

Epidemiology

Sleep Complaints Among Elderly Persons: An Epidemiologic Study of Three Communities

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Summary: The frequencies of five common sleep complaints—trouble falling asleep, waking up, awaking too early, needing to nap and not feeling rested—were assessed in over 9,000 participants aged 65 years and older in the National Institute on Aging's multicentered study entitled "Established Populations for Epidemiologic Studies of the Elderly" (EPESE). Less than 20% of the participants in each community rarely or never had any complaints, whereas over half reported at least one of these complaints as occurring most of the time. Between 23% and 34% had symptoms of insomnia, and between 7% and 15% percent rarely or never felt rested after waking up in the morning. In multivariate analyses, sleep complaints were associated with an increasing number of respiratory symptoms, physical disabilities, nonprescription medications, depressive symptoms and poorer self-perceived health. Sleep disturbances, particularly among older persons, oftentimes may be secondary to coexisting diseases. Determining the prevalence of specific sleep disorders, independent of health status, will require the development of more sophisticated and objective measures of sleep disturbances. **Key Words:** Sleep complaints—Insomnia—Aging—Epidemiology—Mortality.

Over half of the noninstitutionalized U.S. population aged 65 years and older report some chronic disruption of sleep that may arise from a variety of causes, such as retirement and changes in social patterns, death of a spouse, close friends or relatives, comorbidity, medication side-effects and changes in circadian rhythms (1-3). Although sleep problems are not typically life threatening, the sleep loss associated with these disturbances may contribute to increased risk of accidents, falls and chronic fatigue, and it may directly affect quality of life. Additionally, sleep disturbances have been cited along with dementia, frailty and incontinence as a reason for long-term care placement (4-6).

In this report, the epidemiology of sleep complaints in over 9,000 elderly persons was examined using the baseline and 3 years of follow-up data from the "Established Populations for Epidemiologic Studies of the Elderly" (EPESE), conducted by the National Institute

on Aging (NIA) (7). The prevalence of sleep complaints in three community-based cohorts was compared and analyzed in association with other measures of mental, physical and behavioral health and also with mortality and nursing home admission over a 3-year period of follow-up. The consistency of the results is discussed in relation to other epidemiologic studies of sleep complaints that usually had smaller and less representative samples of older participants.

METHODS

Participants

The EPESE began in 1982 with a combined enrollment of 10,294 persons, including 3,809 participants from East Boston, Massachusetts (84% response rate), 2,812 participants from New Haven, Connecticut (82% response rate) and 3,673 participants from Iowa and Washington counties, Iowa (80% response rate). The baseline questionnaires were administered by trained interviewers and averaged 70 minutes in length.

For this analysis, the study population was limited to those with in-person interviews only. Persons with

Accepted for publication February 1995.

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data obtained from a proxy (8%) and those from Iowa who responded by mail or telephone (9%) were excluded because sleep problems were not ascertained. Of those remaining, another 2% were dropped from analyses because responses to the sleep questions were incomplete or missing. Thus, the 9,282 participants represent 93%, 97% and 82% of the respective cohorts from the East Boston, New Haven and Iowa EPESE. Further details on the study population and additional baseline data from this collaborative study have been published elsewhere (3,8).

Measures

The baseline interviews from the three sites included a common core of questions that covered selected demographic characteristics, chronic conditions, physical disabilities, affective well-being, health behaviors and sleep problems. Regarding sleep complaints, participants were asked how often (rarely or never, sometimes or most of the time—weighted 0, 1 and 2, respectively) they 1) have trouble falling asleep, 2) have trouble with waking up during the night, 3) have trouble with waking up too early and not being able to fall asleep again, 4) get so sleepy during the day or evening they have to take a nap and 5) feel really rested when waking up in the morning. The question of feeling really rested was reverse-coded to define a complaint. Also, no reference period of time was given in these five questions.

Four measures of sleep disturbance were constructed from the responses to these questions. The sleep complaint score is the sum of the frequency responses to all five questions and ranges in severity from 0 (rarely or never have any complaint) to 10 (all complaints most of the time). Three other measures represented dichotomies for sleep-deprived syndromes. Difficulty initiating or maintaining sleep (DIMS) included those who reported at least one of the three night-time complaints as occurring most of the time. Subjectively assessed insomnia included those who reported trouble falling asleep and/or waking up too early and not being able to fall asleep again most of the time. Because nighttime awakening among older persons oftentimes may occur to void urine with no problem returning to sleep, insomnia differs from DIMS in that nighttime awakening is omitted from the criteria. Awakening not rested included those who reported that they rarely or never feel really rested when waking up in the morning.

Measures of affective well-being include self-perceived health status (SPHS), reported as excellent, good, fair or poor, a standardized depressive symptomatology score from the Center for Epidemiologic Studies Depression (CES-D) scale (9,10) and a cognitive function score based on a nine-item version of the short

portable mental status questionnaire (SPMSQ), with the score representing the number of errors (11).

Measures of physical health include a physical disability score that represents from 0 to 14 tasks with which help is needed in the activities of daily living (ADLs) or other tasks (8,12), the number of respiratory symptoms ranging from 0 to 4 (13), up to seven chronic conditions including hypertension, heart disease, cancer, stroke, diabetes, hip fracture and other bone fractures (7). We also computed each participant's body mass index (BMI) score (14).

Participants' smoking status was categorized as current, former or never smoked. Use of alcohol was defined as consumption of beer, wine or liquor in the previous month, in the previous year or not within the past year. To ascertain medication use, interviewers asked participants to present all prescription and over-the-counter (OTC) medications used in the past 2 weeks. The drug product name was recorded from the container label or provided by the respondent if the container was not presented. Product names were coded using an updated version of the Drug Products Information Coding System (DPICS) for prescription products and the Iowa Nonprescription DPICS for OTC products (15). Number of prescription and nonprescription drugs and use of sedative and/or hypnotic drugs were based on these codes.

Surveillance for death and nursing home admission was based primarily on data from annual follow-up interviews conducted briefly by telephone in the first and second years and in person again in the third year of followup. Mortality surveillance also included review of local obituaries, locally filed state records and the National Death Index. Death certificates were reviewed for any indication of residency in a nursing home as well (16).

Statistical methods

Tests for statistically significant trends in age- and sex-specific mean sleep complaint scores and prevalence rates were based on linear models of these cross-classified categorical data (17) using the Statistical Analysis Systems (SAS) CATMOD procedure (18). The sleep complaint score was assessed for association with demographic, health and behavioral characteristics by a least-squares general linear model in SAS (19). Odds ratios for insomnia and not feeling rested were computed using a multiple logistic regression model (20). Multiple logistic regression also was used to assess the odds for mortality and nursing home admission. Missing data on the CESD, BMI and SPMSQ measures were included as indicator variables in both the general linear and logistic regression models to adjust for this

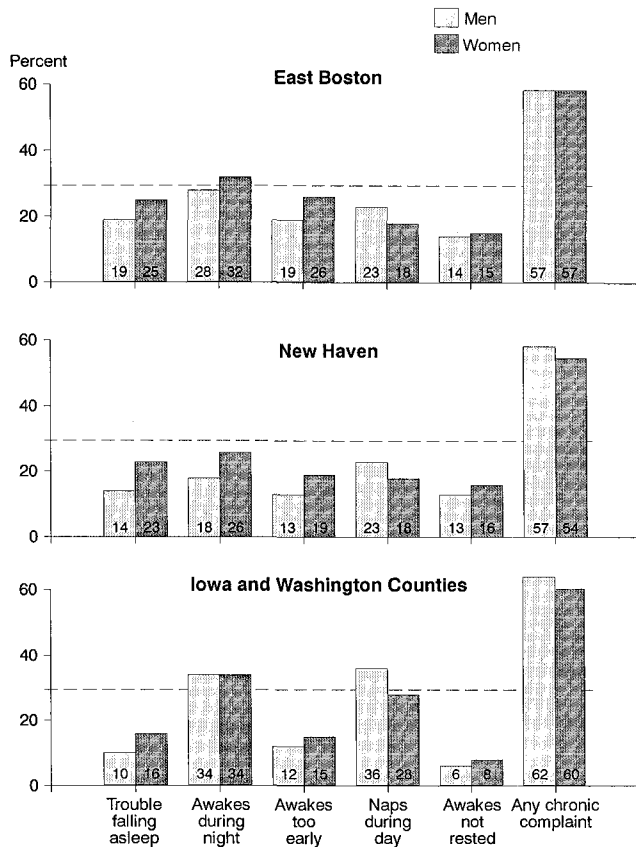


FIG. 1. Prevalence of five chronic sleep complaints among men and women in three communities.

effect rather than delete these observations from analyses.

RESULTS

Over half of the participants reported at least one chronic complaint in each community (Fig. 1). Although women were more likely to report nighttime complaints than men, they were less likely to nap during the day. Napping was more common in the Iowa community compared to the northeastern communities.

The average ages of each cohort did not vary by more than about a year from each other, and the variance estimates (not shown) were similar (Table 1). The average sleep complaint score generally increased with age and was significantly higher among women. DIMS was the most prevalent sleep-deprived syndrome in each cohort (35–40%), followed by symptoms of insomnia (23–34%). Insomnia was significantly higher among women in each cohort and increased with age in Iowa only. Awakening not rested was reported by about 15% of persons in East Boston and New Haven but only by 7% in Iowa. This complaint was not associated with age. The proportion with no complaints

(11% in East Boston, 17% in New Haven and 8% in Iowa) declined significantly with increasing age.

Across all sites, poorer self-rated health, elevated depressive symptomatology and increasing number of physical disabilities, respiratory symptoms and non-prescription medication were associated with a higher frequency of overall complaints as represented by the summary sleep score (Table 2). Use of prescription medications typically given to induce sleep or reduce anxiety was significantly associated with more complaints as well. BMI, however, was not associated with the overall frequency of sleep complaints in any of the cohorts even when using nonlinear terms for BMI. Number of chronic conditions, errors on the SPMSQ and current smoking were associated with scores for sleep complaints in two sites. Age remained as a significant effect in Iowa only. In New Haven, significantly lower complaint scores were reported on average among African-Americans in this cohort (18%).

Table 3 presents odds ratios for insomnia and for not feeling rested for all sites combined in association with demographic and health-related measures noted as most consistent across sites in Table 2. Continuous measures were dichotomized for these models. The physical disability measure was represented by two dichotomies, persons with and without limitations in the ADLs (walking across a small room, bathing, dressing, transferring from bed to chair, using the toilet, grooming or eating) and persons with and without limitations in ambulation (climbing stairs or walking half a mile).

Age was not associated with either insomnia or not feeling rested after adjusting for differences in health status. Among women, the odds for insomnia were almost 50% higher compared to men and yet women were no more likely than men to awake not feeling rested. Depressive symptomatology was the strongest correlate of these two sleep problems; persons in the top quintile of CES-D scores were two-and-a-half times more likely to have insomnia and to awake not feeling rested compared to those with lower scores. Respiratory symptoms such as chronic coughing, wheezing or phlegm increased the odds for these sleep disturbances by approximately 40%. Use of anxiolytic and barbiturate prescription medication was associated with nearly a two-fold increase in the odds for insomnia but only a one-third increase in the odds for awakening not feeling rested. Other measures, such as poor performance on the SPMSQ, comorbidity, use of non-prescription medication, limitations in activities of daily living and ambulation were only marginally associated with these two problems.

The impact of these health-related characteristics on the prevalence of sleep complaints is illustrated in Table 4. Persons with factors present are sequentially

TABLE 1. Average sleep complaint score and prevalence of sleep-derived syndromes by sex and community: EPESE 1982

	n	Average age	Average sum of complaints score	Difficulty initiating or maintaining sleep %	Insomnia %	Awakes not rested %	No complaints %
East Boston^a							
Total	3,537	73.3	3.71*†	45.2*	33.7*	15.0	11.0†
Men—all ages	1,343	72.9	3.35	41.7	29.4	14.2	12.4
Women—all ages	2,194	73.4	3.92	47.4	36.4	15.5	10.2
New Haven^{bc}							
Total	2,717	74.5	3.20*†	34.9*†	27.5*	15.0*	16.8*†
Men—all ages	1,128	73.9	2.82	29.1	21.2	13.2	20.5
Women—all ages	1,589	74.9	3.47	38.3	31.1	16.1	14.7
Iowa^d							
Total	3,028	74.4	3.41*†	45.3†	23.2*†	7.4	7.9†
Men—all ages	1,129	73.7	3.21	43.4	19.5	6.3	8.7
Women—all ages	1,899	74.8	3.53	46.4	25.4	8.1	7.5

^a Excludes persons with interviews by proxy (n = 191) and those with missing sleep data (n = 81).

^b Excludes persons with interviews by proxy (n = 55) and those with missing sleep data (n = 40).

^c Estimates are based on weighted data for the sample size shown.

^d Excludes persons with interviews by proxy (n = 250), telephone interviews (n = 206), abbreviated interviews (n = 120) or those with missing sleep data (n = 69).

Analysis of variance results: * indicates significant sex difference: $p < 0.05$; † indicates significant age trend for those 65–74, 75–84, and 85 years of age and over; $p < 0.05$.

TABLE 2. Multiple linear regression coefficients for selected health and behavioral measures associated with the summary sleep complaint score in three communities: EPESE 1982

Measure	East Boston (n = 3,512)	New Haven (n = 2,704)	Iowa (n = 3,001)
Demographics			
Women	0.031	0.460†	0.088
Years of age	–0.012	0.012	0.027†
Years of education	–0.059†	–0.011	–0.016
African-American	NA	–0.376†	NA
Mental health			
Self-perceived health	0.293†	0.272†	0.326†
CESD scale score	0.352†	0.357†	0.169†
MSQ errors	–0.040	–0.103†	–0.080*
Physical health			
No. of physical symptoms	0.114†	0.079†	0.077†
No. of respiratory symptoms	0.372†	0.332†	0.251†
No. of selected chronic conditions	0.158†	0.118*	0.038
Body mass index score	0.006	–0.005	–0.016
Behavioral health			
No. of OTC medications	0.113†	0.150†	0.141†
No. of prescription medications	0.030	0.067*	0.016
Use of anxiolytic/barbiturate prescription	0.368*	0.404*	0.307*
Use of alcohol in past month	0.142	0.350†	–0.004
Current smoker	–0.379†	–0.166	–0.408†
Former smoker	–0.001	0.122	–0.151
Model mean squares (df)	355.0 (19)	206.9 (22)	123.0 (19)
Error mean square (df)	4.4 (3,492)	4.6 (2,681)	3.5 (2,981)
F-value	79.8	44.6†	39.6†
Model R-square	0.30	0.27	0.18

* $p < 0.05$.

† $p < 0.01$.

NA Not applicable.

TABLE 3. Odds ratios for insomnia and awakening not feeling rested associated with demographic and health-related characteristics: 1982 EPESE

Characteristic n = 9,282	% With characteristic	Insomnia (29%) odds ratio ^a (95% CI)	Not rested (13%) odds ratio ^b (95% CI)
Age 75–84	33	1.06 (0.95–1.18)	0.98 (0.85–1.13)
Age 85 and over	8	1.04 (0.86–1.25)	1.03 (0.81–1.32)
Women	61	1.36 (1.23–1.50)	1.01 (0.88–1.16)
Fair or poor SPHS	36	1.20 (1.08–1.34)	1.47 (1.27–1.70)
>80th percentile depression score	20	2.53 (2.25–2.85)	2.45 (2.11–2.85)
>3 Errors on the SPMSQ	10	0.84 (0.71–0.99)	1.07 (0.88–1.31)
Any ADL limitation	11	1.17 (1.00–1.38)	1.13 (0.93–1.37)
Ambulatory limitation	25	1.12 (0.99–1.27)	1.23 (1.04–1.44)
Any respiratory symptom	32	1.39 (1.25–1.54)	1.42 (1.23–1.63)
Two or more selected diseases	33	1.16 (1.05–1.29)	1.13 (0.98–1.30)
Two or more OTC medications	24	1.22 (1.09–1.36)	1.06 (0.91–1.23)
Used anxiolytic/barbiturate prescription	7	1.80 (1.51–2.15)	1.34 (1.08–1.65)

^a Adjusted for missing data, not feeling rested and community in addition to all other variables shown.^b Adjusted for missing data, insomnia and community in addition to all other variables shown.

removed from the combined cohort, and the prevalences of sleep complaints are determined for the remainder. Among participants not in the upper quintile for depressive symptoms or not taking anxiolytics or barbiturates for example, there was a 12–38% reduction in the rates for the different types and combinations of these chronic complaints. Next removing participants with physical disability, then respiratory symptoms and less than excellent self-perceived health resulted in further reductions. Yet, among a very small group of 175 participants with no associated factors present (about 2% of all participants), over one-fourth had at least one chronic sleep complaint and about 8%

had subjective insomnia. This very select population was slightly younger compared to the entire cohort (age 71.6 years versus age 74.0 years, $p < 0.01$), which may account for some of the reduction.

In longitudinal analyses (Table 5) that examined sleep complaints and their association with 3-year mortality and nursing home admission (adjusted for age, sex, physical limitations and site), we found that napping was associated with a marginal increase in risk and that nighttime awakening was associated with a marginal decrease in risk. No significant associations were observed between specific complaints and nursing home admission.

TABLE 4. Prevalence of chronic sleep complaints in selected subpopulations of participants: EPESE 1982

Population	Type of sleep problem							Any chronic complaint
	Trouble falling asleep	Awakes during night	Awakes too early	Naps during day	Awakes not rested	Difficulty initiating or maintaining sleep	Insomnia	
All participants n = 9,282 (100%) average age = 74.0	19.2	29.7	18.8	24.6	12.7	42.7	28.7	56.9
Not depressed ^a n = 6,994 (75%) average age = 73.8	13.2	24.9	14.3	22.1	8.7	36.1	21.9	50.6
And no physical limitation n = 2,607 (28%) average age = 72.0	10.0	18.0	9.8	14.5	5.6	27.7	16.6	39.4
And no respiratory symptom n = 2,207 (24%) average age = 72.0	9.3	16.8	9.0	13.4	5.1	25.8	15.4	37.2
And excellent SPHS n = 679 (7%) average age = 71.7	7.4	16.5	7.4	11.9	2.7	24.3	13.4	33.9
And no other risk factors ^b n = 175 (2%) average age = 71.6	4.0	13.9	3.5	7.5	2.3	17.9	7.5	26.6

^a And not using an anxiolytic/barbiturate medication.^b Excludes those with any of the seven selected chronic conditions and those taking OTC medications.

TABLE 5. Odds ratio for mortality and nursing home admission by type of chronic complaint: EPESE 1982–1985

Type of sleep problem	3-Year mortality ^a (15%) ^b		3-Year institutionalization ^a (8%) ^b	
	Odds ratio	(95% CI)	Odds ratio	(95% CI)
Trouble falling asleep	1.07	(0.92, 1.24)	1.01	(0.82, 1.23)
Awakes during night	0.80	(0.70, 0.91)*	0.96	(0.80, 1.14)
Awakes too early	0.89	(0.76, 1.04)	1.15	(0.94, 1.40)
Naps during day	1.19	(1.05, 1.36)*	1.08	(0.90, 1.29)
Awakes not rested	1.08	(0.90, 1.28)	0.93	(0.74, 1.18)
Insomnia	0.98	(0.86, 1.12)	1.02	(0.85, 1.21)
Complaints score (0–10)	0.99	(0.96, 1.01)	1.00	(0.96, 1.03)

^a Adjusted for age, sex, community and number of physical limitations.

^b Percentage of total baseline study population.

* $p < 0.01$.

DISCUSSION

The EPESE project was established by the NIA in 1980 to produce estimates of the prevalence and incidence of various chronic conditions, impairments and disabilities and associated risk factors in older populations. Among over 9,000 persons surveyed in East Boston, New Haven and Iowa, 57% reported at least one chronic complaint as occurring most of the time, 29% reported chronic difficulty in initiating sleep or in early morning awakening (subjectively assessed insomnia) and 13% reported rarely or never feeling rested after waking up in the morning. Only 12% reported no sleep complaints. In multivariate analyses, these sleep disturbances were primarily associated with indications of poor health. No association was found with BMI, and advanced age generally was not associated with more frequent complaints after adjusting for health status; Iowa was the exception. The sustained age effect in Iowa may stem from the high prevalence of napping in this community and its strong association with age.

Data from previous studies of older populations (Table 6) show various prevalence rates for difficulty initiating sleep (DIS) ranging from 10% to 17%, difficulty

maintaining sleep (DMS) ranging from 27% to 33%, early morning awakenings (EMA) ranging from 13% to 17% and insomnia (INS) ranging from 19% to 38% (21–32). In the EPESE, the prevalences of DIS, DMS, EMA and INS are 19%, 29%, 18% and 28%, respectively. These data are remarkably similar considering the variety of study designs, populations sampled, age ranges and ascertainment methods. Of the three nighttime complaints, awaking during the night had the highest prevalence. In the older population, in particular, this condition oftentimes may be due to nocturia with no problem returning to sleep (33), which is why we excluded it from our criteria for insomnia. If this complaint is included, we would have estimated a prevalence of 43% for insomnia rather than 28%, similar to the 38% reported by Bixler and colleagues from their prevalence study in Los Angeles (23). For the older population, the true prevalence of insomnia probably lies between these two estimates.

Consistent with other studies, we found the reporting of nighttime sleep disturbances generally more frequent among women than men. Also, the frequency of these problems has few or no significant increasing trends with increasing age among noninstitutionalized persons 65 years of age and older. The middle-aged

TABLE 6. Prevalences of chronic sleep disturbances within older populations of men and women

Study (reference)	n	Ages	% DIS ^a	% DMS ^a	% EMA ^a	% INS ^a
Hammond, 1964 (21)	144,514	65+				23.5
Karacan et al., 1976 (22)	215 ^b	60+				23.0
Bixler et al., 1979 (23)	336	51–80	17.3	32.7	17.3	38.4
Karacan et al., 1983 (24)	285	65+	13	27	13	
Lugaresi et al., 1983 (25)	488	65+				38.0
Smirne et al., 1983 (26)	1,070	60+				19.0
Welstein et al., 1983 (27)	831	65–103				26.0
Mellinger et al., 1985 (28)	798	65–79				25.0
Morgan et al., 1988 (29)	1,023	65+				23.0
Ford and Kamerow, 1989 (30)	1,802	65+				19.3
Weyerer and Dilling, 1991 (31)	393	60+				24.9
Gislason et al., 1993 (32)	430	65–84	10.0	33.4	16.7	
EPESE	9,282	65+	19.2	29.7	18.8	28.5

^a DIS = difficulty initiating sleep; DMS = difficulty maintaining sleep; EMA = early morning awakening; INS = Insomnia.

^b Estimated.

population, however, is known to have significantly lower rates of nighttime complaints compared to the elderly population (22,24,25). Using larger and more representative populations of older persons, this study confirms associations found in previous reports between insomnia and self-perceived health, depression and respiratory symptoms (29,32,34–37). Although we observed an increased likelihood of sleep disturbances associated with OTC medication use, primarily aspirin and other analgesics that may contain caffeine, we found no association with number of prescription medications. Consistent with other studies, however, we found that use of anxiolytic and barbiturate ingredients, commonly prescribed to treat sleep problems, was associated with sleep complaints (28,38,39).

Because these associations between sleep complaints and mental, physical, and behavioral health derive from cross-sectional data, we are unable to make any causal inferences among complaints, chronic disease and medication use. Further longitudinal analyses of these data may help clarify some of these relationships. Although we expect that health problems contribute to sleep disturbances, sleep disorders that result in sleep deprivation may potentially affect health status.

In contrast to an earlier report with a similar length of follow-up but with different criteria for defining sleep disturbances (6), we found no association between insomnia and mortality or nursing home admission after adjusting for age, sex and physical disability. However, persons who reported getting so sleepy during the afternoon or evening that they had to take a nap had a slight but statistically significant increase in the odds for mortality [odds ratio = 1.17, 95% confidence interval (CI) = 1.03, 1.33]. This increased risk may be linked to the possible presence of sleep apnea, which is marked by excessive daytime sleepiness (40). The lack of association with nursing home admission may be due to the fact that the model does not adequately isolate circumstances in which sleep complaints predispose to institutionalization. Previous investigations that have shown an association have done so primarily in the context of a caregiver and care-receiver relationship (4,5). Care-receivers who disrupt the sleep of their caregiver, usually a spouse, are at increased risk of institutionalization.

We cannot explain the 20% reduction in mortality risk associated with nighttime awakening. We examined the use of diuretics, which may control hypertension but could lead to nocturia, as a possible explanation. Adjusting for diuretic use as well as the overall number of medications used failed to weaken this association.

Among older persons with apparently good health, 8% still suffered from insomnia and 2% awoke not rested. Whether this residual level of sleep disturbance

represents idiopathic difficulties due only to the process of aging or to unidentified psychosocial factors such as stressful relationships, recent retirement and loss of spouse or other family members remains to be clarified. Other studies have noted a low prevalence of sleep disturbances among older persons with good medical and psychiatric health (41,42).

Overall, these data suggest that a considerable proportion of sleep complaints among older people may be associated with chronic disease and other health problems that are more prevalent among elderly persons. Whether and the degree to which underlying age-related changes in sleep mechanisms contribute to these health conditions or vice versa needs to be established through further research.

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