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Self-Reported Sleep Characteristics and Mortality Among Older Adults of Mexican Origin: Results from the Hispanic EPESE

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Abstract

BACKGROUND—Poor sleep quality has been linked to negative health outcomes among older adults, yet little data exist on how poor sleep affects health of older ethnic minorities.

DESIGN—Cross-sectional study involving a population-based survey.

SETTING—Hispanic Established Population for the Epidemiologic Study of the Elderly (H-EPESE) survey conducted in the southwestern United.

PARTICIPANTS—2,256 Mexican American men and women aged 65 years and older.

MEASUREMENTS—The association between self-reported sleep problems and mortality over a 15-year period in a population based sample of older Mexican Americans was examined. Using 5 waves of data (1993–2008): Hispanic Established Population for the Epidemiologic Study of the Elderly (H-EPESE), we used Cox proportional hazard models stratified by gender to model the risk of death as a function of chronic sleep problems.

RESULTS—Having any sleeping problems during the last month was associated with increased risk of mortality [hazard ratio (HR) = 1.14, 95% confidence interval (CI): 1.00, 1.29] in unadjusted models, though the association was attenuated after accounting for covariates.

CONCLUSIONS—The association between sleep and mortality was explained by similar factors in men and women: health behaviors, depressive symptoms, and health conditions. These factors

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are related to stress, and both factors may lead to poor sleep quality. Research is needed to better understand the factors moderating the relationship between sleep, mortality and gender.

Keywords

Mexican American; mortality; older adults; sleep

INTRODUCTION

Associations between duration and quality of sleep on health outcomes among adults have been well documented.¹⁻¹² Several epidemiological studies have shown a U-shaped relationship between sleep duration and mortality, with shorter than 7 and longer than 9 hours of sleep per night being associated with increased mortality.¹⁻⁶ With aging comes an increase in rates of sleep-related problems and both shorter and longer sleep duration are common.¹³⁻¹⁴ However, most research on the association between sleep and mortality has focused on sleep duration rather than sleep quality: feeling fatigued upon waking, waking frequently, or having problems falling asleep.^{1,3} Preliminary evidence suggests that poor quality of sleep may be a leading indicator of older adults at risk of premature death.³ A 22-year study of Finnish twins reported a significant association between sleep quality (sleeping fairly poorly or poorly) and increased mortality in young men; the association was not found in women, young or old.³ This finding raises several questions regarding potential gender and age differences in the impact of sleep quality on mortality.

Many questions remain unanswered about the relationship between sleep and mortality among older adults especially with regard to the connection between sleep characteristics and mortality. Many sleep studies have focused on non-Hispanic white and European adults and older adults.^{1-3,6,15} There is little information on how sleep characteristics affect mortality in other ethnic groups. For example, recent research shows that short habitual sleep has been associated with an increased risk of diabetes in non-Hispanic whites.¹⁶⁻¹⁷ While studies suggest that people of Mexican origin are at an increased risk for cardiovascular disease¹⁸ and obesity,¹⁹ both of which have been linked to sleep problems in other populations,^{6,10,20} no study, to our knowledge, has addressed possible differences in the relationship between sleep characteristics and mortality by gender among Hispanics.

In order to further understand the relationship between ethnicity, gender, sleep, and mortality, the present study will address the effects of 4 sleep characteristics (having trouble falling asleep, waking frequently, waking too early, and feeling fatigued after usual amount of sleep) on 15-year mortality among older adults of Mexican origin from the Hispanic Established Populations for Epidemiologic Studies of the Elderly (H-EPESE). Because of report of sleep differences in men and women, we stratify by gender. The primary research goal is to assess the effects of individual and total sleep characteristics on all-cause mortality in a population based sample of older adults of Mexican origin. This research will provide important information on a potentially modifiable risk factor for mortality in a rapidly growing older ethnic group in the United States.

METHODS

The study was approved by the university's institutional review board. This study used the Hispanic Established Epidemiologic Studies of the Elderly (H-EPESE). The H-EPESE is a population-based study of 3,050 non-institutionalized Mexican American individuals aged 65 and older at baseline (1993–94) from 5 southwestern states (Texas, California, New Mexico, Colorado, and Arizona). Baseline and five waves of follow-up data were collected between 1993 and 2007. The sample design was a multistage area probability sampling design modeled after the earlier EPESE studies from New Haven, East Boston, North Carolina, and rural Iowa.^{21–23}

Variables

Sleep characteristics included self report responses to 4 items on the survey.²⁴ These items were all phrased in the form: “How often in the past month did you ...?” The 4 specific domains of sleep were “have trouble falling asleep”, “wake up several times in the night”, “have trouble staying asleep”, and “wake up feeling tired or worn out after usual amount of sleep.” The response categories for each question were: “0” for not at all, “1” for 1–3 nights, “2” for 4–7 nights, “3” for 8–14 nights, and “4” for 15 or more nights. The score to the individual items was used as well as 2 categorical measures. The first categorical measure summed the responses across the 4 sleep characteristics (range 0–16). We then created categories of sleep problems from this summary score: none, low (1–4); medium (5–8), and high (greater than 8). Finally, the second categorical measure dichotomizes the responses into at least 1 night of difficulty for each sleep item compared to those respondents who did not report at least 1 night of sleep difficulty for each sleep item. We conducted a principal components analysis of the 4 sleep variables/domains. The 4 variables all loaded onto 1 factor, and the reliability was high (Cronbach's alpha = 0.88)

Other covariates included age, gender, marital status, nativity, educational attainment (highest grade), financial strain (0–3 scale, where “3” reflects a lot of problems in meeting monthly bills and “0” reflects no problems in meeting monthly bills), chronic conditions (prior heart attack, hypertension, arthritis and diabetes), depressive symptoms [Center for Epidemiologic Depression (CES-D) scale, 0–60, higher scores reflecting greater depressive symptoms²⁵], mini-mental state examination (MMSE), smoking (former/current/never), drinking alcohol (former/current/never), and Body Mass Index (BMI). Mortality was determined by death certificate lookup, and 1,319 (52%) of the survey participants died over the 15 years of follow-up. Only 2,526 of the original sample had complete data for all variables.

Analysis

Sample characteristics were calculated. Nelson-Aalen cumulative hazards of mortality were generated and plotted for the total sample and stratified by gender. Cox proportional hazards models were estimated accounting for covariates for total sample and stratified by gender based on findings from other research that suggests gender differences.³ In addition, we performed interactions between gender and each of the sleep response items and found a significant interaction for each item except for “staying asleep”. The models were repeated

for each measure of sleep. The models discussed above assessed the hazard of mortality as a function of baseline measure of characteristics. Respondents were right censored at date of last interview (wave 5) or if lost to follow-up. The Cox models were adjusted for sample design and clustering within census tracts. The proportional hazard assumption was tested using the scaled Schoenfeld residuals and the residuals were found to have a near zero slope. All analyses were performed using STATA version 10mp.²⁶

RESULTS

Table 1 presents the sample characteristics. The average age was 73 years, respondents were mostly female (58%) and married (56%). Mean educational attainment was less than 5th grade and 43% were immigrants. Demographics were similar for both men and women. More men reported a heart condition than did women (12% and 9%, respectively), while more women reported arthritis (49% compared to 28% in men) and hypertension (49% compared to 35% of men). Women also had higher scores on the CES-D than did men (10.83 and 7.67, respectively). More women reported having difficulty falling asleep (39% vs. 23% for men), waking in the night (50% vs. 39% for men), difficulty staying asleep (36% vs. 23% for men), and waking feeling tired (32% vs. 19% for men).

Figure 1 displays the plot of the Nelson-Aalen cumulative hazard function for the total sample and stratified by gender. In general, individuals who expressed at least 1 night of difficulty in each sleep domain (falling asleep, waking frequently, staying asleep and waking tired) had a higher hazard of mortality over time. This relationship holds for both men and women.

The results of Cox proportional hazards models estimating association of sleep characteristics at baseline on 15-year mortality, unadjusted and adjusted for covariates, in the total sample and stratified by gender are presented in Table 2. Self-reported sleep difficulty was associated with increased mortality only in the unadjusted model using at least one sleep difficulty in each sleep domain as a covariate in the full sample (HR 1.14, 95% CI 1.00–1.29) and the male stratified sample (HR 1.09, 95% CI 1.09–1.74). In both cases this increased hazard is no longer significant after the addition of health measures. The fully adjusted models for women showed a protective effect of 1–4 nights of sleep difficulty (HR 0.79 95% CI 0.66–0.95) and more than 8 night of difficulty sleeping (HR 0.68, 95% CI 0.52–0.88). However, models run without the health status measures (heart, hypertension, diabetes, arthritis, CESD and MMSE) did not show this reduced hazard and was not significant. In the dichotomous self-reported sleep model in men, an increased hazard was associated with age (HR 1.08 95% CI 1.07–1.10), smoking (HR 1.61 95% CI 1.29–2.03), hypertension (HR 1.23 95% CI 1.05–1.44) and diabetes (HR 1.87 95% CI 1.56–2.24). In these analyses we found a reduction in hazard associated with overweight (HR 0.76 95% CI 0.62–0.93) and current drinking (HR 0.75 95% CI 0.60–0.94). In the dichotomous models for women we found an increased hazard associated with age (HR 1.08 95% CI 1.06–1.09), nativity (HR 1.18 95% CI 1.00–1.38), underweight (HR 1.77 95% CI 1.24–2.53), smoking (HR 1.44 95% CI 1.11–1.86), hypertension (HR 1.29 95% CI 1.08–1.54), diabetes (HR 1.52 95% CI 1.31–1.76), and depression (HR 1.02 95% CI 1.01–1.03). We found a reduction in hazard for women in these models associated overweight (HR .081 95% CI 0.68–0.97),

obesity (HR 0.75 95% CI 0.61–0.91), current drinking (HR .068 95% CI 0.50–0.92), and increased cognitive function (HR 0.96 95% CI 0.94–0.98).

Sub analyses of the individual sleep items (not presented) showed an association between an increased hazard of mortality with self-reported difficulty staying asleep 8–14 nights (HR 1.68 95% CI 1.06–2.66) and waking tired 1–3 days (HR 1.41 95% CI 1.09–1.83) only for men in fully adjusted models. Difficulty falling asleep and difficulty staying asleep 15 or more nights were associated with a reduced hazard of mortality in the whole sample (HR 0.72 95% CI 0.57–0.89 and HR 0.77 95% CI 0.62–0.95 respectively) and for women (HR 0.59 95% CI 0.45–0.78 and HR 0.74 95% CI 0.56–0.98 respectively).

DISCUSSION

This research sought to assess the effects of individual and total sleep characteristics on all-cause mortality in a population based sample of older adults of Mexican origin. The majority of studies on sleep and mortality have focused on duration of sleep.^{1–9,11} These analyses focused on sleep quality and used self-response from surveys to define troubles and frequency of troubles in the quality of sleep of the respondents. The observed differences in hazard of death over time in the initial analyses do not appear large, although the hazard for men has a steeper slope. Additionally, the gap between the plots of the hazard functions in men broadens more rapidly. This suggests that men with sleep difficulties, as defined in this study, have a higher risk of death.

The Cox proportional hazards models lend some support to the simple unadjusted cumulative hazard. However, in the sample of men, only two survey items were connected with increased 15-year mortality: difficulty staying asleep and waking feeling tired compared to no problems in those domains. There does not appear to be a dose-response among the individual items.

When combining the sleep items into categories of sleep difficulty, a similar picture emerges. Consistently across the samples, having sleep difficulties across all domains was associated with an increased hazard of mortality in the **unadjusted** models for men, not women. This suggests that greater frequency of sleep problems and increased types of sleep problems are associated with mortality, but not necessarily the individual type of sleep problem in men. Counter to expectations, women having increased sleep difficulties appeared to be protective for mortality after accounting for covariates. While women may suffer from insomnia at 2 or 3 times the rate of men, men have higher rates of sleep apnea. Our study relied on self-report of sleep difficulties and had no way of capturing diagnosis of sleep apnea and what role it may play. It could also be that the partners sleep habits are affecting each other. That is, perhaps women are disturbed in their sleep by their partners more often than men and thus report a higher frequency of poor sleep, but the sleep they do get may be of good quality.

This evidence strongly suggests that sleep characteristics and problems affect mortality among men and women in this cohort differently. Findings on the gender differences in sleep characteristics and mortality are consistent with a recent study that showed self report

sleep quality was associated with increased risk of mortality for men only.³ In addition, in the same study, both short and long duration were associated with increased risk for mortality for men aged 55 years and older but not for women.

Our sample had a large proportion of immigrants (43%). Immigrants often show better health outcomes than the native born population. One intriguing possibility is that immigrants may experience better sleep patterns than their US born comparators. A recent study of NHANES data showed that Mexican immigrants were less likely to report symptoms of and outcomes related to poor sleep.²⁸ Our finding that the US born had a 15% higher hazard of death may be due to selection effects of the immigration process.

It is not surprising that diabetes was associated with a large increase in risk of mortality in our study: 52% higher for women and 85% higher for men. Also unsurprising was the impact of smoking on the risk of mortality with a 44% increase for women and 67% increase for men. One surprising finding was that the consumption of alcohol was strongly associated with a decrease in risk of mortality for women (25% lower) and men (32% lower). Another interesting finding was that increased cognitive function as measured by the MMSE was associated with a reduction in risk among women but not in men. This warrants further study.

There are several limitations to this research. First, we relied on self-report of sleep quality which may not accurately reflect true sleep quality. A related limitation is the relatively short recall period used for the assessment of sleep difficulties, 30 days may not be sufficient to capture truly chronic sleep problems. Additionally, our sample may not have been sufficiently large to accurately predict the effect of self-report of sleep difficulty on mortality and may explain why we found a protective effect for women who reported difficulty sleeping many nights a month.

Evidence linking sleep duration to mortality in large population based samples has been inconsistent, and there is very little evidence regarding sleep characteristics and mortality especially among the Mexican origin population. The current study suggests that, while there is a relationship between sleep characteristics and mortality, it is largely mediated by other factors - particularly overall health characteristics such as hypertension and diabetes. The modest association between depression and mortality in this study may be due to the association of depression with both mortality and sleep length.²⁷ The findings here are consistent with that hypothesis, though findings from another study examining sleep quality did not support it.³

In conclusion, there is an association between sleep problems and mortality among both men and women older adults of Mexican origin. The results from this study add to knowledge of the connection between sleep and mortality by investigating sleep characteristics in a rapidly growing older ethnic population. Further investigation is warranted in other populations on the link between sleep characteristics and mortality.

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Figure 1.

Cumulative Mortality Hazard Estimates by Sleep Characteristics (having one or more problems in each sleep domain compared to not having a problem in each domain) for the Hispanic Established Population for the Epidemiologic Study of the Elderly (H-EPESE) – 1993 – 2007, $n = 2,530$. Estimates for the entire sample (top panel), men (middle panel) and women (bottom panel).

Table 1

Characteristics of the H-EPESE Sample at Baseline (1993–94)

	Total (n =2526)	Women (n = 1465)	Men (n = 1061)	
	Mean (SD) or %, range	Mean (SD) or %, range	Mean (SD) or %, range	
Demographics				
Age	73.08 (6.20), 65–98	73.14 (6.30), 65–98	73.01 (6.05), 65–95	
Female	58			
Married	56.22	41.98	75.87	***
Highest grade completed	4.95 (3.89), 0–20	4.89 (3.80), 0–17	5.04 (4.02), 0–20	
Financial strain	1.60 (1.04), 0–3	1.64 (1.03), 0–3	1.56 (1.04), 0–3	
Born in U.S.	56.85	57.82	55.51	
Average follow-up (months)	109.88 (52.58), 0–178	114.84 (51.76), 0–178	103.02 (52.96), 0–174	***
Health conditions				
Heart condition	10.45	9.42	11.88	*
Diabetes	27.43	26.89	28.18	
Arthritis	40.58	49.35	28.46	***
Hypertension	43.19	49.08	35.06	***
CES-D	9.50 (9.34), 0–53	10.83 (9.48), 0–53	7.67 (8.26), 0–51	***
MMSE	25.30 (3.81), 11–30	25.22 (3.86), 11–30	25.42 (3.75), 13–30	
Health behaviors				
Body Mass Index	27.91 (5.27), 13–59	28.50 (5.76), 15–59	27.09 (4.38), 13–50	***
Current smoker	13.18	8.87	19.13	***
Former smoker	29.14	19.18	42.88	***
Current drinker	21.62	10.24	37.32	***
Former drinker	25.02	15.7	37.89	***
Sleep characteristics¹				
<i>Individual items</i>				
Difficulty falling asleep (nights in last month)				***
No problems	67.89	61.23	77.1	
1–3	14.81	17.41	11.22	
4–7	6.33	7.3	5	
8–14	2.93	4.03	1.41	
15+	8.04	10.03	5.28	
Waking frequently (nights in last month)				***
No problems	53.68	49.28	59.75	
1–3	18.8	20.07	17.06	
4–7	9.26	10.24	7.92	
8–14	4.28	4.85	3.49	
15+	13.97	15.56	11.78	
Difficulty staying asleep (nights in last month)				***
No problems	69.04	63.96	76.06	
1–3	11.92	13.24	10.08	

	Total (n = 2526)	Women (n = 1465)	Men (n = 1061)	
	Mean (SD) or %, range	Mean (SD) or %, range	Mean (SD) or %, range	
4–7	6.97	8.19	5.28	
8–14	4.2	5.32	2.64	
15+	7.88	9.28	5.94	
Waking feeling tired in last month				***
No problems	73	67.65	80.4	
1–3 days	12.23	14.4	9.24	
4–7 days	5.34	6.14	4.24	
8–14 days	2.93	3.48	2.17	
15+ days	6.49	8.33	3.96	
<i>Categories of sleep problems</i>				***
None	47.07	41.77	54.38	
Low	28.7	29.49	27.62	
Moderate	12.19	13.52	10.37	
High	12.03	15.22	7.63	
<i>Dichotomized sleep problems</i>				***
At least 1 day a month across all domains	17.58	22.05	11.4	

Differences reported between men and women:

*
p = 0.05,

**
p = 0.01,

p <= 0.001

¹
p-values represent overall differences within sleep categories not between levels

Abbreviations: H-EPESE, Hispanic Established Population for the Epidemiologic Study of the Elderly; SD, standard deviation; ADLs, Activities of daily living; CES-D, Center for Epidemiological Studies Depression Scale; MMSE, Mini-Mental State Examination.

Table 2

Cox Proportional Hazard Models Showing the Association of Categories of Sleep Difficulty (0, 1–4 night, 5–8 nights and >8 nights) in the Last Month and Having a Sleep difficulty in the Last Month at Least One Night in Each Domain with Mortality in the H- EPESE

	Whole Sample (n = 2,526)		Women (n = 1,465)		Men (n = 1,061)	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
1–4 nights	1.00	(0.89 – 1.13)	0.89	(0.75 – 1.05)	1.20	(0.99 – 1.45)
5–8 nights	1.08	(0.92 – 1.27)	1.08	(0.88 – 1.33)	1.19	(0.93 – 1.54)
More than 8 nights	1.07	(0.90 – 1.27)	1.10	(0.87 – 1.38)	1.24	(0.94 – 1.64)
Unadjusted*	0.92	(0.82 – 1.03)	0.79	(0.66 – 0.95)	1.08	(0.92 – 1.27)
1–4 nights	0.92	(0.78 – 1.08)	0.88	(0.71 – 1.09)	0.97	(0.76 – 1.24)
5–8 nights	0.81	(0.68 – 0.97)	0.68	(0.52 – 0.88)	1.07	(0.82 – 1.39)
More than 8 nights	1.14	(1.00 – 1.29)	1.16	(0.98 – 1.37)	1.38	(1.09 – 1.74)
At least one night in each domain	0.95	(0.82 – 1.09)	0.88	(0.72 – 1.06)	1.17	(0.91 – 1.49)
Adjusted [†]						

* Reference category 0 days in the last month

[†] Models adjusted for age, gender, marital status, nativity, chronic conditions, depressive symptoms, cognitive function, smoking, drinking, and BMI