, $p < .001$), use of home health care services (AOR = 1.29, 95% CI = 1.09–1.52, $p = .004$), and any health service use (AOR = 1.28, 95% CI = 1.15–1.41, $p < .001$). Those reporting greater than or equal to two insomnia symptoms had a greater odds of hospitalization (AOR = 1.71, 95% CI = 1.50–1.96, $p < .001$), use of home health care services (AOR = 1.64, 95% CI = 1.32–2.04, $p < .001$), nursing home use (AOR = 1.45, 95% CI = 1.10–1.90, $p = .009$), and any health service use (AOR = 1.72, 95% CI = 1.51–1.95, $p < .001$) after controlling for demographics. These associations weakened, and in some cases were no longer statistically significant, after adjustment for clinical covariates.

Conclusions. In this study, insomnia symptoms experienced by middle-aged and older adults were associated with greater future use of costly health services. Our findings raise the question of whether treating or preventing insomnia in older adults may reduce use of and spending on health services among this population.

Key Words: Sleep—Health services—Public health.

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INSOMNIA is prevalent among middle-aged and older adults and may be underdetected and undertreated in clinical settings. For example, although 40%-70% of older adults report difficulty sleeping (1–3), only 10% of older adults report receiving treatment for sleep-related difficulties (4). Older adults are also high consumers of health services. The Kaiser Family Foundation estimates that health care costs for Americans aged 65 and older average $8,776 per person each year, with a large proportion of spending on hospitalizations, home health care services, and nursing home use (5). There is some evidence that insomnia is associated with increased use of health services in younger and in clinical populations (6–9). There is also evidence extending these findings to older adults in clinical settings (eg, nursing homes, hospitals [10,11]). Some studies have explored the association between insomnia and health service use in small samples of older adults (12,13). Pollak and colleagues found that, among older adults aged 65 and older, self-reported insomnia was a significant predictor of shortened time to nursing home placement for men, but not for women (12). Spira and colleagues used wrist actigraphy as an objective measure of sleep in community-dwelling older women and found that greater time awake after the onset of sleep and worse sleep efficiency were associated with a greater odds of subsequent placement in long-term care (13). However, the majority of studies have used clinical samples or did not focus on older samples (6–9).

Prospective studies are needed to understand the association between insomnia and the use of a range of health services in the general population of middle-aged and older people. We examined this association in the Health and Retirement Study (HRS), a nationally representative study of middle-aged and older adults. We hypothesized that individuals with a greater number of insomnia symptoms would be more likely to report subsequent hospitalization and use of home health care and nursing home services compared with those without insomnia symptoms.

Methods

Data Source

Data were from the 2006 and 2008 waves of the HRS. The HRS is an ongoing longitudinal population-based survey of approximately 20,000 adults aged 50 or older that began in 1992. The purpose of the HRS is to assess the financial and health care experiences of older Americans as they transition from their careers through retirement. The HRS uses a multistage probability sampling design with clustering to identify household units as the primary sampling unit. The HRS has been conducted every 2 years with the most recent wave in 2010. Five new cohorts have been enrolled in the study since its inception. Details about HRS design and implementation are provided elsewhere (14,15).

Study Population

To be eligible for the HRS, participants are required to be noninstitutionalized adults aged 50 years or older with primary residence in the United States. The study oversamples blacks, Hispanics, and residents of Florida, and sampling weights are constructed to account for the unequal probability of selection for these individuals. Our study sample included participants who completed the HRS 2006 wave (March 2006-February 2007), which served as our "baseline," and the HRS 2008 wave (February 2008-February 2009), which we refer to as "follow-up." Of the 18,469 respondents in HRS 2006, 1,191 died and 785 were lost to follow-up by 2008, leaving 16,493 (89%) who participated in HRS 2008. Of these, we excluded 102 with missing data for one or more of our primary predictors and 23 others with missing data for one or more of our outcomes. Of the remaining 16,368 participants, we excluded 2,013 who were aged less than 55 years at the 2006 wave, leaving an analytic sample of 14,355 participants. Compared with participants who remained in the study in 2008, those who were excluded, who were lost to follow-up, or who died between 2006 and 2008 ($N = 4,114$) were older ($p < .001$) and more likely to be male ($p = .006$). At the 2006 wave, they had more insomnia symptoms ($p = .012$) and were more likely to have been hospitalized ($p = .003$), to have used home health care services ($p < .001$), and to have used a nursing home ($p < .001$).

Measures

Insomnia symptoms.—In 2006, respondents were asked how often they had trouble "falling asleep," trouble with "waking up during the night," trouble with "waking up too early and not being able to fall asleep again," and how often they felt "really rested" when they woke up in the morning. Responses included "most of the time," "sometimes," and "rarely or never." We defined individuals as experiencing an insomnia symptom if they answered "most of the time" or "sometimes" to the first three questions and "rarely or never" or "sometimes" to the fourth question (feeling rested in the morning). We summed the number of insomnia symptoms to create an index ranging from zero to four. Because few participants endorsed three or four symptoms ($N = 602$; 5.9% of the sample), we categorized respondents as having zero, one, or greater than or equal to two insomnia symptoms.

Health services utilization.—Health services utilization was assessed in 2006 and 2008. Respondents were asked questions about their use of several health services, including whether they were hospitalized, used home health care services, or were placed in a nursing home within the prior 2 years. These health services were chosen as outcomes because of the high costs associated with their use. We categorized individuals as having used a health service if they indicated that they used that service in the prior 2 years. We also categorized individuals as using *any* health service if they reported use of any of the three services assessed. For example, if an individual did not report nursing home use, but reported hospitalization and home health care services, they would still be categorized as having used any of these three services.

Other measures.—Demographic characteristics were ascertained in 2006 and included age (which we categorized as 55–64, 65–74, 75–84, and 85 and older), gender (male, female), race (white, black, other), and education (which we categorized as < high school, high school diploma, some/completed college, and graduate degree). In 2006, participants also were asked about current or previous medical conditions, including heart attack, stroke, hypertension, diabetes, cancer, and osteoarthritis; responses were coded dichotomously (yes or no). Depressive symptomatology was assessed using a short form of the Center for Epidemiologic Studies-Depression scale (16). A total of eight items queried about the presence or absence of depressive symptoms within the past week. Consistent with prior research (17), we categorized individuals endorsing greater than or equal to four symptoms as having elevated depressive symptoms.

Statistical Analyses

First, we conducted exploratory analyses to examine the distribution of sleep complaints in the population

across demographic groups and to assess the extent of missing data for sleep variables and other covariates. We assessed the association between number of insomnia symptoms in 2006 (ie, 0 [reference], 1, ≥2) and reports of hospitalization, use of home health care services, use of nursing homes, and use of any of these services at follow-up in 2008, using a series of multivariable-adjusted logistic regression models. For each outcome, we fit three separate models to discern the extent to which demographic characteristics alone, and in combination with health conditions and depressive symptomatology, explain observed associations between insomnia symptoms and outcomes. Model I controlled for age, gender, race, and education. Model II controlled for variables in Model I and common health conditions associated with the use of services: heart attack, stroke, hypertension, diabetes, cancer, and osteoarthritis. Finally, Model III controlled for variables in Model II and elevated depressive symptoms.

For each model, we also tested for a linear trend to examine whether there was a linear association between the number of insomnia symptoms, as measured by our categorical predictor, and each outcome. We also calculated the population attributable fraction (PAF) to determine the proportion of each service utilization outcome that was attributable to having greater than or equal to 1 insomnia symptom. Because one Center for Epidemiologic Studies-Depression item assessed "difficulty sleeping," we explored whether including or excluding the sleep item in the calculation of the dichotomous Center for Epidemiologic Studies-Depression score changed results significantly. Because there was very little change, we retained the sleep item to calculate the Center for Epidemiologic Studies-Depression score.

We also conducted a secondary analysis to assess the extent to which the number of insomnia symptoms predicted new health service utilization. Specifically, we repeated the earlier analyses but restricted our sample to individuals who reported no use of *any* of the three health services at the 2006 wave.

To account for the correlation within clusters associated with the complex sampling design of the HRS, all analyses used the Taylor linearization estimation method. We applied survey weights to our analyses to account for oversampling. All analyses were completed using Stata version 12 (StataCorp, College Station, TX). The p value for all statistical tests was set at less than .05.

Results

Of the 14,355 individuals in the sample, approximately half were aged 55–64 years in HRS 2006, 55% were women, 88% were non-Hispanic white, and the majority had at least a high school education (Table 1). Almost 59% had hypertension, 38% had osteoarthritis, and 21% had diabetes.

A total of 8,441 (59%) reported zero insomnia symptom, 3,392 (24%) had one symptom, and 2,522 (18%) had greater than or equal to two symptoms at baseline (HRS 2006). The number of insomnia symptoms differed by age, gender, race, education, and all health conditions (all $p \leq .001$; Table 1).

At the 2008 follow-up, 27% of the sample reported having been hospitalized, 8% reported use of home health care services, 4% reported use of nursing homes, and 29% reported using any of the three services over the prior 2 years. In this same time period, 21% reported having used one health service, 6% reported having used two health services, and 2% reported having used three health services.

Overall, reports of insomnia symptoms at baseline were associated with increased use of health services at follow-up (Table 2). Compared with those reporting no insomnia symptoms, individuals reporting insomnia symptoms had a greater odds of hospitalization (adjusted odds ratio [AOR] = 1.28, 95% confidence interval [CI] = 1.15–1.43, $p < .001$ for one insomnia symptom; AOR = 1.71, 95% CI = 1.50–1.96, $p < .001$ for ≥2 symptoms; PAF = 11%), use of home health care services (AOR = 1.29, 95% CI = 1.09–1.52, $p = .004$ for one symptom; AOR = 1.64, 95% CI = 1.32–2.04, $p < .001$ for ≥2 symptoms; PAF = 14%), nursing home use (AOR = 1.45, 95% CI = 1.10–1.90, $p = .009$ for ≥ 2 symptoms; PAF = 6%), and any health service (AOR = 1.28, 95% CI = 1.15–1.41, $p < .001$ for one symptom; AOR = 1.72, 95% CI = 1.51–1.95, $p < .001$ for ≥2 symptoms; PAF=11%) after adjustment for age, gender, race, and education (Model I). The association between insomnia symptoms and both hospitalization and use of any health service decreased in magnitude but remained statistically significant in Models II and III. The association with nursing home use was no longer significant in Models II and III, and the association with home health care services was no longer significant in Model III. The p values for linear trend in most models were statistically significant (except Model II for nursing home use and Model III for nursing home use and home health care services), suggesting that the odds of using these respective health services increased in a linear fashion across categories of insomnia severity.

To explore whether hospitalization was driving the associations we observed between insomnia symptoms and use of any health care service, we fit a logistic regression model with the same predictors in each model but substituted use of either home health care services or a nursing home (vs use of no services) as the outcome. In general, the directions of associations remained the same but decreased in magnitude and became marginally significant for one insomnia symptom in Model II and for both one and greater than or equal to two insomnia symptoms in Model III (data not shown).

To determine whether insomnia symptoms were associated with incident health service use, we repeated the earlier analyses after excluding individuals who reported use of any of the health services at baseline. Among individuals

Table 1. Participant Characteristics in the Health and Retirement Study (HRS) 2006 by Number of Insomnia Symptoms

	Total sample (N = 14,355)	Number of insomnia symptoms			
		0 (N = 8,441)	1 (N = 3,392)	≥2 (N = 2,522)	χ^2 Statistic
Demographics	N	N (%)*	N (%)*	N (%)*	p Value†
Age					<.001
55–64	4,579	2,744 (59.7)	1,007 (22.2)	828 (18.1)	
65–74	5,698	3,415 (59.0)	1,327 (23.9)	956 (17.1)	
75–84	3,061	1,747 (56.4)	756 (25.0)	558 (18.6)	
85 and older	1,017	535 (51.0)	302 (30.7)	180 (18.2)	
Gender					<.001
Male	5,974	3,718 (62.1)	1,394 (23.1)	862 (14.8)	
Female	8,381	4,723 (55.5)	1,998 (24.0)	1,660 (20.5)	
Race					.016
White	11,994	6,932 (57.9)	2,920 (24.1)	2,142 (18.1)	
Black	1,995	1,289 (64.1)	397 (19.7)	309 (16.2)	
Other	365	220 (59.7)	74 (21.7)	71 (18.6)	
Education					<.001
<High school	3,892	2,147 (53.7)	907 (23.1)	838 (23.2)	
High school diploma	6,954	4,068 (57.7)	1,658 (23.9)	1,228 (18.4)	
Some/completed college	2,241	1,394 (62.5)	547 (24.1)	300 (13.5)	
Graduate degree	1,268	832 (65.1)	280 (22.4)	156 (12.5)	
Health conditions					
Previous heart attack	323	162 (50.3)	75 (22.5)	86 (27.2)	.001
Stroke	1,258	669 (52.2)	272 (21.2)	317 (26.6)	<.001
Hypertension	9,122	5,182 (55.7)	2,200 (24.6)	1,740 (19.8)	<.001
Diabetes	3,326	1,816 (53.1)	826 (25.2)	684 (21.7)	<.001
Cancer	2,426	1,329 (54.3)	621 (25.5)	476 (20.2)	<.001
Osteoarthritis	5,575	2,900 (50.5)	1,439 (26.2)	1,236 (23.4)	<.001

Notes. *All percentages correspond to row totals and are corrected to account for complex sampling design and unequal probabilities of participant selection.
†p value corresponds to the χ^2 statistic corrected for the complex sampling design and unequal probabilities of participant selection.

Table 2. Association Between Number of Insomnia Symptoms and Subsequent Service Utilization

	Service use, n (%)	Model I,* OR (95% CI)	Model II,† OR (95% CI)	Model III,‡ OR (95% CI)
Hospitalization				
0 symptom	2,230 (23.8)	(ref)	(ref)	(ref)
1 symptom	1,082 (29.2)	1.28 (1.15, 1.43)	1.21 (1.08, 1.36)	1.18 (1.05, 1.32)
≥2 symptoms	924 (35.2)	1.71 (1.50, 1.96)	1.46 (1.26, 1.69)	1.33 (1.14, 1.55)
p value for trend		<.001	<.001	<.001
Home health care service				
0 symptom	684 (6.8)	(ref)	(ref)	(ref)
1 symptom	357 (9.1)	1.29 (1.09, 1.52)	1.21 (1.02, 1.43)	1.16 (0.98, 1.37)
≥2 symptoms	311 (11.2)	1.64 (1.32, 2.04)	1.37 (1.08, 1.72)	1.20 (0.94, 1.52)
p value for trend		<.001	.009	.138
Nursing home use				
0 symptom	419 (3.5)	(ref)	(ref)	(ref)
1 symptom	192 (3.9)	0.98 (0.75, 1.27)	0.94 (0.72, 1.24)	0.91 (0.69, 1.19)
≥2 symptoms	170 (5.3)	1.45 (1.10, 1.90)	1.29 (0.98, 1.69)	1.13 (0.85, 1.50)
p value for trend		.009	.073	.405
Any health service				
0 symptom	2,452 (25.6)	(ref)	(ref)	(ref)
1 symptom	1,187 (31.3)	1.28 (1.15, 1.41)	1.21 (1.09, 1.35)	1.17 (1.05, 1.30)
≥2 symptoms	1,011 (37.6)	1.72 (1.51, 1.95)	1.47 (1.28, 1.68)	1.32 (1.15, 1.53)
p value for trend		<.001	<.001	<.001

Notes: CI = confidence interval; OR = odds ratio; ref = reference.
N = 14,330–14,348 for Model I, N = 14,226–14,283 for Model II, and N = 14,266–14,283 for Model III.
All percentages and ORs account for the complex survey design and are weighted to make results nationally representative.
*Adjusted for age, gender, race, and education.
†Adjusted for same variables as Model I and for heart attack, stroke, hypertension, diabetes, cancer, and osteoarthritis.
‡Adjusted for same variables as Model II and depression.

reporting no health service use at baseline, 6,325 (62%) reported no insomnia symptoms, 2,335 (23%) reported one symptom, and 1,561 (16%) reported greater than or equal to two symptoms. Results followed a pattern similar to that described earlier (Supplementary Table 1).

Discussion

We examined the prospective association between insomnia symptoms and health service utilization in a large representative cohort of U.S. middle-aged and older adults. We found that a greater number of insomnia symptoms were associated with a greater odds of hospitalization, use of home health care services, nursing home use, and use of any of these services after controlling for demographic characteristics. A greater number of insomnia symptoms predicted hospitalization and use of any of the three health services after further adjustment for medical conditions and elevated depressive symptoms. Findings were similar after limiting our sample to participants reporting no service use at baseline.

The observed association between number of insomnia symptoms and use of health services extends prior evidence of this association in younger populations (6–9) to a nationally representative sample of middle-aged and older adults. Results suggest that insomnia is an important risk factor for greater health service utilization and presumably the poor health outcomes that necessitate these services. The assessment and recognition of insomnia by clinicians might help identify individuals at greater risk of hospitalization and other costly services. However, findings from this observational study cannot provide conclusive evidence for a causal relationship. Although a greater number of insomnia symptoms predicted future hospitalization after controlling for chronic health conditions and depression, we also found that the associations between the number of insomnia symptoms and use of home health care services and nursing home use were no longer significant after adjustment for these variables. Indeed, individuals who experience insomnia often have a poorer health status than individuals without insomnia (8). Thus, insomnia may simply be a marker of poor health status. However, it is also possible that insomnia exacerbates the severity of underlying health conditions resulting in increased service utilization (18,19).

It should also be noted that individuals who were lost to follow-up or were excluded from our sample had a greater likelihood of reporting more insomnia symptoms and greater use of all health services at baseline. Thus, selective attrition may have led to artificially low estimates of the association between insomnia and health service use; the true association may be higher than we observed.

More than 40% of older adults in our sample reported at least one insomnia symptom, consistent with prior studies showing insomnia to be highly prevalent in this population (1–3). In addition, if the association between insomnia symptoms and subsequent health service utilization is in fact causal, our findings suggest that by preventing insomnia in this population, we could see a 6%–14% decrease in health service use. Under this scenario, treating insomnia might decrease the patient load in many health care settings and lead to significant health care cost savings.

This study had several limitations. First, the HRS did not measure sleep apnea, which is associated with adverse health outcomes, including cardiovascular disease (20), cognitive impairment (21), and mortality (22), and may therefore be a significant cause of health service utilization. Because sleep apnea is associated with insomnia (23), observed associations between insomnia and health service use may have been driven in part by sleep apnea. Second, all data came from self-report. It is unclear how our results would have changed if we used objective measures of sleep, such as polysomnography or actigraphy, or subjective measures that better capture the variability in sleep patterns over time, such as sleep diaries. Third, the HRS did not assess the intensity or frequency of health service use, and the reasons for health service use were not assessed, limiting our ability to examine a direct relationship between insomnia symptoms and health service utilization. Finally, as in all observational studies, our results may be explained by confounders that were unmeasured or imperfectly measured. Although we controlled for potential demographic and clinical confounders, residual confounding by other health conditions may explain some of our results.

Despite these limitations, this study extends previous findings of an association between insomnia and health service utilization in clinical samples to a population-based sample of community-dwelling middle-aged older adults. Our findings suggest that, within this population, insomnia symptoms are associated with a greater use of costly health services. Results raise the question of whether treatment or prevention of insomnia would reduce costly health service utilization among middle-aged and older adults.

Supplementary Material

Supplementary material can be found at: http://biomedgerontology.oxfordjournals.org/

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