

Prospective Data on Sleep Complaints and Associated Risk Factors in an Older Cohort

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Objective: The purpose of this study is to provide data on the prevalence of insomnia and hypersomnia among older persons, the stability of these sleep complaints over time, and factors associated with disturbed sleep, in particular age. **Method:** Data on symptoms of insomnia and hypersomnia were examined for the 1994 to 1995 cohort of the Alameda County Study. In addition to age, the effects of gender, education, marital status, chronic medical conditions, functional impairment, life events, financial strain, and mood disturbance were examined using multiple logistic analyses. **Results:** Prevalence in 1994 was 23.4% for insomnia and 6.8% for hypersomnia. There was moderate concordance between sleep complaints in 1994 and 1995 ($\kappa = .43$). There was a tendency for insomnia and hypersomnia to increase with age in 1995, but not in 1994. Only gender, mood disturbance, and chronic health problems predicted insomnia. Life events, mood disturbance, and chronic conditions predicted hypersomnia. Age, net of the effects of other factors, was not associated with risk of either insomnia or hypersomnia. **Conclusions:** The results contribute to the expanding body of evidence concerning the important roles of psychological and somatic dysfunction in sleep disturbance. Age in and of itself is not a risk factor for insomnia or hypersomnia. That is, after adjustment for an array of putative risk factors for sleep problems, it seems the association between sleep difficulties and age is primarily due to depressed mood and physical health problems. **Key words:** age, obesity, depression, prospective, epidemiology.

ADL = Activities of Daily Living.

INTRODUCTION

Sleep complaints are one of the more prevalent problems reported in epidemiological surveys that focus on well-being of older persons. Although prevalences of disturbed sleep exhibit considerable variability, largely due to differences in places and populations studied and procedures used, it is clear that the burden of such complaints represents a significant public health problem. In many studies, the prevalence of moderate-to-severe sleep complaints is in the range of 20% to 40% (1-5).

Several studies have reported lower prevalences, among which are those of Henderson et al. (6) (16%), Blazer et al. (7) (14%), Ford and Kamerow (8) (12%), and Bliwise et al. (9) (< 4%). On examination, these lower rates are typically the product of more stringent definitions of problematic sleep. Even so, most would agree that even prevalences of 4% to 12% represent a substantial public health burden.

A wide array of putative risk factors have been examined in an effort to clarify the epidemiology of

disturbed sleep. Detailed review of these diverse results is beyond the scope of this report. However, there has been significant commonality of focus across studies regarding the effects of four factors: age, gender, physical health, and mental health. In general, researchers have reported that women report more sleep complaints; that persons with greater numbers of and more severe somatic complaints report more sleep problems; and that persons with psychological dysfunction, particularly depression and anxiety, also report more sleep problems (1-8, 10-13). The role of aging in disturbed sleep is unclear. In his comprehensive review of sleep in normal aging, Bliwise (14) points out that evidence on the association between aging and problematic sleep is mixed. He notes that in samples of middle-aged and elderly persons, age per se often does not correlate with poor sleep.

The extent to which sleep complaints represent chronic symptoms, as opposed to more transitory states, and the effects of chronicity are little explored. There have been studies, albeit not many, and the results suggest that sleep complaints are relatively stable over time. The proportions reporting sleep complaints over multiple observation periods range from less than 10% to 50%, with most in the 30% to 50% range (3, 8, 11, 15-17). Only two of these studies focused on older subjects (3, 15). In general, these studies also provide evidence that chronic sleep problems greatly increase the risk of subsequently developing depression.

Given the paucity of data from prospective studies on the epidemiology of problematic sleep, particularly among older populations, our purpose is to provide additional data on the prevalence of insomnia and hypersomnia among older persons, the stability of these sleep

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SLEEP COMPLAINTS IN AN OLDER COHORT

complaints over time, and factors associated with disturbed sleep, in particular age.

The mental and physical health of a community sample in Alameda County, CA, has been studied for more than 28 years (7). In 1994, a fourth wave of data was collected on subjects 46 to 102 years of age. As part of this follow-up study, data on major depression were obtained using DSM criteria. Symptoms included insomnia and hypersomnia. In addition, extensive data on putative risk factors were collected, including data on social and physical functioning. In 1995, a follow-up survey was conducted.

Using data from the 1994 and 1995 surveys, we estimated prevalence and stability over time of symptoms of disturbed sleep in the Alameda County Study, and examined associated risk factors in a cohort 50 years old and older. We examined age trends in sleep complaints and the contribution of other putative risk factors: gender, marital status, socioeconomic status, physical health and disability, life stress, social support, and disturbed mood.

METHODS

Sample

The sample was drawn from the Alameda County Study, a longitudinal study of physical and mental health and mortality that has followed a cohort of 6928 persons selected in 1965 to represent the adult noninstitutionalized population of Alameda County, California. Subjects are observed regardless of subsequent location or disability status. Survivors have been interviewed in 1974, 1983 (50% sample), and 1994 with response rates of 85%, 87%, and 93%, respectively. More than 2000 of the subjects have died since 1965. Detailed design and sampling procedures for this study have been reported elsewhere (18, 19).

The 1994 follow-up sample included 2730 subjects aged 46 to 102 years who responded to the survey. This represented 93% of those still alive and available to participate ($N = 2935$) in 1994. All who completed a questionnaire in 1994 were contacted in 1995; of these, 2661 were relocated and 2570 (97%) completed a brief version of the 1994 questionnaire which focused primarily on health and functional status. The analyses reported here were based on a subsample ($N = 2380$) in which respondents were 50 years or older in 1994, had complete data on the measures of sleep disturbance in 1994 and 1995 and the risk factor measures in 1994, and were married, widowed, divorced or separated, or never married. There were actually 2504 subjects 50 years or older in 1995, but 112 of these had missing risk factor data and 29 were missing sleep data in 1994 or 1995. The 2380 represent 95% of eligible subjects. The mean age was 64.9 years (range 50–102, $SD = 10.2$).

Table 1 presents distributions for the 1994 survey for age, gender, marital status, and education. Fewer than 16% had less than a high school education, nearly 71% were married, slightly more than half were female, and about a third of the sample were 70 years old or older.

TABLE 1. Characteristics of the 1994–1995 Alameda County Study in 1994

Factor	N	%
Age (yr)		
50–59	879	36.9
60–69	695	29.2
70–79	582	24.5
80+	224	9.4
Gender		
Male	1037	43.6
Female	1343	56.4
Marital status		
Married	1682	70.7
Divorced/separated/widowed/never married	698	29.3
Education		
≥ 12 yr	2009	84.4
< 12 yr	372	15.6
Financial/problems		
No problems	1979	83.2
Any problems	401	16.8
Recent life events		
None	918	38.6
1	654	27.5
2	438	18.4
3+	370	15.5
Mood disturbance		
Low	1136	47.7
Moderate	744	31.3
High	500	21.0
Chronic conditions		
None	1006	42.3
1	696	29.2
2+	678	28.5
ADLs		
No problems	2142	90.0
Any problems	238	10.0

Measures

Sleep complaints are measured using two items that inquired whether respondents in the last 2 weeks had experienced “nearly every day” a) trouble falling asleep or staying asleep (insomnia) or b) sleeping too much (hypersomnia). The response categories were yes/no. These items were part of a larger set assessing the point (past 2 weeks) prevalence of major depressive episodes (20). Thus, our measure of sleep problems does not allow us to distinguish between acute and chronic sleep disturbance at baseline.

Risk factors (correlates) examined were age, gender, education, marital status, life stress (life events and financial strain), health status (problems with normal daily activities and chronic medical conditions), and mood disturbance. These factors can be categorized as status attributes, and psychosocial resources and stressors and are widely considered to be correlates of many types of psychological and behavioral dysfunction, including disturbed sleep (21, 22). Definitions of age, education, and marital status are shown in Table 1. We asked subjects about whether 17 life events had occurred in the current or previous year (1993). The total number of recent events was summed and categorized as none, one, two, or three or more. Financial strain consisted of five items that asked how many times there was not enough money: a) to buy clothes; b) to fill a prescription; c) to see a doctor; d) to pay rent or mortgage; and e) to buy food. We asked about the occurrence of 12 chronic medical

conditions (heart trouble, high blood pressure, asthma, chronic bronchitis, arthritis, emphysema, diabetes, stroke, cancer, cataracts, osteoporosis, and circulatory problems) in the last 12 months and whether a physician had been consulted. We also asked respondents whether they had difficulty with ADL: a) walking across small room; b) bathing; c) brushing hair or washing face; d) eating; e) dressing; f) moving from bed to a chair; g) using the toilet. Any difficulty on any item was classified as having a problem with ADLs.

Our measure of disturbed mood has been included in every wave of the Alameda County Study and its properties are well described (23, 24). Four items are from the negative affect subscale of the Affect Balance Scale: very lonely or remote from other people; depressed or very unhappy; bored; and too restless to sit long in a chair (25). The fifth item asks whether the respondent felt vaguely uneasy about something without knowing why. Response categories are "often," "sometimes," and "never." In 1994, coefficient α was .71 in this sample. For these analyses, we classified subjects into three levels of mood disturbance: low, 0–2; moderate, 3–4; and high, 5+.

Statistical Analysis

Prevalence of sleep complaints by age, gender, and marital status were calculated for hypersomnia, insomnia, and "any sleep complaints" and 95% confidence intervals (CI) were presented. χ^2 tests were used to test for differences among the comparison groups.

The concordance of sleep problems between 1994 and 1995 was examined using a simple κ statistic and 95% confidence limit.

Logistic regression was used to test associations between 1994 risk factors and 1995 (incident) sleep complaints, excluding people with sleep problems from the analysis. Prospective analyses of insomnia are made excluding those with insomnia at baseline, that is, with incident cases. Insomnia, hypersomnia, and any sleep problems were run in separate models.

RESULTS

Table 2 presents prevalence ratios and 95% CI in 1994 and 1995 for hypersomnia, insomnia, and any

(either or both) sleep complaint by age, gender, marital status, and education. χ^2 tests were used to test for differences. There was a tendency for sleep complaints to increase with age, although the pattern in 1994 was not as consistent as in 1995. In 1994, only for "any sleep complaint" was the association statistically significant. Women reported more insomnia and "any sleep problem" in both 1994 and 1995. The pattern of association for marital status was mixed as well. In general, lower education was not associated with any of the sleep complaints in 1994, nor with any complaint and insomnia in 1995.

Table 3 presents data on stability of sleep complaints over 12 months. There was moderate concordance between sleep disturbance in 1994 and 1995 ($\kappa = .43$). Insomnia was reported at both times by 13% and hypersomnia by 1.8%. By contrast, 18.2% reported one or both problems in 1994 and 1995. Of the 127 (5.3%) who reported hypersomnia in 1994, only 42 (33.1%) also reported it in 1995. Of the 683 (28.7%) reporting any sleep complaint in 1994, 433 (63.4%) did so again in 1995.

There was a slight tendency for stability of insomnia to increase with age, with those 70 years old and older reporting significantly greater concordance between 1994 and 1995 than those aged 50 to 69 years (data not shown). This was limited to insomnia. To illustrate, the test for equality of κ coefficients across age groups for 1994 to 1995 concordance was significant for insomnia ($p = .049$) but not for hypersomnia ($p = .93$). For example, among those aged 50 to 59 years, 51.9% reported insomnia in both 1994 and 1995, contrasted

TABLE 2. Crude Prevalence of Sleep Complaints, by Age, Gender, Marital Status, and Education: 1994 and 1995^a

Age (yr) in 1994	Prevalence 1994			Prevalence 1995		
	Hypersomnia	Insomnia	Any problems	Hypersomnia	Insomnia	Any complaint
50–59	6.0 (4.5–7.6)	23.1 (20.3–25.9)	27.5 (24.6–30.5)	7.1 (5.4–8.7)	23.0 (20.2–25.8)	27.5 (24.6–30.5)
60–69	5.5 (3.8–7.2)	21.0 (18.0–24.0)	25.6 (22.4–28.9)	5.2 (3.5–6.8)	23.9 (20.7–27.1)	27.1 (23.7–30.4)
70–79	8.4 (6.2–10.7)	25.1 (21.6–28.6)	32.0 (28.2–35.7)	10.3 (7.8–12.8)	28.2 (24.5–31.8)	35.4 (31.5–39.3)
80+	9.4 (5.6–13.2)	27.2 (21.4–33.1)	34.4 (28.2–40.6)	6.3 (3.1–9.4)	35.3 (29.0–41.5)	38.8 (32.5–45.2)
<i>p</i> value	.056	.170	.016	.005	.001	.001
Gender						
Male	6.0 (4.5–7.4)	19.8 (17.3–22.2)	24.3 (21.7–26.9)	7.2 (5.7–8.8)	20.9 (18.4–23.5)	26.0 (23.4–28.7)
Female	7.4 (6.0–8.8)	26.1 (23.8–28.5)	32.1 (29.6–34.6)	7.2 (5.8–8.6)	29.3 (26.9–31.8)	33.7 (31.2–36.3)
<i>p</i> value	.180	.001	.001	.993	.001	.001
Marital status						
Married	5.8 (4.7–6.9)	22.7 (20.7–24.7)	27.4 (25.3–29.5)	6.7 (5.5–7.9)	24.5 (22.4–26.5)	28.9 (26.7–31.1)
Not married	9.0 (6.9–11.2)	25.1 (21.9–28.3)	31.8 (28.4–35.3)	8.6 (6.5–10.7)	28.5 (25.2–31.9)	34.0 (30.4–37.5)
<i>p</i> value	.005	.204	.031	.097	.041	.015
Education						
≥ 12 years	6.5 (5.4–7.5)	22.8 (20.9–24.6)	27.9 (26.0–29.9)	6.9 (5.8–8.0)	24.2 (22.3–26.1)	28.8 (26.8–30.8)
< 12 years	8.4 (5.5–11.2)	26.7 (22.2–31.2)	32.9 (28.1–37.7)	8.9 (6.0–11.8)	33.7 (28.9–38.5)	38.8 (33.9–43.8)
<i>p</i> value	.184	.100	.052	.177	.001	.001

^a Point estimate (95% CI).

SLEEP COMPLAINTS IN AN OLDER COHORT

TABLE 3. Stability of Sleep Complaints, 1994 and 1995^a

Sleep Complaints, 1994	Sleep Complaints, 1995								Totals	
	None		Insomnia		Hypersomnia		Both			
	N	(%)	N	(%)	N	(%)	N	%	N	(%)
None	1407	(59.1)	214	(9.0)	56	(2.4)	20	(0.8)	1697	(71.3)
Insomnia	190	(8.0)	309	(13.0)	8	(0.3)	15	(0.6)	522	(21.9)
Hypersomnia	52	(2.2)	19	(0.8)	42	(1.8)	14	(0.6)	127	(5.3)
Both	8	(0.3)	9	(0.4)	6	(0.3)	11	(0.5)	34	(1.4)
Totals	1657	(69.6)	551	(23.2)	112	(4.7)	60	(2.5)	2380	(100)

^a Simple $\kappa = 0.429$ (0.394–0.465).

with 60.7% for those 80 years old and older. These results suggest that sleep complaints, particularly insomnia, become more chronic as age increases.

Table 4 presents odds ratios indicating risk for insomnia across nine putative risk factors. Two sets of

results are presented, crude incidences of insomnia in 1995 among persons without insomnia in 1994 and incidences adjusted for the effects of the factors. Crude incidences were higher for those 80 years old and older, for women, for the unmarried, for the less edu-

TABLE 4. Crude Odds Ratios and Adjusted Odds Ratios for Insomnia in 1995^a and Associated Risk Factors in 1994

Risk Factor, 1994	Insomnia			
	Crude odds ratio, 1995	95% CI	Adjusted odds ratio, 1995 ^b	95% CI
Age (yr)				
50–59	1.00		1.00	
60–69	1.06	0.77–1.47	0.91	0.65–1.29
70–79	1.06	0.75–1.50	0.77	0.52–1.14
80+	2.05	1.34–3.13	1.25	0.76–2.06
Gender				
Male	1.00		1.00	
Female	1.66	1.27–2.17	1.58	1.19–2.10
Marital status				
Married	1.00		1.00	
Divorced/separated/widowed/never married	1.32	1.00–1.74	1.02	0.75–1.38
Education				
≥ 12 yr	1.00		1.00	
< 12 yr	1.60	1.15–2.23	1.30	0.91–1.86
Financial problems				
No problems	1.00		1.00	
Any problems	1.20	0.85–1.70	0.85	0.58–1.25
Recent life events				
None	1.00		1.00	
1	1.19	0.87–1.63	1.18	0.85–1.65
2	0.88	0.60–1.30	0.86	0.58–1.29
3+	1.09	0.73–1.62	1.01	0.66–1.54
Mood disturbance				
Low	1.00		1.00	
Moderate	1.27	0.94–1.73	1.32	0.96–1.81
High	1.55	1.32–1.83	1.50	1.26–1.79
Chronic conditions				
None	1.00		1.00	
1	1.60	1.15–2.23	1.56	1.11–2.20
2+	2.77	2.02–3.79	2.43	1.70–3.45
ADLs				
No problems	1.00		1.00	
Problems	2.23	1.52–3.28	1.45	0.95–2.22

^a N = 1824; excludes people with insomnia in 1994.

^b All variables added simultaneously.

cated, for those with greater mood disturbance, and for those with one or more chronic conditions and ADL problems. Multiple logistic regression results were somewhat different: only women, those with mood disturbance, and those with one or more chronic conditions were at significantly greater risk for insomnia. The multivariate results suggest the crude odds ratio for age, for example, can be attributed to the effects of the other covariates, in particular the effects of mood disturbance and chronic health problems. It seems that the group 80 years of age or older experiences mood disturbance and chronic health problems more than the younger age groups and that confounding with these risk factors is the explanation for the decreased association with age.

Table 5 presents the same set of analyses for hypersomnia. The results of analyses of crude incidence

data were somewhat different from those for insomnia—only those with three or more life events, high mood disturbance, two or more chronic conditions, and ADL problems were at increased risk for hypersomnia. Multiple logistic regression analyses additionally eliminated ADL problems, leaving only life events, mood disturbance, and chronic conditions as risk factors for hypersomnia.

Table 6 presents a similar set of analyses for “any sleep problem” (insomnia and/or hypersomnia). Univariate analysis results closely parallel those for insomnia. That is, those 70 years old and older, women, the unmarried, the less educated, and those with mood disturbance, chronic conditions, and ADL problems all were at increased risk. Multivariate results reduced the significant predictors to only three: mood disturbance, chronic conditions, and ADL problems.

TABLE 5. Crude Odds Ratios and Adjusted Odds Ratios for Hypersomnia in 1995^a and Associated Risk Factors in 1994

Risk Factor, 1994	Hypersomnia			
	Crude odds ratio, 1995	95% CI	Adjusted odds ratio, 1995 ^b	95% CI
Age (yr)				
50–59	1.00		1.00	
60–69	0.65	0.38–1.13	0.62	0.35–1.10
70–79	1.41	0.88–2.27	1.30	0.75–2.26
80+	0.74	0.33–1.68	0.61	0.25–1.50
Gender				
Male	1.00		1.00	
Female	0.83	0.55–1.24	0.75	0.49–1.14
Marital status				
Married	1.00		1.00	
Divorced/separated/widowed/never married	1.20	0.78–1.85	1.16	0.73–1.84
Education				
≥ 12 yr	1.00		1.00	
< 12 yr	1.15	0.68–1.97	0.99	0.56–1.76
Financial problems				
No problems	1.00		1.00	
Any problems	1.47	0.90–2.42	1.16	0.67–1.98
Recent life events				
None	1.00		1.00	
1	0.70	0.40–1.23	0.72	0.42–1.27
2	0.83	0.45–1.53	0.83	0.44–1.54
3+	1.91	0.14–3.18	1.80	1.05–3.11
Mood disturbance				
Low	1.00		1.00	
Moderate	1.55	0.96–2.51	1.53	0.94–2.49
High	1.49	1.16–1.92	1.37	1.06–1.79
Chronic conditions				
None	1.00		1.00	
1	1.57	0.94–2.62	1.52	0.90–2.56
2+	2.12	1.30–3.46	1.86	1.07–3.23
ADLs				
No problems	1.00		1.00	
Problems	2.14	1.23–3.74	1.52	0.83–2.80

^a N = 2219; excludes people with hypersomnia in 1994.

^b All variables added simultaneously.

SLEEP COMPLAINTS IN AN OLDER COHORT

TABLE 6. Crude Odds Ratios and Adjusted Odds Ratios for Insomnia or Hypersomnia^a in 1995 and Associated Risk Factors in 1994

Risk Factor, 1994	Any Problems			
	Crude odds ratio, Problems, 1995	95% CI	Adjusted odds ratio, 1995 ^b	95% CI
Age (yr)				
50-59	1.00		1.00	
60-69	0.98	0.71-1.35	0.83	0.59-1.17
70-79	1.27	0.91-1.77	0.92	0.63-1.34
80+	1.83	1.19-2.81	1.07	0.65-1.78
Gender				
Male	1.00		1.00	
Female	1.34	1.03-1.73	1.27	0.97-1.67
Marital status				
Married	1.00		1.00	
Divorced/separated/widowed/never married	1.29	0.98-1.69	1.03	0.76-1.39
Education				
≥ 12 yr	1.00		1.00	
< 12 yr	1.51	1.08-2.09	1.25	0.87-1.79
Financial problems				
No problems	1.00		1.00	
Any problems	1.19	0.84-1.70	0.86	0.58-1.26
Recent life events				
None	1.00		1.00	
1	1.04	0.76-1.41	1.04	0.75-1.44
2	0.73	0.50-1.07	0.72	0.48-1.08
3+	1.26	0.87-1.83	1.22	0.82-1.81
Mood disturbance				
Low	1.00		1.00	
Moderate	1.35	1.00-1.82	1.43	1.05-1.94
High	1.67	1.42-1.97	1.65	1.39-1.96
Chronic conditions				
None	1.00		1.00	
1	1.78	1.30-2.45	1.77	1.27-2.45
2+	2.97	2.18-4.05	2.65	1.87-3.75
ADLs				
No problems	1.00		1.00	
Problems	2.51	1.68-3.76	1.64	1.05-2.54

^a N = 1697; excludes people with any sleep problems in 1994.

^b All variables added simultaneously.

DISCUSSION

Among members of this aging cohort, the prevalence of insomnia was 23.4% in 1994. The prevalence of hypersomnia was much lower, at 6.8%, whereas 28.7% reported one or more of the sleep complaints in 1994. How do our results compare with those from other studies?

Morgan (1) reviewed results of six studies that presented data on older adult populations (most were 65 years old or older). He concluded that between 20% and 40% of noninstitutionalized elderly people living at home experience disturbed or poor quality sleep, ranging from moderate to severe. Since that review, other studies have reported the prevalence of sleep disturbance in community samples of older persons. In several of these, prevalences ranged between 20% and 45% (2-5). Prevalences in our study of any sleep

problem of 28.7%, of insomnia 23.4%, and of hypersomnia 6.8% are at the lower range of these estimates, but within these ranges, nonetheless.

Several studies have reported lower prevalences of sleep disturbance. Henderson et al. (6) reported a prevalence of 16% for persistent insomnia in a sample aged 70 years and older. Insomnia was defined as trouble sleeping nearly every night for the past 2 weeks. Using data for a sample aged 50 to 65 years, Bliwise et al. (9) reported very low prevalences of trouble falling asleep (1.1%-2.6%) and early morning awakening (3.3%-4.4%). To meet criteria, subjects must report that the sleep problem occurred every night or almost every night for the past month. Blazer et al. (7) reported prevalences of 14.8% for trouble falling asleep, 26.6% for wakeful sleep, and 14.3% for early morning awakening in a community sample of nearly 4000 aged 65

years and older. Ford and Kamerow (8) reported a prevalence of insomnia of 12% among their sample aged 65 years or older. Insomnia was defined using DSM-III criteria for a major depressive episode, including exclusions for sleep problems related to physical illness. Ohayon (26), using DSM-IV diagnostic criteria for sleep problems, reported that 18.6% of a national sample from France had insomnia complaints. Only 5.6% of the sample received a primary diagnosis of a sleep disorder. In a second study, Ohayon et al. (27) used data from a national survey of the United Kingdom and reported that symptoms of insomnia occurred in 36.2% of the subjects. Subjects with one or more insomnia complaints who were dissatisfied with their sleep represented 8.7% of the sample.

In our sample, insomnia seemed to be more chronic than hypersomnia, with almost 60% of those reporting insomnia in 1994 also reporting that problem in 1995. The comparable rate of concordance for hypersomnia was 33%. There was a significant tendency for stability of insomnia, but not hypersomnia, to increase with age.

There have been few prospective studies of changing patterns of sleep complaints among samples of older subjects. Using data from almost 8000 subjects from the Epidemiologic Catchment Area study, Ford and Kamerow (8) reported that only 31% of those who met criteria for insomnia at baseline had insomnia 1 year later. Breslau et al. (13) reported that 45% of young adults with a lifetime history of insomnia also reported insomnia at follow-up 3 years later, compared with 27.5% of persons with a lifetime history of hypersomnia. Rodin et al. (15) reported significant stability of sleep complaints in a study of older subjects assessed up to eight times over a 3-year period. For example, 22.7% reported one or more sleep complaints at all eight assessments and 34.1% on six or more assessments. In a study of subjects aged 65 years and older, Livingston et al. (3) found that 51.4% of those reporting sleep disturbance at baseline also reported sleep problems at follow-up 2 years later. In one of the few long-term, prospective studies, Klink et al. (11) found that 10 to 12 years after baseline the rate of complaints of initiating and maintaining sleep was more than twice as high among subjects with previous insomnia in comparison with those without previous insomnia (56.4% vs. 23.7%). Hohagen et al. (16) conducted a three-wave survey in which respondents (aged 18–65 years) were followed up at 4 months and again 2 years later. Over the entire study period, 42% reported severe insomnia at all three assessments. Among those with severe insomnia at baseline, 75% still suffered from moderate or severe insomnia at T_2 and 52% of these continued at T_3 . Retrospectively,

42% with severe insomnia reported they had the problem for more than 5 years. Vollrath et al. (17) assessed young adults three times over a 7-year period and reported that 16% had some form of insomnia at all three assessments. When only the more severe cases were included, this decreased to 5%. There was a significant lack of stability over time in terms of the specific type of insomnia (continued, repeated brief, occasional), but moderate stability for insomnia in general.

Examining associated factors in our data, multivariate analyses revealed that women, those with mood disturbance, and those with more chronic health problems in 1994 were at greater risk of developing insomnia. Age was not a significant predictor of risk of future insomnia net of the effects of the other putative risk factors examined. For hypersomnia, the significant predictors of future hypersomnia were life stress (life events), mood disturbance, and chronic health problems. Gender was not a significant predictor of hypersomnia, nor was age. When we examined the correlates of any sleep complaint (insomnia or hypersomnia, or both), only mood disturbance, chronic health problems, and functional impairment were significant predictors. Again, neither age nor gender predicted future sleep complaints.

The results of our multivariate analyses of predictors of future sleep problems clearly demonstrate the important roles of psychological and somatic dysfunction. For insomnia, hypersomnia, or "any sleep complaint," only mood disturbance and chronic health problems were consistent risk factors.

A growing number of studies have found sleep problems to be strongly associated with physical health problems, both cross-sectionally and prospectively (2–7, 11, 13, 15). Results from large, epidemiological studies suggest that there may be substantial future health risks for hypersomnia (14, 28). In one study, those who reported sleeping substantially more were at almost twice the risk of dying in the follow-up period (14). In the other, both short and long sleepers had excess mortality at follow-up, but two-thirds of the excess deaths were found among those reporting hypersomnia (28). As these authors suggest, hypersomnia may be an indicator of underlying physiological dysfunction that is reflected over time in excess risk of death. There also is a growing body of evidence from epidemiological studies that demonstrates a close link between sleep problems and psychological dysfunction, particularly depression and anxiety (2–8, 13, 15, 17).

Sleep problems generally are believed to increase with age, but epidemiological evidence on this point is mixed, at best. We found that hypersomnia was unre-

SLEEP COMPLAINTS IN AN OLDER COHORT

lated to age and that insomnia was unrelated to age, net of the effects of mood disturbance and physical health problems. Three studies using prospective data report no association between age and sleep complaints (3, 8, 15). On the basis of cross-sectional data, three studies have found no association between age and sleep complaints in multivariate analyses (4, 6, 7).

Thus, our results and those from several other studies suggest that increasing age is not a risk factor for insomnia or hypersomnia. That is, after adjustment for an array of putative risk factors for sleep problems, it seems that the presumed association between sleep difficulties and age primarily is due to the effects of depressed mood and physical health problems. Blizewicz (14) has reached the same conclusion, noting that there is increasing evidence pointing to the role of medical diseases and chronic illness in much of the poor sleep seen in old age.

Sleep problems also have been widely reported to be more prevalent among women. We found that gender prospectively predicted insomnia, net of the effects of other factors. However, there was no gender effect for hypersomnia nor for "any sleep complaint." Few other studies have prospectively addressed the role of gender. Rodin et al. (15) reported that women complained of more sleep problems, particularly insomnia. Livingston et al. (3) also found women to have higher rates of disturbed sleep. Hohagen et al. (16), however, found increased risk of insomnia among women only for more severe insomnia. Klink et al. (11) found women to be at greater risk of insomnia, even after multivariate analyses. However, Breslau et al. (13), found no excess risk among women for either insomnia or hypersomnia. Women were at greater risk prospectively only for insomnia plus hypersomnia. (The sample was 21–30 years of age.)

Regarding age and gender as risk factors for sleep complaints, we suggest that the evidence available thus far suggests three conclusions: First, the crude prevalence of sleep problems, particularly various forms of insomnia, seems to be higher among women and older subjects. Second, adjusting for the effects of other factors, particularly psychological and somatic dysfunction, largely eliminates age effects, and in some cases, gender effects. Third, when results of cross-sectional and prospective studies are compared, even bivariate associations of age and gender with sleep complaints observed in cross-sectional studies seem to be attenuated and sometimes eliminated in prospective analyses.

Like all field studies, the nature of the Alameda County Study imposes certain limitations on analysis and interpretation of the data. First, and foremost, our measure of disturbed sleep is not comprehensive. Al-

though we were able to examine both hypersomnia and insomnia, we were not able to examine different dimensions of the latter. For example, we did not have separate data on the difficulty of initiating and maintaining sleep or on early morning awakening. The latter has been implicated in risk of depression in adult samples (13, 15).

As noted earlier, our sleep items assessed whether subjects had experienced disturbed sleep (insomnia, hypersomnia) almost every day in the past 2 weeks. The items were a subset of DSM-IV diagnostic criteria for a major depressive episode. Thus, our results are limited in that we were not able to partition our sample into those with acute versus chronic sleep problems. In their epidemiological study performed in the United Kingdom, Ohayon et al. (27) found that the median duration of insomnia symptoms was 24 months. We could not examine whether risk factor profiles differed for those with sleep disturbance of shorter and longer duration, although it might be expected that the role of comorbid somatic and psychiatric problems would be more pronounced for chronic sleep problems (29).

Another obvious limitation is that we did not have objective data on disturbed sleep. That is, we did not have physiological parameters on sleep generated by procedures such as electroencephalography (EEG). Although such measures are desirable, to date they have not been regularly incorporated into community-based, epidemiological studies. Thus, although such data would be useful to have, self-reports and interview-based measures remain the measures most widely used in community surveys. Our study was no exception.

Thus far, there have been few community-based, prospective studies of the epidemiology of disturbed sleep that have examined a broad array of putative risk factors. More are needed if we are to better understand sleep and its role in health. Sleep disorders are diverse, and future research efforts need to focus on better understanding of specific sleep syndromes (20). Prevalences of various sleep problems seem to be quite different, suggesting that risk factors may be different as well.

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