An Epidemiological Study of Insomnia Among the Japanese General Population

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Abstract: The study examined the prevalence and correlates of insomnia in a representative sample (n=3030) from the general population of Japan. Using a structured questionnaire, we found that the overall prevalence of insomnia during the preceding month was 21.4%, including difficulty initiating sleep (DIS: 8.3%), difficulty maintaining sleep (DMS: 15.0%), and early morning awakening (EMA: 8.0%). Multiple logistic regression analysis showed that older age, being unemployed, lack of habitual exercise, poor perceived health, psychological stress, and being unable to cope with stress were associated with an increased prevalence of insomnia. These findings indicate that the prevalence of insomnia in the general population of Japan is comparable to that reported in Western countries, and that insomnia is associated with multiple psychosocial factors.
Key words: Insomnia; epidemiology; psychosocial factor; Japan

INTRODUCTION

SLEEP DISORDERS, ESPECIALLY INSOMNIA AND EXCESS DAYTIME SLEEPINESS, ARE COMMON COMPLAINTS. They are associated with an increased risk for various physical and/or psychiatric disorders as well as accidents.[1-7] Previous general population studies in Western countries have estimated that the prevalence of sleep disorders ranges from 10% to 42%.[2,8-10] The considerably large variance in prevalence seems to be due to methodological differences, including case definition, case assessment, duration of sleep disruption, and target population. Although two studies of sleep disorders have been carried out in Japan, the populations were specific and generally small.[3,6] Therefore, the epidemiology of sleep disorders among the Japanese general population remains unclear.

Many studies in Western countries have examined the risk factors for sleep disorders, including age, sex, socioeconomic status, life habits, and psychological factors.[1,2,4,5,8,10,11-20] Although the risk factors examined were not identical from study to study, it seems that social and cultural characteristics may affect the risk factors for sleep disorders.

Here, we document an epidemiological study of sleep disorders in a large sample from the general population of Japan. The aims of the study were: 1) to estimate the prevalence of sleep disorders; 2) to examine age and sex differences in the occurrence of sleep disorders; and 3) to determine the association of sleep disorders with psychosocial factors.

METHODS

Subjects & Procedure

The present study was part of a national survey (Attitudes to Personal Health Maintenance in Japan) conducted by the Japan Health Promotion and Fitness Foundation between February 1 and March 30, 1997. The aim of the national survey was to provide useful guidelines for future planning of personal health care programs. The sample was drawn from respondents to the 1996 census in Japan. Four thousand individuals were selected using a two-stage stratified random sampling method. First, the country was divided into five geographical regions: north, east, middle, west, and south. Next, a big city (population >1,000,000), a middle-sized city (population >150,000), a small city (population <150,000), and a town or village were drawn randomly from each target region. A total of 4,000 subjects aged 20 years or older were selected randomly from the house register in the targeted cities, towns, and villages with a sampling ratio of 4/100,000 proportional to the general adult population.

Table 1—Demographic characteristics of survey sample and the Japanese population

Characteristic	Sample (%)	Population (%)
Sex		
Male	48.9	48.4
Female	51.1	51.6
Age group		
20-29	15.3	19.5
30-39	17.3	16.1
40-49	22.6	20.2
50-59	19.6	17.0
60-69	16.4	14.5
>70	8.8	12.7
Total number	"3,030"	"97,932,000"

We sent the subjects a letter containing information about the purpose of the survey and a request to participate. After the subjects had given their informed consent, they were interviewed in their homes by well-trained interviewers who had already participated in several national health surveys. Finally, 3,030 subjects were interviewed, giving a response rate of 75.8%. The sociodemographic characteristics of the sample are shown in Table 1.

Measures

A structured questionnaire was developed, which asked about sociodemographic characteristics and contained 52 individual questions focusing on health attitudes, health behavior, lifestyle, and sleep. The following three questions about insomnia experienced during the previous month were embedded in the questionnaire:

1. "Do you have difficulty falling asleep at night?" (difficulty initiating sleep; DIS)
2. "Do you wake up during the night after you have gone to sleep?" (difficulty maintaining sleep; DMS)
3. "Do you wake up too early in the morning and have difficulty getting back to sleep?" (early morning awakening; EMA)

Each question had five possible replies: "never," "seldom," "sometimes," "often," and "always." "Often" and "always" were taken as an affirmative answer to the ques-

Table 2—Association of insomnia with sociodemographic, lifestyle, and psychological factors

INSOMNIA (INS)

Variables	INS			Crude		Adjusted[a]	
	N	NO.	%	OR	95%CI	OR	95%CI
Age							
Younger (20-39)	986	178	18.1	1.0			
Middle (40-59)	1278	242	18.9	1.1	0.9-1.3	1.1	0.9-1.3
Older (60 and over)	766	226	29.5	1.9	1.5-2.4**	2.1	1.6-2.7**
Occupation							
Employed	2051	395	19.3	1.0			
Unemployed	979	251	25.6	1.4	1.2-1.7**	1.2	1.0-1.5*
Habitual exercise							
Yes	836	144	17.2	1.0			
No	2194	502	22.9	1.4	1.2-1.8**	1.3	1.0-1.6*
Enough leisure time							
Yes	2206	450	20.4	1.0			
No	824	196	23.8	1.2	1.0-1.5*		
Life satisfaction							
Yes	2320	452	19.5	1.0			
No	710	194	27.3	1.6	1.3-1.9**		
Perceived health status							
Good	2362	403	17.1	1.0			
Poor	668	243	36.4	2.8	2.3-3.4**	2.1	1.7-2.6**
Psychological stress							
No	1376	219	15.9	1.0			
Yes	1654	427	25.8	1.8	1.5-2.2**	1.8	1.5-2.2**
Being able to cope with stress							
Yes	2562	500	19.5	1.0			
No	468	146	31.2	1.9	1.5-2.3**	1.4	1.1-1.8**

Note: OR, odds ratio ; CI, confidence interval
a , Adjusted for other factors in multiple logistic regression analyses with stepwise elimination procedure at the p = 0.05 significance level for entry into the model.
* p<0.05 ** p<0.01

tion. The presence of DIS, DMS, and EMA were defined when affirmative answers were obtained to questions 1, 2, and 3, respectively. The presence of insomnia was defined when affirmative answers were obtained to any of the three questions.

The sociodemographic variables were sex, age (younger: 20-39 years/middle: 40-59 years/older: 60 years and older), marital status (married/single), education (college or above/junior college/high school/middle or lower school), occupation (employed/unemployed), area of residence (rural/suburban/urban), and perceived economic status (high/middle/low).

Lifestyle questions concerned habitual exercise (yes/no), enough leisure time (yes/no), activity in leisure life (active/inactive), habitual drinking (≥4days/week) (yes/no), and habitual smoking (yes/no). Psychological factors included life satisfaction (satisfied/dissatisfied), perceived general health (good/poor), psychological stress (yes/no), and being able to cope with stress (yes/no).

Statistical Analysis

Analyses using the WesVar®Complex Samples 3.0 computer software permitted precise estimations of vari-

ance and confidence intervals to account for the stratified random sampling of the survey. The prevalence estimates were corrected for the male/female ratio and age structure of the general population. To examine the association of sociodemographic, lifestyle, and psychological factors with DIS, DMS, and EMA and with insomnia in general, we first performed a series of univariate logistic regression analyses individually. Variables found to be significant in univariate analyses ($p<0.05$) were then subjected to multivariate logistic regression analysis with a stepwise elimination procedure. All of the analyses were performed using SPSS® 8.0 for Windows 95.

RESULTS

1. Insomnia and associated factors

The overall prevalence of insomnia was 21.4% with a 95% confidence interval of 19.9-23.0%. The prevalence of insomnia was 20.5% (95% CI, 18.4-22.6%) in women and 22.3% (95% CI, 20.1-24.5%) in men.

Univariate logistic regression analyses revealed that 7 variables were significant associated with insomnia. Table 2 shows prevalence of insomnia and their significant correlats.

Table 3—Association of DIS with sociodemographic, lifestyle, and psychological factors

DIFFICULTY INITIATING SLEEP(DIS)

Variables		N	NO.	%	OR	95%CI	OR	95%CI
			DIS			Crude		Adjusted[a]
Sex								
	Male	1482	103	7.0	1.0			
	Female	1548	145	9.4	1.4	1.1-1.8*		
Occupation								
	Employed	2051	146	7.1	1.0			
	Unemployed	979	102	10.4	1.5	1.2-2.0**	1.6	1.2-2.1**
Habitual exercise								
	Yes	836	46	5.5	1.0			
	No	2194	202	9.2	1.7	1.3-2.4**		
Enough leisure time								
	Yes	2206	161	7.3	1.0			
	No	824	87	10.6	1.5	1.1-2.0**		
Life satisfaction								
	Yes	2320	151	6.5	1.0			
	No	710	97	13.7	2.3	1.7-3.0**		
Perceived health status								
	Poor	2362	130	5.5	1.0			
	Bad	668	118	17.7	3.7	2.8-4.8**	2.8	2.1-3.7**
Psychological stress								
	No	1376	56	4.1	1.0			
	Yes	1654	192	11.6	3.1	2.3-4.2**	2.2	1.6-3.1**
Being able to cope with stress								
	Yes	2562	168	6.6	1.0			
	No	468	80	17.1	3.0	2.2-4.0**	1.7	1.3-2.4**

Note: OR, odds ratio ; CI, confidence interval
a , Adjusted for other factors in multiple logistic regression analyses with stepwise elimination procedure at the p = 0.05 significance level for entry into the model.
* p<0.05   ** p<0.01

Using a multivariate model with insomnia as the dependent variable, we found older age was the most significant factor followed by being unemployed, lack of habitual exercise, poor perceived health, psychological stress, and being unable to cope with stress remained significant after controlling for other factors.

2. Difficulty initiating sleep (DIS) and associated factors

The overall prevalence of DIS was 8.3% (95%CI, 7.3-9.4%). Table 3 shows the prevalence of DIS and significant factors by univariate logistic regression analyses.

Multivariate logistic regression analysis revealed that the following factors had significant associations with DIS: being unemployed, poor perceived health, psychological stress, and being unable to cope with stress.

3. Difficulty maintaining sleep (DMS) and associated factors

DMS, with a proportion of 15% (95%CI, 13.6-16.3%), was most frequently reported among the three subtypes of insomnia. Table 4 shows the prevalence of DMS and its associated factors. Univariate logistic regression models showed that older age, education to college level or further, being unemployed, lack of habitual exercise, life dissatisfaction, poor perceived health, psychological stress, and being unable to cope with stress were significantly associated with DMS.

However, in the multivariate model, older age, education to college level or further, lack of habitual exercise, poor perceived health, psychological stress, and being unable to cope with stress remained significant.

4. Early morning awakening (EMA) and associated factors

Overall, 8.0% of the sample reported EMA (95%CI, 7.0-9.0). Prevalence and correlates of EMA are shown in Table 5.

As indicated in Table 5, older age, being unemployed, life dissatisfaction, poor perceived health, psychological stress, and being unable to cope with stress were associated significantly with DMS in the univariable models, but older age, life dissatisfaction, poor perceived health, psy-

Table 4—Association of DMS with sociodemographic, lifestyle, and psychological factors

DIFFICULTY MAINTAINING SLEEP(DMS)

Variables		DMS			Crude		Adjusted[a]	
	N	NO.	%	OR	95%CI	OR	95%CI
Age							
Younger (20-39)	986	109	11.1				
Middle (40-59)	1278	174	13.6	1.1	0.8-1.4	1.3	1.0-1.7
Older (60 and over)	766	173	22.6	1.8	1.3-2.5**	2.4	1.8-3.3**
Education							
Middle or low >	573	80	14.0	1.0			
High school	1434	192	13.4	1.0	0.7-1.3	0.9	0.7-1.3
Junior college	504	83	16.5	1.2	0.9-1.7	1.2	0.9-1.7
College <	519	101	19.5	1.5	1.1-2.1*	1.5	1.1-2.1**
Occupation							
Employed	2051	270	13.2	1.0			
Unemployed	979	186	19.0	1.5	1.3-1.9**		
Habitual exercise							
Yes	836	100	12.0				
No	2194	356	16.2	1.4	1.1*1.8**	1.3	1.0-1.7*
Life satisfaction							
Yes	2320	327	14.1	1.0			
No	710	129	18.2	1.4	1.1-1.7**		
Perceived health status							
Poor	2362	271	11.5	1.0			
Bad	668	185	27.7	3.0	2.4-3.4**	2.3	1.8-2.9**
Psychological stress							
Yes	1376	154	11.2	1.0			
No	1654	302	18.3	1.8	1.4-2.2**	1.9	1.5-2.4**
Being able to cope with stress							
Yes	2562	355	13.9	1.0			
No	468	101	21.6	1.7	1.3-2.2**	1.3	1.0-1.7*

Note: OR, odds ratio ; CI, confidence interval
a , Adjusted for other factors in multiple logistic regression analyses with stepwise elimination procedure at the p = 0.05 significance level for entry into the model.
* p<0.05 ** p<0.01

chological stress, and being unable to cope with stress remained significant after controlling for other factors in the multivariate model.

DISCUSSION

Sociodemographic Variables and Insomnia

Using a structured questionnaire, we investigated a representative sample of 3,030 residents in Japan and found that the overall prevalence of insomnia was 21.4%, including DIS (8.3%), DMS (15.0%), and EMA (8.0%). The prevalence rates were comparable to those reported in American and European samples, despite the great cultural differences between Western countries and Japan.

Several studies have shown that insomnia most commonly occurs in the aged population.[8,14,17] Our study also showed that the overall prevalence of insomnia increased with age, from 18.1% for the younger group to 29.5% for the older.

For the subtypes of insomnia, we found that there was no significant difference in the prevalence of DIS among the younger (8.3%), middle-aged (7.1%), and older (9.7%) groups (χ^2=4.58, df=2, p>0.1). These findings are consistent with those reported by Karacan et al.[14] In contrast, Mniszek[9] and Welstein et al.[21] reported that DIS was higher in younger people. However, Bixler et al. found a higher prevalence of DIS in the older population.[8] The cause of this discrepancy requires further study.

The effect of age on the prevalence of DMS and EMA was consistent with the findings of most of the previous studies. Based on our study together with the others, it may be concluded that the high prevalence of insomnia in the aged is due to the increased prevalence of DMS and EMA in that group.

In the present study, although univariate analysis indicated significant female preponderance among individuals with DIS, gender differences in the prevalence of insomnia, including the subtypes, disappeared after controlling for other factors. Previous epidemiological studies have indicated that women are more prone to insomnia, especially DIS.[8,5] Some researchers have pointed out that DMS and/or EMA are also more prevalent in women.[9-11,17] We postulate that the female dominance in the previous studies might have been caused by other factors, including sociodemographic and psychological status.

Previous studies have shown that sociodemographic factors, such as being unemployed, lower education, and low socioeconomic status, are great risks for insomnia.[2,14,17] All of these factors may increase life stress or risks for poor sleep hygiene, leading to insomnia. In the present study, the unemployed had a higher prevalence of insomnia than the employed, but no significant correlation was revealed between perceived economic status and insomnia. There are two possible explanations for this finding. It is possible that the differences in economic status in the general population of Japan are less marked than those in Western coun-

Table 5—Association of EMA with sociodemographic, lifestyle, and psychological factors

EARLY MORNING AWAKENING(EMA)

Variable		EMA			Crude		Adjusted[a]	
	N	NO.	%	OR	95%CI		OR	95%CI
Age								
Younger (20-39)	986	50	5.1	1.0				
Middle (40-59)	1278	86	6.7	1.4	0.9-1.9		1.4	0.9-2.0
Older (60 and over)	766	102	13.3	2.9	2.0-4.1**		3.0	2.0-4.5**
Occupation								
Employed	2051	135	6.6	1.0				
Unemployed	979	103	10.5	1.7	1.3-2.2**			
Life satisfaction								
Yes	2320	153	6.6	1.0				
No	710	85	12.0	1.9	1.5-2.5**		1.5	1.1-2.0*
Perceived health status								
Poor	2362	146	6.2	1.0				
Bad	668	92	13.8	2.4	1.8-3.2		1.6	1.2-2.2**
Psychological stress								
Yes	1376	82	6.0	1.0				
No	1654	156	9.4	1.6	1.2-2.2**		1.7	1.2-2.3**
Being able to cope with stress								
Yes	2562	178	6.9	1.0				
No	468	60	12.8	2.0	1.4-2.7**		1.5	1.1-2.2*

Note: OR, odds ratio ; CI, confidence interval
a , Adjusted for other factors in multiple logistic regression analyses with stepwise elimination procedure at the p = 0.05 significance level for entry into the model.
* p<0.05   ** p<0.01

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tries. Also, socioeconomic status in this study was self-assessed and not determined by objective measures such as income. Neither marital status nor area of residence was related to the general prevalence of the three subtypes of insomnia.

Psychological Factors and Insomnia

Many previous studies have shown that psychological factors are significantly associated with insomnia.[1-3,5-7] In the present study, poor perceived health, psychological stress, and being unable to cope with stress were significantly associated with an increased risk of insomnia, including DIS, DMS, and EMA, after adjusting for other factors in the general population of Japan. Although poor perceived health had the highest odds ratio, in both the univariate and multivariate models, it was not possible to determine a causal link between perceived health and insomnia from this cross-sectional study. This issue should be addressed in future investigations.

Psychological stress and being unable to cope with stress were also associated with insomnia symptoms. The relationship between psychological stress and insomnia in specific populations such as posttraumatic stress disorder and combat veterans has been documented by several previous studies.[21-24] To our knowledge, only one study (Karacan et al.) has reported such a relationship in the general population. In that study, subjects with a great deal worry were found to be vulnerable to DIS, DMS, and EMA.[14] Our findings together with those of Karacan et al. may suggest that psychological stress is at risk for insomnia.

Lifestyle and Insomnia

Among factors concerning lifestyle, only habitual exercise had a significant association with insomnia. Among the three subtypes of insomnia, only DMS appeared to be significantly associated with habitual exercise. The relationship between habitual exercise and insomnia in the general population has not been reported. In a specific population study, Fabsitz et al. reported that lack of physical exercise was significantly associated with insomnia.[12] Several human experimental studies have found that daytime exercise increased deep sleep at night, decreased intermittent awakening, and improved sleep quality.[18,25] Our findings as well as previous ones suggest that habitual exercise should be considered a possible measure to prevent insomnia, especially DMS.

Smoking and drinking habits did not have a significant association with insomnia in the present study. The relationship between smoking or drinking and insomnia was not consistent in previous studies. In a community study, Karacan et al.[14] did not find a relationship between smoking and insomnia. Although Lexcen et al.[15] and Phillips et al.[20] pointed out that smoking was associated with a high

risk of sleep problems, they had not controlled for confounding factors such as caffeine or alcohol consumption. Fabsitz et al[12] investigated a sample of combat veterans and reported that heavy alcohol consumption was associated with a high risk of sleep problems, but cigarette smoking was associated with a low risk of sleep problems after adjusting for other factors.[12] The relationship between smoking or drinking and insomnia requires further study.

This is the first epidemiological study to estimate the prevalence of insomnia and its correlates among the general population in Japan. The present study, however, had following limitations. Reliance on self-reported data to identify sleep problems is the first limitation of the present study, even though several studies have indicated that self-reported sleep disturbance shows at least moderate agreement with polysomnographic findings.[26,27] Second, as it is true for all cross-sectional researches, this study could not demonstrate causal directions.

In conclusion, the main finding of this study shows that the prevalence of insomnia in Japan is comparable to that in Western countries. A number of psychosocial factors are significantly associated with insomnia. The implications of these findings are of great importance and suggest a need for comprehensive programs to prevent sleep problems in the general population of Japan.

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