Impact of Insomnia on Individual Health Dissatisfaction in Japan, South Korea, and Taiwan

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Study Objectives: This study assessed the impact of insomnia on individual health dissatisfaction in Japan, South Korea, and Taiwan.

Design: Cross-sectional surveys with a face-to-face interview were conducted in Japan (n = 1414), South Korea (n = 1007), and Taiwan (n = 785). Participants completed a questionnaire on general health dissatisfaction and insomnia symptoms. Insomnia was defined as having at least one of three types of insomnia symptoms (i.e., difficulty initiating sleep, difficulty maintaining sleep, and early-morning awakening). Information on sociodemographic characteristics (i.e., sex, age, education level, and household income) was also collected.

Setting: N/A

Participants: A nationwide sample of subjects aged 20 years or older

Interventions: N/A

Measurements and Results: The age-adjusted prevalence of insomnia "lasting more than 2 weeks" was 4.0% in Japan, 9.9% in South Korea, and 10.3% in Taiwan. Insomnia was an independent contributor to health dissatisfaction after adjusting for sociodemographic characteristics in the three countries, with odds ratios of 2.54 (95% CI, [1.51-4.28]) in Japan, 2.15 (95% CI [1.33-3.48]) in South Korea, and 2.31 (95%CI [1.37-3.89]) in Taiwan. A multivariate logistic analysis showed that the sociodemographic characteristics that significantly influenced health dissatisfaction varied among nations—including older age and low education level in Japan and female gender and middle-income level in South Korea. No independent variables were selected in Taiwan.

Conclusion: Insomnia is closely linked to health dissatisfaction in the three Asian countries, with variation according to social and demographic factors.

Keywords: Health dissatisfaction; Insomnia; Japan; Sociodemographic characteristics; South Korea; Taiwan.

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INTRODUCTION

INSOMNIA HAS BEEN INVESTIGATED EXTENSIVELY IN WESTERN COUNTRIES. IT IS ESTIMATED THAT FROM 9% TO 48% OF THE GENERAL POPULATION suffers from insomnia. This wide range of prevalence is owing to methodologic differences (ie, time frame and various frequency criteria)[1]; however, insomnia is a significant public-health problem. Recent studies have concluded that insomnia is closely correlated with sleep dissatisfaction, which lead to adverse general health outcomes.[2-5] Compared with subjects who are satisfied with their sleep, those who are not satisfied demonstrate impaired work productivity owing to daytime sleepiness,[3] and they consume more medical resources.[4] However, medical help has been found to be ineffective in people who complain of sleep problems.[5]

The literature suggests that sociodemographic factors such as sex, age, education level, and income level are important when studying the relationship between insomnia and subjective health status.[6, 7] Past studies have shown that women are more likely to complain about their health than men, the elderly are more likely to complain than the young,[6] those with low education levels are more likely to complain than those with higher education levels,[7] and those with low income levels are more likely to complain than those with high income levels.[7, 8]

Although several studies[9-11] have investigated the role of sleep and sleep quality on mental and physical well-being, these studies have not adjusted for sociodemographic characteristics. Hence, the purpose of this study was to examine the specific relationship between insomnia and subjective health status (ie, health satisfaction or dissatisfaction), adjusting for the effects of sociodemographic characteristics, such as sex, age, education, and income, in 3 Northeastern Asian countries: Japan, South Korea, and Taiwan.

METHODS

Population and Samples

The data were collected from cross-sectional surveys conducted in Japan, South Korea, and Taiwan in 2003. The surveys were a part of the "Health and Culture Survey," which was developed to investigate the effect of culture on health. The target population included adults aged 20 years and older residing in each of the 3 countries. Each survey involved a face-to-face interview conducted by well-trained interviewers, who used a questionnaire specifically developed for the study to interview the subjects and a standardized answer sheet to record their responses. The sample-selection process differed among the 3 countries; a stratified 2-stage probability sampling method was used in Japan,[12] while a multistage (2 and more) method was used in South Korea and Taiwan.[13] These probability sampling methods are especially useful for linking population members to some kind of grouping that can be sampled. These groupings can be sampled as a first stage. Lists then are made of individual members of selected groups,

with possibly a further selection from the created list at the second (or later) stage of sampling. [14] In the present study, primary sampling units (large administrative units) that stratified by population size and district based on official census data from 2000, were determined for each of the 3 countries. Then, in Japan, from the second sampling units that were randomly selected from the primary sampling units, a respondent was chosen by means of systematic random sampling.[14] In South Korea, through several stages of the selection of sampling units, a household (final sampling unit) was randomly selected, and a respondent was selected from each household using the birthday rule. The birthday rule is specifically designed for a sampling method for interview to reduce sampling bias and selects the person whose birthday comes first in the forthcoming 12 months from the interview day. The last 2 processes continued until the desired sample numbers were obtained; therefore, an exact response rate in South Korea cannot be calculated. In Taiwan, households (final sampling units) were chosen from the primary sampling units by random sampling using a telephone code book, which covers more than 90% of all households, and, subsequently, a respondent was selected from each household using the Kish method.[15] All the surveys were conducted after the subjects had given their informed consent.

MEASURES

Health Dissatisfaction

Health dissatisfaction was assessed with the question: "Are you satisfied with your health?" The respondents chose from 4 possible answers: "very satisfied," "fairly satisfied," "fairly dissatisfied," and "very dissatisfied." For the purpose of analyses, responses of "fairly dissatisfied" or "very dissatisfied" were classified as "health dissatisfaction," while "fairly satisfied" or "very satisfied" were classified as "health satisfaction" (ie, dissatisfied = 1; satisfied = 0).

Insomnia

Insomnia was defined as having at least 1 of the following 3 types of insomnia symptoms: difficulty initiating sleep, difficulty maintaining sleep, and early morning awakening. The subjects responded to the questions, "Do you have difficulty falling asleep at night?" "Do you wake up during the night after you have gone to sleep?" and "Do you wake up too early in the morning and have difficulty getting back to sleep?" The response for these questions had 3 choices, namely "almost every night for more than 2 weeks," "sometimes," and "seldom or never." Cases were defined as insomnia occurring "almost every night for more than 2 weeks" and noncases as individuals reporting insomnia either "sometimes" or "seldom."

Sociodemographic Characteristics

Variables analyzed included sex, age, education, and household income. Age was divided into 3 groups: 20 to 34 years old, 35 to 49 years old, and 50 years of age and older. Education was divided into 3 groups: below high school (less than 12 years of education), high school (12 to 15 years), and college and above (16 years or longer). Household income was divided into 4 groups: low, middle, high, and "do not know." Missing income data were treated as "do not know" and were added into the analyses.

Statistical Analysis

To show the representative nature of the survey sample, age and sex distributions were compared with published tabulated data[16] for the general populations of Japan, South Korea, and Taiwan. Significant differences between the study sample and the national sample in each nation were assessed with χ^2 test.

The prevalence of insomnia in the survey sample was adjusted for the average age distribution, with 10-year intervals, of the populations of the 3 nations. Responses to the individual questions on health dissatisfaction were summarized for each nation, and the associations between insomnia and general health dissatisfaction were assessed using the χ^2 test and stratified by nation. Odds ratios (OR), both crude and adjusted for sex, age, education, and household income and their 95% confidence intervals (95% CI), were calculated using a logistic regression model. Trends were assessed by assigning the rank order as the representative score for age and education level. All tests were 2-sided, using Wald χ^2 test. Age was treated as a continuous independent variable in a logistic regression analysis because the outcome of health dissatisfaction appeared to increase with age. ORs reflected an increase in the odds of health dissatisfaction per 10-year increase in age. In addition, a single, logistic regression model was used to assess the differences among the nations. In the analysis, respective weights of 0.707, 0.993, and 1.274 for Japan, South Korea, and Taiwan were used to exclude the effects of a difference in the sample sizes.

Missing data were excluded from the analysis, with the exception of household income, since the missing numbers might influence the results, especially in Japan. Therefore, a new category, "do not know," was used for the missing data. A sensitivity analysis was conducted to examine the bias.[17] Complete case analyses (without missing data) and single imputation analysis (with missing data; missing values were defined as low, middle, or high) were carried out. Analyses were conducted using SAS Version 8.12 for Windows (SAS, Inc., Cary, NC). All tests were 2-sided, with a significance level at 5%.

RESULTS

Demographic Characteristics

The numbers of participants were 1414 in Japan (response rate 70.7%), 1007 in South Korea (complete sample), and 785 in Taiwan (response rate 43.6%). Table 1 gives the sex and age distribution of the respondents and the total populations of Japan, South Korea, and Taiwan, with the corresponding distributions of census data from 2000.[16,18] The samples from the 3 nations differed slightly in age and sex distribution from those of census data, but no significant difference was observed between census data and sample data.

Table 2 shows the distributions of sociodemographic characteristics and insomnia according to health dissatisfaction. A large number of Japanese (35.6%) avoided answering the household-income question, as compared with Koreans (3.4%) and Taiwanese (5.5%). Female gender (except for Japan), older age, lower levels of education, and low income seemed to be associated with health dissatisfaction in all three nations.

Table 1—Age and Sex Distribution of Survey Sample and the General Population of Japan, South Korea, and Taiwan

	Japan		South Korea		Taiwan	
	Sample	Population*	Sample	Population*	Sample	Population*
Characteristics						
Sex						
Men	46.9	48.8	49.7	50.3	42.3	51.2
Women	53.1	51.2	50.4	49.7	57.7	48.8
Age, y						
20-29	11.7	16.7	16.2	24.8	16.9	24.2
30-39	20.0	17.8	30.4	25.5	29.9	24.5
40-49	18.2	15.6	27.6	21.4	23.8	21.9
50-59	20.9	18.8	11.9	13.2	13.3	12.1
60-69	16.6	15.4	11.8	9.5	9.9	9.2
≥70	12.5	15.6	2.1	5.8	6.1	8.1

Data are presented as percentages. *Population data were based on Census data in 2000. No statistical significance was observed between census data and sample data by χ^2 test. ≥70 in population includes those who are aged 80 years and older.

Table 2—Insomnia and Sociodemographic Characteristics According to Health Dissatisfaction in 3 Nations

	Japan (n=1398)			South Korea (n=997)			Taiwan (n=784)		
	Total	Dissatisfied with health*		Total	Dissatisfied with health*		Total	Dissatisfied with health*	
Variable		N	%		N	%		N	%
Insomnia									
Yes	63	33	52.4	84	54	64.3	73	32	43.8
No	1335	369	27.6	913	384	42.1	711	145	20.4
Sex									
Women	743	213	28.7	500	237	47.4	453	113	24.9
Men	655	189	28.9	497	201	40.4	331	64	19.3
Age, y									
50-90	703	241	34.3	257	136	52.9	230	76	33.0
35-49	399	94	23.6	436	186	42.7	323	53	16.4
20-34	296	67	22.6	304	116	38.2	231	48	20.8
Education*									
Low	219	94	42.9	225	129	57.3	342	104	30.4
Middle	718	193	26.9	434	189	43.6	259	45	17.4
High	459	115	25.1	337	119	35.3	183	28	15.3
Household income									
Do not know	503	160	31.8	34	15	44.1	43	10	23.3
Low	316	103	32.6	275	141	51.3	312	94	30.1
Middle	402	97	24.1	274	136	49.6	346	60	17.3
High	177	42	23.7	414	146	35.3	83	13	15.7

Insomnia is defined as having at least 1 of the 3 types of insomnia symptoms observed "lasting more than 2 weeks."
"Dissatisfied with health" is counted based on the presence of health dissatisfaction (Presence or Absence).
*Missing values; Education: Japan=2, Korea=1; Health satisfaction: Japan=16, Korea=10, Taiwan=1.

Prevalence of Insomnia

When insomnia was defined as having at least 1 of 3 types of insomnia symptoms lasting more than 2 weeks (ie, cases), the prevalence was 4.5% in Japan, 8.4% in South Korea, and 9.3% in Taiwan, with age-adjusted prevalences of 4.0%, 9.9%, and 10.3%, respectively. The prevalence of insomnia defined as "almost every night for more than 2 weeks" and "sometimes" was 42.2% in Japan, 50.0% in South Korea, and 47.9% in Taiwan, with age-adjusted prevalences of 39.5%, 51.0%, and 48.9%, respectively. No matter which definition of insomnia (ie, "one occurring more than 2 weeks" or "one occurring more than 2 weeks and sometimes") was used, the prevalence of insomnia was statistically different among 3 nations (P < .001).

With regard to the types of insomnia symptoms lasting more than 2 weeks, difficulty initiating sleep (prevalence, age-adjusted prevalence) was most prevalent in Taiwan (6.8%, 7.6%), followed by South Korea (5.5%, 6.5%), and Japan (2.6%, 2.1%). However, the prevalence (age-adjusted prevalence) of difficulty maintaining sleep and early morning awakening in South Korea, at 5.1%

(6.0%) and 4.4% (5.9%), respectively, was higher than that of either Taiwan, at 3.6% (3.9%) and 3.8% (4.1%), respectively, or Japan, at 2.6% (2.5%) and 2.3% (2.0%), respectively.

Insomnia and Health Dissatisfaction

Because 16 subjects had incomplete health-satisfaction data, the numbers for the analyses were 1,398 for Japan, 997 for South Korea, and 784 for Taiwan (Table 2). Those with insomnia symptoms lasting more than 2 weeks (ie, cases) were more likely to report health dissatisfaction than were those who were noncases, irrespective of nation (Figure 1, all P < .05). Insomnia was also related to increased age, a low level of education, and low income (except for Japan, data not shown).

We conducted simple and multiple logistic regression analyses to assess the relationship between insomnia and subjective health. Table 3 shows the crude and adjusted ORs of health dissatisfaction, as compared with health satisfaction for each nation. Multivariate analyses showed that those with insomnia were more likely to be dissatisfied with their overall health than were those

Table 3—Crude and adjusted odds ratios of health dissatisfaction compared with health satisfaction and their 95% confidence intervals calculated using logistic models

	Japan Univariate OR	95%CI Lower	Upper	p value	Japan Multivariate (N=1396) OR	95%CI Lower	Upper	p value	South Korea Univariate OR	95%CI Lower	Upper	p value	South Korea Multivariate (N=962) OR	95%CI Lower	Upper	p value	Taiwan Univariate OR	95%CI Lower	Upper	p value	Taiwan Multivariate (N=784) OR	95%CI Lower	Upper	p value
Variable																								
Insomnia				<.0001				0.001				0.001				0.002				<.0001				0.002
Yes	2.88	1.73	4.79		2.54	1.51	4.28		2.48	1.56	3.95		2.15	1.33	3.48		3.05	1.85	5.01		2.31	1.37	3.89	
No	1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—	
Sex				0.938				0.888				0.027				0.044				0.064				0.104
Female	0.99	0.79	1.25		0.98	0.77	1.25		1.33	1.03	1.71		1.31	1.01	1.70		1.39	0.98	1.96		1.35	0.94	1.94	
Male	1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—	
Age*				<.000				0.005				<.0001				0.078				<.0001				0.078
	1.21	1.12	1.30		1.13	1.04	1.23		1.24	1.12	1.37		1.13	0.99	1.29		1.31	1.17	1.47		1.14	0.99	1.31	
Education†				<.0001				0.035‡				<.0001				0.164				<.0001				0.255
Low	2.25	1.60	3.16		1.56	1.05	2.32		2.46	1.74	3.48		1.61	0.98	2.66		2.42	1.52	3.85		1.44	0.82	2.51	
Middle	1.10	0.84	1.44		1.00	0.75	1.33		1.41	1.05	1.89		1.21	0.89	1.64		1.16	0.70	1.95		1.00	0.59	1.70	
High	1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—	
Household income				0.012				0.097				<.0001				0.011				0.001				0.156
Do not know	1.50	1.01	2.22		1.43	0.95	2.14		1.45	0.72	2.94		1.38	0.67	2.84		1.63	0.65	4.10		1.27	0.49	3.31	
Low	1.55	1.02	2.36		1.28	0.83	1.99		1.93	1.42	2.64		1.18	0.79	1.74		2.32	1.23	4.40		1.63	0.82	3.23	
Middle	1.02	0.68	1.55		1.01	0.66	1.54		1.81	1.33	2.47		1.72	1.25	2.37		1.13	0.59	2.17		1.05	0.54	2.06	
High	1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—		1.00	—	—	

p-values and 95%CIs: Based on Wald Chi-square test
*OR reflects increase in odds of health dissatisfaction per unit (10 year) increase in age
Insomnia is defined as having at least one of the three types of insomnia symptoms observed "lasting more than 2 weeks".
†p values of "education level" for trend test in multivariate analyses were 0.064 in Japan, 0.062 in Korea, and 0.161 in Taiwan.
‡ In sensitivity analyses, p values were varied from 0.019 to 0.038 analyzed using imputed values and 0.115 analyzed using complete data (without imputed).

without insomnia. This association was consistently significant across nations (P = .001 for Japan, P = .002 for South Korea, and P = .002 for Taiwan).

The sociodemographic characteristics that contributed to health dissatisfaction differed among the nations. South Korean women tended to report health dissatisfaction more often than men (P = .044). In Japan, age was an independent contributor to health dissatisfaction (P = .005), and those with low education levels were more likely to report health dissatisfaction than were those with more education (P = .035). Household income was a significant factor only in South Korea; those with middle-income levels were more likely to report health dissatisfaction than were those with higher incomes (P = .011), which was confirmed by significant statistical interactions with nations between insomnia and health dissatisfaction. No other statistically significant interactions of sociodemographic characteristics on health dissatisfaction were found between any other possible pairs.

As for the missing data, sensitivity analyses showed that missing data altered the significance of education in Japan; P values ranged from .019 to .038 when analyzed using imputed values and averaged .115 when analyzed using the complete data (without imputed values).

When the 3 nations were analyzed together in a single, fixed-effect model, Japanese and South Korean subjects were more likely to report dissatisfaction with their health than were Taiwanese subjects, adjusting for sociodemographic characteristics (OR 1.52, 95% CI, [1.19-1.95] and OR 3.47, 95% CI, [2.79-4.32], respectively).

DISCUSSION

This study sampled the general populations in 3 Northeast Asian countries, Japan, South Korea, and Taiwan, and the available evidence suggests that those with insomnia were more likely to be dissatisfied with their health than those without insomnia. This association was observed consistently across nations, even after adjusting for sociodemographic characteristics. The effects of socioeconomic characteristics on health dissatisfaction varied among nations. In addition, the prevalence of insomnia was lower in Japan than in South Korea and Taiwan when the same insomnia definition was used.

Previous studies on insomnia have reported prevalence rates ranging from 11% to 36%[4,19-24] in Western countries and from 11% to 21%[25-27] in Japan. Compared with those reports, we found that the prevalence of insomnia in 3 Northeast Asian countries was slightly lower, ranging from 4.5% to 9.3%. The difference may be owing to the time frame used to define insomnia (ie, "lasting more than 2 weeks"), which makes it difficult to compare our results with those of previous prevalence studies. However, a comparison among the 3 countries is possible using the age-adjusted prevalence of insomnia symptoms. Accordingly, it appeared that Japanese subjects were less likely to have insomnia than were either South Korean or Taiwanese subjects.

There are several limitations to this study that we should discuss for proper interpretation of the results. First, the sampling methods used in our study differed among the 3 countries, and this could have led to bias. We used random sampling methods, but people who were not residing in the household at the time of the investigation might have been excluded. Low response rates, as well as the difference in the rates between Japan and Taiwan, and the nonapplicability of the response rate in Korea (complete sample) may also have contributed to a bias. Despite these concerns, the effect of potential bias may be minimal; our samples were not statistically different from the corresponding national census data for the 3 nations.

Second, this study was based on a questionnaire survey incorporated into a face-to-face interview in a cross-cultural setting, and problems with translation accuracy could have affected the

response. To minimize such an error, we validated our questionnaire by back translation and confirmed the stability (reproducibility) of the data.[13,28-29]

Third, with regard to the missing data in household income, a new category, "do not know" was created because the data were not likely missing at random: from our empirical observation, Japanese people tend to avoid responding to income questions. This might be related to cultural factors specific to Japanese; many Japanese people are less likely to talk about money to other people. The avoidance of the report by a large number of Japanese subjects might indicate the cultural differences among 3 nations. To assess the bias, we performed sensitivity analyses, complete case analyses, and the single imputation of missing data defined as low, middle, or high. However, none of these analyses altered the insignificant effect of household income on health dissatisfaction. As for education, complete case analyses changed its significance to insignificance among Japanese subjects. However, this effect may be the matter of statistical power due to a large amount of missing data. Rather, the results of the sensitivity analyses suggest that the effect of low educational background on health dissatisfaction is robust.

In conclusion, insomnia was found to correlate to poorly perceived individual health even after adjusting for sociodemographic characteristics. Healthcare practitioners should know that insomnia symptoms can lead to health dissatisfaction that may possibly induce adverse health outcomes.

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