Table 2
Question items and percentages of respondents in the analyzed 421 inpatients

Items		1)	2)	3)	4)
Q1. How long did it take from light off until you went to sleep?					
1) less than 15 minutes 2) 15-29 minutes 3) 30-59 minutes 4) more than 60 minutes		50.4	20.4	14.5	14.7
Q2. How many times did you awake during last night?					
1) none 2) 1-2 times 3) 3-4 times 4) more than 5 times		21.4	35.9	24.9	17.8
Q3. What time did you get up this morning (h:min)?		22.6*	77.4		
Q4. Did you get up in the morning unrefreshed or nonrestored?					
1) good 2) fair 3) insufficient 4) poor		38.7	37.1	19.2	5.0
Q5. Do you have daytime sleepiness?**					
1) none 2)some 3) moderate 4) severe		22.8	22.8	47.5	6.9
Q6. Did you experience any of the following symptoms during last night (completed by a patient)					
Q6-a creeping sensation or restless discomfort in the limbs	1) yes 2) no	5.9	94.1		
Q6-b legs or arms jerk	1) yes 2) no	2.4	97.6		
Q6-c hot flash	1) yes 2) no	4.8	95.2		
Q6-d night sweat	1) yes 2) no	6.9	93.1		
Q6-e palpitation	1) yes 2) no	1.2	98.8		
Q6-f anxiety or panic	1) yes 2) no	1.0	99.0		
Q6-g sleep paralysis	1) yes 2) no	0.0	100.0		
Q6-h nightmare	1) yes 2) no	3.1	96.9		
Q7. Did the patient experience any of the following symptoms during last night (completed by nursing staffs)					
Q7-a loud snoring, or apnea lasting for 10 seconds or longer	1) yes 2) no	10.0	90.0		
Q7-b periodic legs or arms jerk	1) yes 2) no	2.1	97.9		
Q7-c sleep-talking, delirium or abnormal behaviors such as wandering	1) yes 2) no	6.9	93.1		
Q8. Whether or not the patient took any hypnotic-sedative drug(s) for treatment of insomnia within the past one week and the name of the drug(s) if any (completed by nursing staffs)					
1) yes 2) no Name of drugs [ ]		27.6	72.4		

* Patients who woke up 30 minutes or earlier than the desired time without falling asleep again (Q3).
** answered at 2 pm.

which patients were supposed to be in bed as specified by each hospital ward, and specifically the time from "lights out" to the time at which patients were expected to wake. Mean TIB was approximately between 9 p.m. and 6 a.m. Observations by the nursing staffs on each of the wards confirmed that the patients were in bed during TIB on the evenings of the study.

For the observational sleep evaluations, several nursing staffs alternated in order to record continuously the subjects' sleep states. Opening and closing of eyes, breathing, movement and any unusual behavior of the subjects were observed and recorded at a distance so as to not disturb the subjects.

2.3. Differential diagnosis of sleep disorders

The diagnostic flow for the patients included in the investigation is shown in Fig. 1. Some of the preselected subjects (n=136) were either excluded from data analyses or could not participate due to reasons such as sudden change in physical condition such as fever, severe dementia, consciousness disturbance due to organic brain damages, need for emergency examination, hospital transfer or discharge or due to missing data on their amount of physical activity. As a result, a total of 421 patients comprised the analysis population [228 males, 193 females; mean age, 72.5±12.6 (S.D.) years; range 22-96 years]. The number of respondents for each question item is shown in Table 2.

Patients were initially examined for the presence of SAS (positive answer to Q7-a), RLS (positive answer to Q6-a), PLMD (positive answer to Q6-b or Q7-b) or NBD (positive answer to Q7-c). Those who were NOT diagnosed with SAS, RLS, PLMD or NBD were subsequently examined for the presence of insomnia. Patients were judged as having insomnia when the subjective sleep investigation indicated the presence of any one of the following:

i. Disturbances of initiating sleep (DIS): Q1, the answer indicates 30 min or more.
ii. Disturbances of maintaining sleep (DMS): Q2, the answer indicates three times or more.
iii. Early morning awakening (EMA): Q3, the answer indicates wake time 30 minutes or earlier than the desired time without falling asleep again.
iv. Non-restorative sleep (NRS): Q4, the answer indicates insufficient or poor sleep.

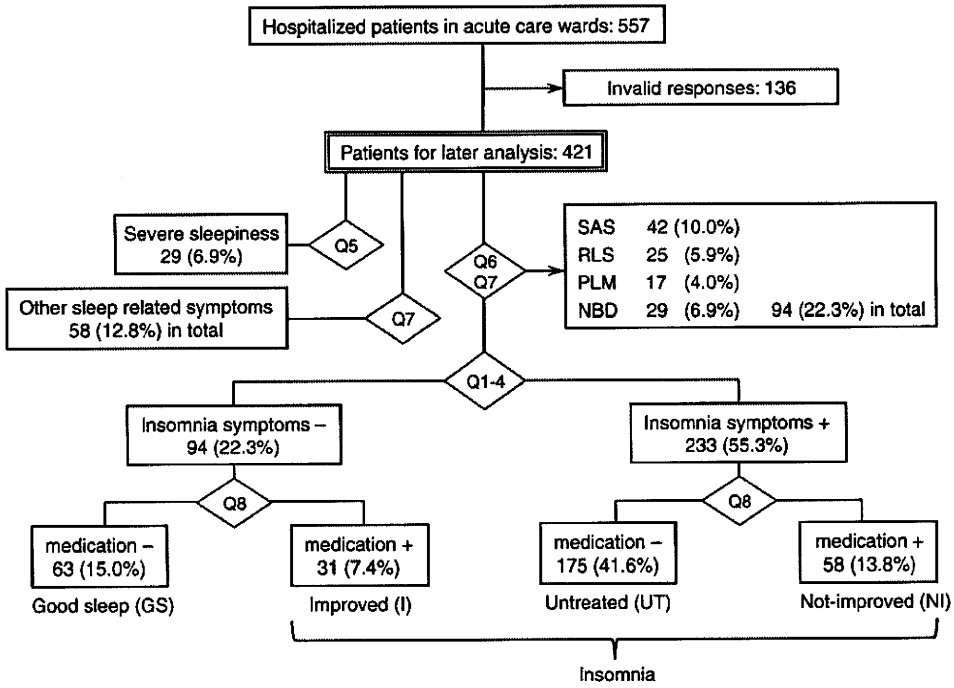

Fig. 1. Diagnostic flow of the subjects in this study. See text and Table 2 for explanation.

The subjects were also divided into the following four groups according to the presence or absence of insomnia and use or not of hypnotic-sedative drugs for insomnia treatment: the good sleep (GS) group consisting of those without insomnia and taking no medication, the improved (I) group consisting of those without insomnia and taking medication (s), the untreated (UT) group consisting of those with insomnia but taking no medication, and the not-improved (NI) group consisting of those with insomnia and taking medication(s). Of these groups, the I, UT and NI groups were grouped together and defined as the insomnia group (Fig. 1).

2.4. Daytime sleepiness

The 421 patients were examined for the presence or absence of daytime sleepiness according to the following criteria: Q5, the answer indicates the presence of moderate or severe sleepiness.

2.5. Sleep-related symptoms

The 421 patients were examined for the presence or absence of other sleep-related symptoms, such as hot flashes in the foot or body (Q6-c), night sweats (Q6-d), palpitations (Q6-e), anxiety and panic (Q6-f), sleep paralysis (Q6-g) and nightmares (Q6-h).

2.6. Statistical analysis

One-way analysis of variance followed by Tukey's multiple comparison tests was used to identify significant differences in sleep parameters (TST, TWT and SE) among the insomnia group and GS group. Sleep parameters were also compared between each sleep disorder group and the GS group using a two-tailed Student's t test. Analysis values are expressed as mean±S.D. Multiple logistic regression analysis was carried out to calculate the odds ratio (OR) and 95% confidence interval (CI) for assessing the association of primary disorders, sleep disorders and use of hypnotic-sedative drugs with severe sleepiness. Presence of severe sleepiness was used as the dependent variable, and primary disorders, sleep disorders and use of hypnotic-sedative drugs were used as independent variables. We performed multiple logistic regression analyses to control for all sociodemographic (sex and age) and other factors. Statistical significance was set at $P<.05$. All analyses were made using SPSS 11.5 for Windows.

3. Results

3.1. Prevalence of sleep disorders

The breakdown of the diagnoses of sleep disorders is shown in Fig. 1. Of the 421 inpatients, 42 (10.0%, M/F=29/13) had SAS, 25 (5.9%, 14/11) had RLS, 17 (4.0%, 11/6) had PLMD and 29 (6.9%, 19/10) had NBD. A total of 94 (22.3%) had at least one of the four sleep disorders. Seventeen patients had two sleep disorders concurrently.

Of the 421 inpatients, 58 (13.8%, NI) and 175 (41.6%, UT) complained of insomnia symptoms. A total of 264 (62.7%), including the NI, UT and I (31, 7.4%) groups were given a diagnosis of insomnia. The most common insomnia

Table 3
Comparison of objective sleep parameters determined by LC in the insomnia and good sleep patients

	SAS n=42	P	RLS n=25	P	PLMD n=17	P	NBD n=29	P	Insomnia						Good sleep n=63
									Untreated n=175	P	Improved n=31	P	Not-improved n=58	P	
TST (min)	367.6±119.2	.06	331.9±117.7	0	354.6±111.5	.01	359.8±126.1	.04	369.2±102.5	.04	400.7±118.4	n.s	399.7±91.0	n.s	409.4±102.4
TWT (min)	172.4±119.2	.05	208.1±117.7	0	185.4±111.5	.01	180.2±126.1	.04	170.3±102.3	.03	139.4±118.4	n.s	140.3±91.0	n.s	129.3±103.3
SE (%)	68.1±22.1	.05	61.5±21.8	0	65.7±20.6	.01	66.6±23.4	.04	68.4±19.0	.03	74.2±21.9	n.s	74.0±16.9	n.s	76.1±19.1

Value are expressed as mean±S.D..
P value vs. Good sleep group.
n.s; not significant.

symptom was DMS (60.1%), followed by DIS (41.2%), EMA (33.9%) and NRS (31.8%). Only 63 (15.0%) were free of the above-mentioned sleep disorders and were assigned to the GS group.

3.2. Objective sleep parameters

Sleep parameters in each sleep disorder group are summarized in Table 3. There were significant differences in TST [F(3,323)=3.24, P=.022], TWT [F(3,323)=3.28, P=.021] and SE [F(3,323)=3.31, P=.020) among the insomnia group and GS group. TST (P=.039) was significantly shorter and TWT (P=.033) and SE (P=.032) were significantly longer in the NI group than in the GS group. Patients with RLS (P<.01) and NBD (P<.05) also presented a significantly shorter TST, significantly longer TWT and significantly lower SE than those in the GS group. A similar tendency was observed for patients with SAS or PLMD (P<.06). On the other hand, we found no significant differences in the sleep parameters between the medicated group (the I or NI group) and the GS group, regardless of whether or not any subjective improvement was observed.

3.3. Daytime sleepiness

Of the 421 inpatients, 229 (54.4%) experienced moderate to severe sleepiness and 29 (6.9%) experienced severe sleepiness. Severe sleepiness was commonly observed in those with sleep disorders; it was most commonly observed in patients with multiple sleep disorders (27.8%, 5/18), followed by those with PLMD (18.2%, 2/11), SAS (17.9%, 5/28) and NBD (17.7%, 3/17). Multiple logistic regression analysis revealed that SAS (adjusted OR=3.78, 95% CI, 1.24–11.53, P<.05) and PLMD (adjusted OR=5.93, 95% CI, 1.50–23.4, P<.05) showed a significantly positive association with the presence of severe sleepiness.

3.4. Other sleep-related symptoms

Of the 421 inpatients, 19 (4.5%, M/F=7/12) had hot flashes, 29 (6.9%, 13/16) had night sweats, 5 (1.2%, 1/4) had palpitations, 4 (1.0%, 2/2) had anxiety or panic and 13 (3.1%, 7/6) had nightmares. None of the patients experienced sleep paralysis.

3.5. Prevalence of use of hypnotic-sedative drugs

Of the 421 inpatients, 116 (27.6%) were taking some kind of hypnotic-sedative drug for the treatment of insomnia symptoms. The breakdown of the prescribed drugs was as follows: benzodiazepine hypnotics including zolpidem and zopiclone accounted for 73.2% (26.1% for ultrashort-acting, 30.6% for short-acting and 16.5% for intermediate-acting), benzodiazepine anxiolytic accounted for 5.8%, antipsychotics accounted for 15.6% and other drugs accounted for 5.2% of all prescribed drugs. In the insomnia group, those receiving medication therapy for insomnia only accounted for 33.7% (the I+NI group). Two thirds of the patients receiving medication therapy (65.2%, corresponding to the NI group) complained of persistent insomnia symptoms. In addition, 36.0% of RLS patients, 29.4% of PLMD patients, 26.2% of SAS patients and 17.2% of NBD patients were taking at least one of the above hypnotic-sedative drugs.

4. Discussion

This is the first multicenter study investigating the prevalence of sleep disorders in inpatients of acute wards in general hospitals. Sleep disorders are extremely common disorders among community residents, and are even more so among patients with underlying physical diseases as in the subjects of the present study. Insomnia, as well as other sleep disorders, while frequently thought to be transitory or secondary to a physical disease, can become prolonged without appropriate treatment in the early stages. Furthermore, chronic sleep disorders can exacerbate lifestyle-related diseases such as hypertension and diabetes, and increase the risk of psychiatric symptoms such as depression and anxiety, not to cause subjective distress [16,17]. Many sleep disorders go undetected and are not appropriately treated in clinical practice. Therefore, this study was conducted to alert practitioners of sleep disorders to this situation, by shedding more light on their current status in general medical practice.

In the present study, we investigated the prevalence of sleep disorders and the use of hypnotic-sedative drugs in 421 inpatients with mean age of 72.5 years by questionnaire-, actigraph- and observation-based sleep evaluations, and have revealed a high prevalence of diverse types of sleep disorders

in the study population. SAS, RLS, PLMD, NBD and insomnia, in particular, were highly prevalent (10.0, 5.9, 4.0, 6.9 and 62.7%, respectively). The inpatients also suffered from various sleep-related symptoms (1.0–6.9%, except for sleep paralysis), which are common conditions with physical disorders and which could cause disrupted sleep [18–21]. In fact, the patients with these sleep disorders also showed poor sleep parameters recorded by actigraphy, which objectively indicates that they have poor-quality sleep during the night. Consequently, of the 421 patients, only 13.8% were free of any type of sleep disorder diagnosed, severe daytime sleepiness or sleep-related symptoms, revealing that sleep-related problems are very common clinical problems among inpatients of acute hospital wards.

Due to restrictions on the disclosure of personal information, the only information available regarding the underlying diseases of the patients was the names of the primary diseases according to the major classification of the *ICD-10*. We were thus unable to analyze respective medical conditions that are commonly associated with these sleep disorders, such as chronic pain, cardiovascular diseases, chronic renal failure, hemodialysis and iron deficiency anemia.

The prevalence of SAS and RLS is generally high in elderly people and patients with physical disorders. However, even though the mean age of our patients was high (72.5 years) and they had physical disorders in the exacerbation phase, contrary to our expectations, the prevalence of SAS and RLS was not higher in the study population than in community dwellers of previous studies. For example, the prevalence of SAS in middle-aged to elderly people has been shown to be 9–10% in males and 4–10% in females [22,23], which is comparable to that in the present study population (10% in the entire population, 12.7% in males, 6.7% in females). In the present study, patients were defined as having SAS if they reported loud snoring or apnea lasting for 10 seconds or more, because loud snoring is the most prominent symptom of upper airway resistance syndrome, which is included in the category of SAS [7,24]. Nevertheless, the prevalence of SAS patients including those who snored loudly in the present study was similar to that in the general population. Similarly, a large-scale survey which employed a self-administered questionnaire and used a definition of RLS similar to that in the present study has reported that the prevalence of RLS among Japanese people aged 70 years or more is 4.1% (3.4% in males, 4.6% in females), which is practically identical to that in the present study (5.9% in total, 6.1% in males, 5.7% in females) [25]. Furthermore, the frequency of NBD was as low as 6.9%, despite the occurrence rate of delirium per admission varying between 11 and 42% [26]. The low NBD frequency of the present study compared to that of all previous studies is thought to be because patients with severe physical conditions or with organic brain damages were excluded from the analyses.

In many of the epidemiologic studies on the prevalence of sleep disorders, sleep evaluation is performed during a period of one week to one month. The fact that sleep evaluation in this study was performed on a single night might have held down the prevalence of sleep disorders. However, since the physical status of the inpatients of acute hospital wards can change in a very short period of time and their sleep condition is also subject to change, we assumed that the results obtained from a long investigation period would not properly reflect the actual status of their sleep-related problems. Extension of the duration for determining the presence or absence of sleep disorders may result in a dramatic increase in the prevalence of the sleep disorders in inpatients of acute hospital wards.

Patients with physical disorders, especially with advanced age, are generally vulnerable to insomnia [27–29]. We have found that approximately two thirds (62.7%) of the representative patients in acute wards in Japan are suffering from insomnia. It was confirmed not only from the subjective complaints of patients but also from the objective sleep evaluation that the quality of sleep for patients with insomnia receiving no treatment or who had other sleep disorders was significantly lower than that for patients in the GS group (Table 3). A survey among 1500 community dwellers aged 55–84 years in the United States has demonstrated that the quality of sleep decreases in proportion to an increase in the number of physical disorders suffered [27]. Several studies have also reported a high prevalence (34–69%) of insomnia in outpatients of primary care clinics or regular inpatients with acute or chronic physical disorders [30–33]. The findings of the present study for acute ward inpatients are consistent with those obtained in the previous studies in spite of shorter-term sleep evaluation.

In many cases of sleep disorders, daytime sleepiness often occurs to compensate for low-quality sleep during the night. In the present study, 47.5% of the patients experienced mild or severer sleepiness and 6.9% experienced severe sleepiness, which was particularly high in those with multiple sleep disorders, including SAS, RLS, PLMD and NBD. The results of multiple logistic regression analysis indicated that severe sleepiness is significantly associated with SAS and PLMD, and not with an underlying disease or type of hypnotic-sedative drug.

Only one-third (33.7%) of the patients with insomnia included in the present investigation received treatment for insomnia symptoms. In addition, two-thirds (65.2%) of the patients receiving medication therapy complained of residual insomnia symptoms. The relatively low frequency of patients prescribed hypnotic-sedative drugs in the present study, which is very similar to that reported in the Meissner's study [30], suggests the possibility that physicians are not fully aware of the presence of insomnia in their patients.

The prescribed drugs mainly consisted of benzodiazepine hypnotics including intermediate-acting agents and antipsychotics. Caution should always be exercised when

using these hypnotic-sedative drugs in inpatients with physical disorders, especially in elderly patients. This is because elderly patients present a poor risk-benefit balance for hypnotic-sedative drugs due to such reasons as decreased drug metabolizing capacity, increased drug sensitivity, risk of fall and fracture or suppressed mental function, and worsening of underlying diseases induced by medication [34–37].

Moreover, administered hypnotic-sedative drugs may be ineffective or even worsen underlying diseases unless sleep disorders are properly diagnosed. In fact, 23.8% of the patients with SAS were prescribed hypnotic-sedative drugs including benzodiazepines and 36.0% of the patients with RLS were taking hypnotic-sedative drugs other than clonazepam. These results suggest that medications that are not necessarily appropriate for treatment of individual patients' sleep disorders are often selected in actual clinical practice, possibly causing a reduction in the patients' ADL and QOL.

Several limitations should be noted when interpreting the results of the present study. First, as elderly patients aged 65 years or more accounted for a large portion (76.0%) of the 421 inpatients, it is speculated that the high prevalence of sleep-related problems observed in the patients of the present investigation were associated with not only sleep disorders attributable to physical disorders but also age-related changes in sleep property.

Second, one-fourth (24.4%) of the initially enrolled 557 patients were excluded. Patients who were unable to answer questions on the day of the survey because of a change in their physical condition (e.g. fever, consciousness disturbance or need for emergency examination) or those patients with missing data due to interruptions in LC data collection were excluded. Some of these excluded patients might have developed some type of sleep disorder during their stay in hospital.

Third, insomnia defined in the present study is different from insomnia that meets the general criteria of the International Classification of Sleep Disorders, second edition (ICSD-2) [7], because we did not consider the presence or absence of "daytime impairment related to the nighttime sleep difficulty". This investigation item was not included in the present study because it was difficult to determine whether the patients' diverse psychosomatic symptoms observed during the daytime were attributable to insomnia or physical disorders.

Fourth, the questionnaire employed in the present study has not been validated. A set number of items taken from the original were configured so as to reduce the burden on inpatients who were in poor physical condition. Therefore, the questionnaire can only suggest the possibility of certain disorders such as SAS, PLMD and RLS; it does not predict the presence of these disorders with high accuracy. However, the frequency of sleep disorders and the percentage of patients exhibiting symptoms of insomnia found in the present study closely resemble the data of several other studies. This is thought to be indirect evidence that, to a certain degree, the survey items work effectively to detect patients suffering from sleep disorders.

Fifth, the sleep/wake scoring algorithm used for the LC data in the present study has been validated for a sample of healthy young subjects [15], but not for elderly subjects with physical disorders, as in the present study's sample. However, as the results demonstrate, meaningful differences were detected in the sleep parameters calculated with this algorithm for total sleep time, total wake time, and efficiency of sleep between the UT group with insomnia and the GS group. Given this, the clinical application of the LC and sleep/wake scoring algorithm for the subjects of the present study can be considered a sound approach to a certain degree.

5. Conclusion

In the present study, which initially involved 557 inpatients who had been admitted to acute hospital wards in 44 general hospitals, we have revealed an extremely high prevalence of sleep disorders using subjective and objective sleep evaluation scales, and have also indicated several problems in the current practice of sleep medicine. Proper diagnosis of sleep disorders should be made while being aware of the high prevalence of sleep disorders among elderly patients with physical disorders, and a treatment strategy that provides a favorable risk-benefit balance must be developed.

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Regular Article

Relationship between late-life depression and life stressors: Large-scale cross-sectional study of a representative sample of the Japanese general population

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Aim: The purpose of the present study was to clarify the relationship between late-life depression and daily life stress in a representative sample of 10 969 Japanese subjects.

Methods: Data on 10 969 adults aged ≥50 who participated in the Active Survey of Health and Welfare in 2000, were analyzed. The self-administered questionnaire included items on 21 reasons for life stressors and the magnitude of stress, as well as the Japanese version of the Center for Epidemiologic Studies Depression Scale (CES-D). The relationship between the incidence of life stressors and mild–moderate (D_{16}) and severe (D_{26}) depressive symptoms was examined using logistic regression analysis.

Results: A total of 21.9% of subjects had D_{16} symptoms, and 9.3% had D_{26} symptoms. Further, increased age and being female were associated with more severe depressive state. Logistic regression analysis indicated that the strongest relationship between both the incidence of D_{16} and D_{26} symptoms and life stressors stemmed from 'having no one to talk to' (odds ratio = 3.3 and 5.0, respectively). Late-life depression was also associated with 'loss of purpose in life', 'separation/divorce', 'having nothing to do', 'health/illness/care of self', and 'debt'.

Conclusion: There is a relationship between late-life depression and diminished social relationships, experiences involving loss of purpose in life or human relationships, and health problems in the Japanese general population.

Key words: affective disorder, epidemiology, old age psychiatry, public health, stress.

WITH A 12-MONTH prevalence rate of 3–5%[1,2] and a lifetime prevalence rate of 3–20%,[3] depression (major depression) is a highly prevalent and serious disorder with significant clinical and socioeconomic ramifications. Based on the disability-adjusted life year (DALY), a measure developed by the World Health Organization (WHO), depression is projected by the year 2020 to become the second leading burdensome disease following coronary heart disease, imposing a tremendous health burden upon people. Patients with depression experience marked impairments in life functioning and well-being, and are reported to exhibit a reduction in social functioning at a level equivalent to, or more significant than, those living with chronic physical

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illness such as cardiopulmonary disease, arthritis, hypertension, and diabetes.[4,5]

Of the general population aged ≥65, approximately 10–15% are estimated to be depressed and 1–3% are estimated to have major depression.[6,7] Older adults with depression have poor clinical outcomes. In a meta-analysis of 24-month clinical outcomes among the elderly with depression, only 33% were healthy, while 33% remained depressed and 21% had died.[8]

Depression is the most serious psychiatric disorder in late life that is associated with suicide.[9] Results from WHO research investigating the types of psychiatric disorders in suicide victims at the time of their death using techniques such as psychological autopsy indicate that approximately 30% of suicide victims had a mood disorder.[10] The total number of suicides in Japan, which is known for its high suicide rate, exceeded 30 000 in 2007; 36.6% and 21.3% of the suicide victims were people aged ≥60 and those in their 50s, respectively. Therefore, nearly 60% of all suicides were committed by individuals in late life, that is, people aged ≥50 (42% of the population at the time). Thus, improvement of mental health among people in late life is considered to be medically urgent in order to prevent an increase in suicides in a progressively aging society.

The entire clinical course of a psychiatric disorder – from onset to recovery – is affected by biological, psychosocial, and environmental factors in a complex manner. Although psychiatric symptoms are largely determined by biological factors, their clinical outcomes are exacerbated by psychosocial stress.[11] Risk factors for depression identified in research include neurotransmitter abnormalities, sleep disorders, hormone imbalance, substance use, premorbid personality, and stressful life events.[12–14] Stressors that may trigger depression, such as decreased physical and mental functioning due to aging, high prevalence of physical illness, hospitalization, and changes in living environment (e.g. retirement, living alone), are especially salient in late life. Risk factors for the incidence and recurrence of late-life depression have been found to include impairments due to physical illness, fatigue of caregiving, and psychosocial stress such as bereavement and social isolation.[15] Although these insights suggest that psychological stress plays an important role in late-life depression, this has not yet been investigated in a large-scale study using a representative sample of the Japanese general population. The aim of the present study was therefore to clarify the relationship between the incidence of psychosocial stress in daily life (life stressors) and depressive symptoms among more than 10 000 late-life adults selected from 300 communities in Japan.

METHODS

Subjects

The present study was conducted as part of the Active Survey of Health and Welfare (ASHW), a nationwide survey on sleep, mood, stress, and related coping behaviors conducted by the Japanese Ministry of Health, Labour and Welfare in June 2000. The purpose of the ASHW, which was conducted in 1996, 1997, 1999, and 2000, was to provide data to aid the Government's health and welfare policy making. To ensure that the sample was representative of the general population, survey participants were selected among individuals aged ≥12 living in 300 communities in Japan. These communities were selected from 881 851 precincts identified in the 2000 Census using a stratified sampling design. In each community, a part-time investigator employed by the local public health center delivered the self-administered questionnaire to the participants and collected the completed questionnaires a few days later. Oral informed consent was obtained from all subjects.

Table 1 lists the age distribution and male : female ratio of the final study sample with corresponding statistics calculated from the Census data from the same year.

Procedures

The self-administered questionnaire included items concerning sociodemographic characteristics such as age, sex, and community size, and items concerning life stress. In addition, depressive symptoms were assessed using the Japanese version of the Center for Epidemiologic Studies Depression Scale (CES-D).[16,17]

The life stressors were assessed with the question: 'What types of troubles, hardships, stress, or dissatisfaction with daily life did you experience during the past month? Please select all that apply'. The questionnaire was designed to ask participants to mark items only when they identified them as stressors, rather than simply asking about the presence of stressors. The list included a total of 21 choices subsumed under five domains: (i) problems with

Table 1. Subject characteristics ($n = 10\,969$) vs 2000 Census data

Age group (years)	Present study				Census (2000)			(thousand)
	Total (%)	Female (%)	Male (%)	M/F	Total (%)	Female (%)	Male (%)	M/F
50–59	5 036 (45.9)	2583 (44.3)	2453 (47.7)	0.95	19 176 (39.2)	9 676 (36.6)	9 500 (42.3)	0.98
60–69	3 436 (31.3)	1745 (30.0)	1691 (32.9)	0.97	14 841 (30.3)	7 735 (29.2)	7 107 (31.6)	0.92
70–79	1 802 (16.4)	1003 (17.2)	799 (15.5)	0.80	10 051 (20.5)	5 755 (21.8)	4 296 (19.1)	0.75
80–	695 (6.3)	495 (8.5)	200 (3.9)	0.40	4 848 (9.9)	3 279 (12.4)	1 569 (7.0)	0.48
Total	10 969 (100.0)	5826 (100.0)	5143 (100.0)	0.88	48 917 (100.0)	26 445 (100.0)	22 472 (100.0)	0.85

primary support group (separation/divorce; health/illness/care of self; death of a close person; burden of housework; family relationship; relationship with relatives; and health/illness/care of family); (ii) problems related to social environment (having no one to talk to; loss of purpose in life; having nothing to do; and retirement); (iii) occupational problems (commuting [crowded public transportation, long distance etc.]; workplace relationship; unemployment; adjusting to a new job; stress on the job); (iv) housing problems (relationship with neighbors; living environment [pollution, noise etc.]; concerns about housing); and (v) financial problems (debt; and income/household budget). The strength (burden) of life stressors was assessed with the question: 'Have your troubles, hardships, stress, or dissatisfaction with daily life interfered with your social life or everyday life during the past month?' Participants answered this question on a 4-point scale: 1, much; 2, some; 3, little; or 4, none.

The CES-D is a 20-item instrument specifically designed to screen for depression among the general population, and in the present study it was used to assess subjective depressive symptoms during the past week. Each item on the CES-D is scored from 0 to 3, yielding a total score ranging from 0 to 60, with higher scores indicating more severe depressive symptoms. A cut-off score of ≥16 may indicate the presence of depression.[16] Almost 30% of Japanese adults reportedly score ≥16 on the CES-D,[18] suggesting an overestimation of the prevalence of depression compared with Japan as a whole, as well as to Western European countries. Therefore, we defined a CES-D score of ≥26 as a cut-off to select subjects whose symptoms more closely approximate those of major depression according to the criterion used by Cho *et al.*[19] As a result, the present study identified the following three groups of subjects based on the severity of depressive state: (i) control group scoring <16 on the CES-D (mean ± SD = 9.5 ± 4.0); (ii) D_{16} group having mild–moderate depressive symptoms with a score of 16–25 on the CES-D (mean ± SD = 19.8 ± 2.8); and (iii) D_{26} group having severe depressive symptoms with a score of ≥26 on the CES-D (mean ± SD = 32.8 ± 6.5).

Statistical analysis

After contrasting our study sample data with the Census data, we adjusted the sample size for gender and age group. The study sample was classified into two gender groups and four age groups in decades (Table 1). For each of these eight subgroups, we weighted the sample size based on the population proportion (weight(i) = percentage of Census population in subgroup(i)/percentage of sample in subgroup(i), where $i = 1, \ldots, 8$).[1] We conducted the following statistical analyses based on the weighted samples.

Mean CES-D scores were compared using two-way (age group × gender) analysis of variance (ANOVA), followed by Bonferroni post-hoc comparisons. Differences in the distribution of subjects in the control, the D_{16}, and the D_{26} groups as well as the male : female ratios were analyzed using the χ^2 test.

We further examined the relationship between the incidence of life stressors and mild–moderate (D_{16}) and severe (D_{26}) depressive symptoms using multiple logistic regression analysis. The following parameters were entered as covariates: life stressors, gender, age group, community size (cities with population of ≥150 000 were coded as metropolis, while those with a population <150 000 were coded as town/village), geographic region (north, east, west, or south), and strength (burden) of life stressors. Odds ratios (OR) and 95% confidence intervals (CI) were calculated.

Statistical significance was set at 0.05. All analyses were performed using SPSS 11.5 for Windows (SPSS, Chicago, IL, USA).

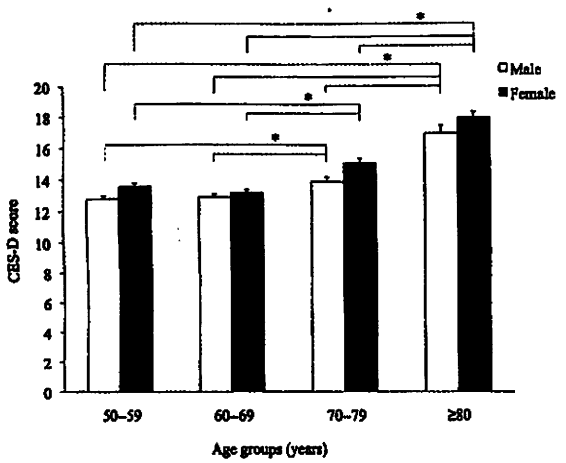

Figure 1. Center for Epidemiologic Studies Depression Scale (CES-D) score vs age group and gender: (□) male; (■) female. Data are given as average ± SEM. Increased age was associated with higher CES-D scores. Compared with men, women scored significantly higher on the CES-D (*$P < 0.001$).

RESULTS

The questionnaire was returned by 32 729 participants. Because the number of residents in each sampling community who were contacted for participation in the ASHW was not made public by the Ministry of Health, Labour and Welfare, we were unable to calculate the response rate. The response rate for a similar survey, however, conducted 3 and 4 years previously, was 87.1% and 89.6%, respectively. We assume that the response rate for the present study, which used a similar methodology, resembled those. A total of 707 subjects who returned a blank questionnaire were excluded from the analysis. Further, subjects who did not respond to items on gender or age ($n = 208$) or those who did not respond to five or more items on the CES-D ($n = 7471$) were excluded from the analysis. Because the present study was focused on late life, we further excluded subjects who were younger than 50 years of age ($n = 13\,374$). The final sample size was 10 969.

Figure 1 shows the mean CES-D scores by age group and sex. Two-way ANOVA found a significant main effect of age group ($F(3,10\,961) = 82.3$, $P < 0.001$). Post-hoc analyses indicated a significantly higher CES-D score among those in their 70s ($P < 0.001$) and 80s ($P < 0.001$) than those in their 50s and 60s, in other words, there were significantly more depressive symptoms with increased age. We also found a significant main effect of gender ($F(1,10\,961) = 18.5$, $P < 0.001$). Women reported a significantly higher CES-D score than men ($P < 0.001$). Age group × gender interaction was not significant ($F(3,10\,961) = 1.3$, $P = 0.275$).

Table 2 lists the distribution of subjects in the control, the D_{16}, and the D_{26} groups as well as the male : female ratio in each age group. Of the entire study sample, 2397 (21.9%) and 1019 (9.3%) fell under the D_{16} and the D_{26} groups, respectively. Across age groups, there were significant differences in the distribution of subjects in the three symptom groups ($\chi^2 = 316.9$, d.f. = 6, $P < 0.001$). The majority of the subjects in the D_{16} group were in their 80s, while those in the D_{26} group were older than 70. There were also significant differences in the male : female ratio across the three symptoms groups ($\chi^2 = 40.9$, d.f. = 2, $P < 0.001$). The male : female ratio in the D_{16} and the D_{26} groups was lower at 0.71 and 0.70, respectively, compared with 0.92 in the control group.

Table 3 lists the percentage of subjects who endorsed the item as well as the relative risks (OR) for the presence of D_{16} and D_{26} symptoms for each of the life stressors, derived from and grouped based on the classification for the DSM-IV-TR Axis IV.[20] The most frequently endorsed life stressors were 'health/illness/care of self' (34.2%), 'health/illness/care of family' (21.5%), 'stress on the job' (15.9%), and 'income/household budget' (15.7%).

Among problems regarding the primary support group, all items except 'separation/divorce' and 'health/illness/care of family' had significant relationships with the increased incidence of D_{16} and D_{26} symptoms. The relationship was especially strong for 'health/illness/care of self' (OR = 1.7 and 2.2 for D_{16} and D_{26} symptoms, respectively). 'Separation/divorce' had a strong relationship with the increased incidence of D_{16} symptoms (OR = 2.8), but its

Table 2. Age vs severity of depression

Age group	%Control group (M/F ratio)	%D_{16} group (M/F ratio)	%D_{26} group (M/F ratio)
50–59	71.5 (1.05)	21.6 (0.85)	6.9 (0.75)
60–69	73.3 (0.97)	20.2 (0.74)	6.5 (1.02)
70–79	65.5 (0.81)	22.2 (0.63)	12.3 (0.64)
≥80	51.7 (0.50)	27.4 (0.44)	20.9 (0.47)
Whole	68.9 (0.92)	21.9 (0.71)	9.3 (0.70)

Significant differences were found for both D_{16} and D_{26} with respect to gender and age (χ^2 test, $P < 0.001$).

Table 3. Relative risk for the presence of D_{16} and D_{26} symptoms vs life stressor

Life stressor	% responders	D_{16} group			D_{26} group		
		Adjusted OR	95%CI	*P*	Adjusted OR	95%CI	*P*
Problems with primary support group							
Separation/divorce	0.7	2.8	1.4–5.3	0.002	2.2	0.9–5.6	NS
Health/illness/care of self	34.2	1.7	1.5–1.9	<0.001	2.2	1.9–2.7	<0.001
Death of a close person	5.6	1.6	1.3–2.0	<0.001	1.5	1.1–2.0	0.006
Burden of housework	3.8	1.4	1.1–1.8	0.006	1.7	1.2–2.4	0.004
Family relationship	12.5	1.5	1.3–1.8	<0.001	1.8	1.5–2.3	<0.001
Relationship with relatives	8.2	1.5	1.3–1.8	<0.001	1.4	1.1–1.9	0.009
Health/illness/care of family	21.5	0.9	0.8–1.05	NS	0.8	0.6–0.9	0.005
Problems related to social environment							
Having no one to talk to	4.5	3.3	2.5–4.4	<0.001	5.0	3.6–6.9	<0.001
Loss of purpose in life	6.4	1.8	1.5–2.2	<0.001	2.8	2.2–3.7	<0.001
Having nothing to do	3.1	1.5	1.1–2.0	0.016	2.4	1.7–3.4	<0.001
Retirement	12.1	1.1	0.95–1.3	NS	0.8	0.6–1.1	NS
Occupational problems							
Commuting (crowded, long distance, etc.)	0.9	1.5	0.9–2.3	NS	1.3	0.6–2.8	NS
Workplace relationship	8.5	1.4	1.2–1.7	<0.001	1.5	1.1–2.0	0.014
Unemployment	1.9	1.3	0.9–1.8	NS	1.2	0.7–1.9	NS
Adjusting to a new job	1.0	0.9	0.6–1.5	NS	1.1	0.6–2.1	NS
Stress on the job	15.9	1.1	0.9–1.2	NS	0.8	0.6–0.9	0.030
Housing problems							
Relationship with neighbors	7.6	1.4	1.1–1.7	<0.001	1.6	1.2–2.0	<0.001
Living environment (pollution, noise, etc.)	4.1	1.0	0.8–1.3	NS	1.0	0.7–1.5	NS
Concerns about housing	6.1	0.9	0.7–1.1	NS	0.9	0.7–1.2	NS
Economic Problems							
Debt	4.9	1.3	1.1–1.7	0.014	2.1	1.5–2.9	<0.001
Income/household budget	15.7	1.0	0.8–1.1	NS	1.0	0.8–1.2	NS

Covariates: life stressor, gender, age group, community size, geographic region, strength (burden) of life stressors.
CI, confidence interval; OR, odds ratio.

relationship with the incidence of D_{26} symptoms was not significant. In contrast, there was a significant relationship between 'health/illness/care of family' and decreased incidence of D_{26} symptoms (OR = 0.8).

Among problems related to social environment, 'having no one to talk to' (OR = 3.3 and 5.0), 'loss of purpose in life' (OR = 1.8 and 2.8), and 'having nothing to do' (OR = 1.5 and 2.4) had significant relationships with the increased incidence of D_{16} and D_{26} symptoms, respectively. Among occupational problems, only 'workplace relationship' had significant relationships with the increased incidence of D_{16} and D_{26} symptoms (OR = 1.4 and 1.5, respectively). 'Stress on the job' had a significant relationship with the decreased incidence of D_{26} symptoms (OR = 0.8). Among housing problems, only 'relationship with neighbors' had significant relationships with the increased incidence of D_{16} and D_{26} symptoms (OR = 1.4 and 1.6, respectively). Among financial problems, 'debt' had significant relationships with the increased incidence of D_{16} and D_{26} symptoms (OR = 1.3 and 2.1, respectively).

DISCUSSION

The aim of the present study was to clarify the psychosocial stress in daily life associated with late-life depression. The study subjects were individuals aged ≥50 randomly selected throughout Japan. Their age distribution was comparable to that from the Census conducted around the same time. That is, the present study has epidemiological value due to its use of a large representative sample of the general population. This study included >10 000 subjects in late life who were living in 300 different communities across Japan, which enabled us to obtain data representing

the Japanese general population. In the present sample approximately one in five (21.9%) and one in 10 (9.3%) subjects fell into the groups D_{16} (mild–moderate depressive symptoms with a score of 16–25 on the CES-D) and D_{26} (severe depressive symptoms with a score of ≥26 on the CES-D), respectively. Further, increased age and being female were associated with more severe depressive symptoms (i.e. higher scores on the CES-D). In order to examine whether the presence of subjective stress in late life is associated with the incidence of D_{16} and D_{26} depressive symptoms, survey questions were designed to ask participants to report stressors only when they identified items in the list as stress, rather than simply asking about the presence of stressors.

The study found the strongest relationship between incidence of both D_{16} and D_{26} symptoms and life stressors stemming from 'having no one to talk to'. All other life stressors related to social relationships such as 'relationship with neighbors', 'workplace relationship', and 'relationship with relatives' were also significantly related to the presence of depressive symptoms. The association between diminished social contacts and the development of depression in late life has been established in previous studies.[21,22] With the aging of the population, the number of Japanese elderly people living alone is markedly increasing. This is unlikely to be unrelated to the high prevalence of late-life depressive state found in the present study. Diminished social contacts in late life include attenuation of human relationships and insufficient social support. Indeed, previous research suggests that adequate social support not only directly improves psychological health, but may act as a buffer against social stress as a risk factor for depression.[23] Therefore, improvement in nursing care insurance services in Japan, especially increasing service utilization among community-living elderly people may help combat late-life depression.

Next to 'having no one to talk to', experiences of loss and bereavement ('loss of purpose in life', 'separation/divorce', 'death of a close person', and 'having nothing to do') were strongly related to the incidence of late-life depressive symptoms. A number of studies in Europe and USA have consistently shown a strong relationship between the death of a spouse or a loved one and subsequent development of depression.[24–27] Life events associated with a strong sense of loss that may be destructive to the individual and that may persist over a long period of time, such as separation from or bereavement of an important person, loss of purpose in life, and loss of social roles, have been identified as risk factors for late-life depression.[15,28] The present results support the possibility that experiences of loss and bereavement may increase the risk for late-life depression among the Japanese as well. Previous studies that examined risk factors for depression did not identify 'separation/divorce' as a significant risk factor.[29,30] This may be attributable in large part to insufficient statistical power to detect its effect due to the low frequency of occurrence. Although the proportion of respondents who selected 'separation/divorce' was also very low in the present study, at 0.7% (the least), a relationship was found between 'separation/divorce' and the incidence of D_{16} symptoms, due to the larger sample size. In contrast, among experiences of loss and bereavement, 'separation/divorce' was not significantly associated with the incidence of D_{26} symptoms. This finding suggests that even though 'separation/divorce' in late life was associated with mild depressive symptoms, examining whether this item could be a risk factor for moderate–severe clinical depression remains as a question for further study.

The third strongest relationship with late-life depressive symptoms was found for 'health/illness/care of self'. This item was the most common life stressor, endorsed by 34.2% of the entire sample, 49.2% of the D_{16} group, and 66.4% of the D_{26} group. Studies on the elderly have repeatedly shown that having physical illness and/or disabilities increases the risk for developing depression.[22,26,31,32] Cerebrovascular disease, in particular, is a risk factor consistently associated with the development of late-life depression.[33] The influence of physical illnesses on the development of depression has primarily been attributed to biological processes, including alterations in the neuroendocrine system or cerebral blood flow and physical stress such as chronic pain. As a psychosocial risk factor, in contrast, physical illnesses play a role in one's psychological reactions when faced with aging or death or in social aspects such as hospitalization, institutionalization, and reduced social activities.[15] Similar to other life events, development or exacerbation of a severe and fatal illness may incur strong psychological burden and frequent and significant confusion in lifestyle among afflicted elderly people. Some elderly people must face serious yet unavoidable issues such as their own senility, remaining days, or death upon receiving a diagnosis or being informed of serious or chronic physical illness such as cerebrovascular disease

cancer, myocardial infarction, or diabetes. These issues may result in impairment in life functioning or hospitalization, which in turn may diminish social contact.

Another life stressor significantly associated with late-life depressive symptoms was 'debt'. It is generally well-recognized that economic status affects physical and mental health. It is therefore not surprising that the present study found a relationship between 'debt' and late-life depressive symptoms. Limited income leads to poor access to medical care and mental health services, which consequently hinder the early detection and treatment of depression. Even when depression is detected at a relatively early stage, financial hardship will hamper prevention of major depressive episodes or access to mental health resources ensuring appropriate treatment for the current depressive episode.[34] Meanwhile, the present study did not find a significant relationship between 'income/household budget' and depressive symptoms. This may be attributable to Japan's universal health insurance system, in which people with low income have relatively easy access to medical care. Therefore, depression among the elderly people who have debts may be largely attributable to reduced quality of living conditions or psychological pain stemming from the obligation to repay the debt.

Finally, the relative risk of respondents who endorsed 'health/illness/care of family' and 'stress on the job' to have severe depressive symptoms (i.e. score ≥26 on the CES-D) was <1, suggesting that these two items were not identified as risk factors for clinical depression. These two items, however, were both endorsed at high frequencies overall, indicating that many of the subjects in the control (no depression) group also endorsed them. Therefore, the lack of relationship between increased incidence of depressive symptoms and either of 'health/illness/care of family' or 'stress on the job' observed in the present study does not guarantee that these items do not affect late-life depression.

Study limitations

There were several limitations to the present study. First, as a cross-sectional survey, it was not possible to ascertain the time of onset and duration of depressive symptoms and life stressors or the time interval between them. Therefore, a causal relationship cannot be inferred. Investigation into the causal relationship was outside of the scope of the present study, but is suggested for future research. We were able, however, to achieve the primary goal of the study, which was to clarify the relationship between life stressors and late-life depressive symptoms in a large representative sample of the general population.

Second, the survey data were collected via a self-administered questionnaire, and structured interview was not used to determine definitive diagnosis. Data collection using interview for a large sample in the present study would present tremendous methodological and financial challenges. Hence there is the possibility that some of the individuals defined as having depression in the present study may have had comorbid psychiatric disorders such as anxiety disorders.

Third, because the CES-D is a screening instrument for depression among the generations,[16] some of the study subjects who scored 16 (the cut-off) or higher on the CES-D may not have met the clinical diagnostic criteria (e.g. DSM-IV-TR) for depression. The reliability and validity of the CES-D, however, have been widely established in epidemiological studies using a representative population sample. We therefore believe that the investigation into the relationship between life stressors and late-life depression is beneficial to gaining insight into how to combat the risk factors for depression.

Fourth, it is difficult to identify whether items included in the 'problems related to social environment' domain (such as 'loss of purpose in life' and 'having nothing to do') are stress factors or induced as a part of depressive symptoms. It is necessary to consider the possibility that the study results may include both.

Conclusion

The aim of the present study was to clarify the relationship between late-life depression and life stressors in a large representative sample of the Japanese general population. A relationship was found between late-life depression and diminished social relationships, experiences with loss of purpose in life or human relationships, and health problems. The findings provide valuable insights for policies to help sustain mental health in late life in rapidly 'super-aging' Japan, where the population is growing older at a rate incomparable to any other country.

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ORIGINAL ARTICLE

Stress coping behaviors and sleep hygiene practices in a sample of Japanese adults with insomnia

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Abstract

This study examined the characteristics of behaviours for coping with stress and sleep hygiene practices utilized by adult people with insomnia. Self-administered questionnaire data from a representative sample of 24 551 adults (completed in 2000) were analyzed. Participants reported insomnia symptoms present during the last 1-month period, answering 11 items on physical and psychological conditions, 7 items on problem-solving and emotion-focused coping behaviors in response to stress (SCBs), 5 items on measures taken to ensure adequate sleep (SHPs), and the Center for Epidemiologic Studies Depression Scale (CES-D). Those presenting with insomnia symptoms accompanied by daytime complaints were defined as having insomnia. Multivariable logistic regressions were performed with sex, age, and the presence of stress as covariants to determine which SCBs and SHPs are factors associated with insomnia. Prevalence of insomnia was 43.4% (n = 10 653) and comorbidity of depression (CES-D > 26) occurred in 12.7% of participants (n = 1357, 5.5% of total sample). Logistic regression analysis controlling for other adjustment factors revealed that insomnia was positively associated with 4 emotion-focused SCBs ("Bearing", "Smoking", "Eating" and "TV/Radio"), negatively associated with "Problem-solving," and positively associated with 3 SHPs ("Alcohol", "Books/Music" and "Bath"). Insomnia comorbid with depression had a strong positive association with Bearing (OR = 3.44), but a strong negative association with Problem-solving (OR = 0.50). Japanese adults with insomnia might engage in various maladaptive SCBs and SHPs. The negative correlate of Problem-solving supports the importance of promoting self-help sleep practices in public health.

Key words: depression, insomnia, Japanese adult population, sleep hygiene practices (SHPs), stress coping behaviors (SCBs).

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Acronyms used: ICSD-2 = International Classification of Sleep Disorders, 2nd Edition; DSM-IV-TR = Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision; SCBs = stress coping behaviors; SHPs = sleep hygiene practices; CES-D = Center for Epidemiologic Studies Depression Scale; OR = odds ratio.

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INTRODUCTION

Insomnia is a common sleep disorder. The reported prevalence of insomnia in the general population varies widely, ranging between 4.4% and 48%, depending on sample characteristics and the definition of insomnia.[1–4] Chronic insomnia not only reduces the quality of sleep during the night, but also causes a variety of impairments in mental and physical functioning during the daytime.[5–10] Chronic insomnia is associated with both human and socioeconomic costs, such as increased long-term absenteeism at work, reduced performance and productivity, and increased industrial accidents and health-care costs.[11–16] Moreover, alongside insomnia being the most common symptom of depression,[17–21] persistent insomnia is a risk or exacerbating factor of depressive disorders.[22–27]

Factors leading to the onset and worsening of insomnia are multidimensional in nature,[28] and many life events and life stresses can result in acute insomnia.[28–30] Based on the 3P model proposed by Spielman that is widely used to explain the onset mechanism of insomnia,[31] three factors (predisposing, precipitating, and perpetuating) are closely linked to insomnia development. With underlying predisposing factors (including age, sex, genetic disposition, and lifestyle), insomnia emerges as precipitating factors (stressful life events such as divorce, pain, and psychological and physical problems) are superimposed, and the insomnia becomes chronic and difficult to treat because of perpetuating factors (maladaptive sleep hygiene practices, dysfunctional cognition about sleep loss and its impact on life).[23,31–34]

Inadequate stress coping behavior also precipitates insomnia, and heightens uneasiness and tension around being unable to sleep, thereby perpetuating the sleeplessness.[7,8,35] Further, insomniacs may often engage in poor sleep hygiene, such as having an inadequate sleep environment, lack of daytime activities, and excessive afternoon napping.[7,8,30–35] It is reported that the majority of people with insomnia attempt to cope with sleep problems in various ways,[36] have fewer adaptive coping skills, rely more on emotion-focused coping strategies than on problem-solving strategies,[37] and report lower feelings of mastery.[24,38–40] Although reduced quality of life associated with insomnia has been reported in a general population sample,[9,10,32] few studies have examined specific daily behaviors and practices of people with insomnia.

The aims of this study are: (i) to investigate the prevalence of insomnia during the past one month associated with daytime impairments among Japanese adults; and (ii) to examine how insomnia and comorbid depression are associated with stress coping behaviors (SCBs) and sleep hygiene practices (SHPs), using data of a representative sample from a large-scale epidemiological study on sleep habits and their correlates.

MATERIALS AND METHODS

Data source

The present study was conducted using partial data from the Active Survey of Health and Welfare performed in June 2000 by the Ministry of Health, Labour and Welfare. The purpose of the survey was to collect basic data on health and welfare, including sleep habits, from the general public of Japan. To provide a representative sample of the general population, the survey was conducted through public health centers in 300 target areas randomly selected from the 881 851 national census areas nationwide. Participants were household members aged ≥12 years, all Japanese. Survey officials for home visits were employed part-time and trained as research associates by public health centers across Japan during this time. For data collection, these research associates visited each participating household to distribute self-administered questionnaires and collect them a few days later.

All survey respondents provided verbal informed consent to participate. Their privacy was protected in accordance with the Declaration of Helsinki guidelines.

Measures

The self-administered questionnaire for the present study was developed by two of the authors (MU and TO.) and an appropriate official from the Ministry of Health, Labour, and Welfare. The self-administered questionnaire consisted of 44 items covering: (ii) sociodemographic characteristics including age and sex; (ii) general health status; (iii) physical and psychological complaints; (iv) information on mental stress; (v) sleep habits and problems; and (vi) Center for Epidemiologic Studies Depression Scale (CES-D) Japanese version.[41]

To examine factors associated with 1-month insomnia and determine whether stress was present, one item ("Have you experienced stress in your daily life during the last one month period?") was extracted from the 44 items on the self-administered questionnaire. Seven items related to mental stress were extracted from the question "What do you do to deal with insomnia, worries, difficulties, and/or stress?" Five items related to sleep habits and problems were extracted from the

question "Have you tried to do any of the following during the last one month period to get enough sleep?" The CES-D is a self-report scale designed specifically to measure depressive symptomatology in the general population during the previous week-long period[42] and has appropriate levels of reliability and validity for use with a general population. Each item is rated on a scale of 1 to 3 points, and the result is evaluated based on the total score for all 20 items (range 0 to 60 points). Higher scores indicate increased severity of depression. This scale is designed to screen, not to diagnose, major depression. The reliability and validity of the CES-D Japanese version has been reported in Japan.[41]

Case definition of insomnia

Based on an algorithm that combined the general criteria of insomnia in ICSD-2[43] and the diagnostic criteria of primary insomnia in DSM-IV,[44] we first selected cases reporting the presence of both insomnia symptoms and physical/psychological complaints during the past one month, identified based on the responses to the survey questionnaire about sleep problems and daytime functioning during the past one month. Then we excluded cases reporting a common comorbid sleep disorder (sleep-disordered breathing and restless leg syndrome). Therefore, people with insomnia were defined here as individuals who reported all of the following.

A) *Sleep problems*. We determined a respondent had insomnia symptoms when reporting any of the following items occurring or persisting during the past one month: "difficulty falling asleep," "waking up frequently during the night," "waking up early in the morning," and "getting up in the morning feeling unrefreshed or not restored (nonrestorative sleep)."
B) *Daytime impairments*. We determined that a respondent had daytime impairments when reporting any of 6 physical complaints (head-heaviness/headache, gastric discomfort, diarrhea/constipation, shoulder/neck stiffness, fatigability, and residual fatigue) or 5 psychological complaints (depression, irritability, anxiety, hypochondria, and daytime sleepiness), which are common symptoms of insomnia,[43] occurring or persisting during the past one month.[44]
C) *No comorbid sleep disorder*. We excluded cases with comorbid sleep-disordered breathing or restless legs syndrome, which are also common in the general population. We excluded respondents reporting either "waking up during the night due to loud snoring and breathing difficulty" or "feeling a crawling sensation deep inside my legs" occurring or persisting during the past one month.

Case definition of insomnia comorbid with depression

We defined the presence of depression as a score of ≥26 (range 0–60) on the 20-item CES-D Japanese version. Studies in West European countries indicate that a score of ≥16 is indicative of probable clinical depression,[42] but we set the cutoff score for depression at 26 according to the criterion used by national census studies conducted in Korea[45] and Japan.[46] Among the respondents of the Active Survey of Health and Welfare, 8.1% scored ≥26 on the CES-D, which was close to the 12-month prevalence of mood disorders based on the DSM criteria (6.8%) obtained in a community survey conducted between 2002 and 2003 in Japan.[47] We defined "people with insomnia comorbid with depression" as those who had 1-month insomnia and scored ≥26 points on the CES-D Japanese version.

Stress coping behaviors (SCBs)

Respondents were asked to answer the following questions: "Do you use the following coping behaviors when you feel dissatisfied or distressed, or experience problems or stress?" (yes = 1, no = 0). They indicated if each of the following 7 items describing everyday stress coping behaviors applied to them: (i) "Making an effort to solve the problems actively [Problem-solving];" (ii) "Making plans to take time off [Time off];" (iii) "Eating something [Eating]," (iv) "Watching TV/ Listening to the radio [TV/Radio];" (v) "Taking it easy [Ease];" (vi) "Smoking [Smoking];" and (vii) "Bearing the stress without taking any action [Bearing]."

Sleep hygiene practices (SHPs)

Respondents were asked to answer the following questions: "Did you engage in any of the following practices in the past one month in order to sleep well?" (yes = 1, no = 0, except for the first item). They indicated whether each of the following 5 items describing everyday sleep hygiene practices applied to them: (i) "Drinking alcohol [Alcohol];" (ii) "Taking light exercise [Exercise];" (iii) "Taking a bath [Bath];" (iv) "Reading books/Listening to music [Books/Music];" and (v) "Trying to have regular daily habits [Regularity]."

Table 1 Demographic characteristics of analyzed subjects in a sample of the Japanese adult general population (n = 24 551)†

	Study subjects			Census 2000 (n = 100 733 618)	
Age class (years)	Subtotal % (n)	Male % (n)	Female % (n)	Male %	Female %
20–29	18.2 (4468)	18.4 (2145)	18.0 (2323)	19.1	17.2
30–39	18.4 (4508)	18.4 (2152)	18.3 (2356)	17.5	16.1
40–49	18.8 (4606)	19.2 (2249)	18.3 (2357)	17.2	16.0
50–59	20.5 (5036)	21.0 (2453)	20.0 (2583)	19.5	18.6
60–69	14.0 (3436)	14.5 (1691)	13.6 (1745)	14.6	14.9
≤70	10.2 (2497)	8.5 (999)	11.6 (1498)	12.1	17.4
Total	100 (24551)	100 (11689)	100 (12862)	100	100

†Data for both the present study and the overall census were obtained in 2000.

Respondents rated the item [Alcohol] on a 4-point scale: "None," "1–2 times per month," "1–2 times per week," and "more than 3 times per week." On this item, we coded "1–2 times per week" and "more than 3 times per week" as "yes."

Presence of stress

Respondents were asked to answer the following question: "Did you feel dissatisfied or distressed, or experience any difficulties or stress during the past one month?" They answered this question on a 4-point scale: "much," "some," "little", and "none." In our study, "much" was coded as "yes" and the other response choices were coded as "no" (yes = 1, no = 0).

Statistical analysis

The prevalence of insomnia and prevalence of insomnia comorbid with depression were compared by sex and age group, using chi-square tests. Associations between individual SCB and SHP factors and insomnia (or comorbid with depression) were examined. Logistic regression analyses were performed to identify associations between each factor and 1-month insomnia.

Sex, age group – younger (20–39), middle-aged (40–59), and old-aged (≥60) – and presence of stress were entered into the regression models to adjust for the confounding effects of sociodemographic and other factors. Odd ratios (ORs) were calculated from both the univariate analyses and the multivariate logistic regression analysis with 95% confidence intervals. Statistical significance was set at $P < 0.01$. All analyses were performed using SPSS 11.5 for Windows (SPSS Inc, Chicago, IL, USA).

RESULTS

Sample characteristics

A total of 32 729 people completed the survey questionnaire. We limited the sample to adults aged ≥20 years and further excluded those with any missing data for the variables included in our analysis. Before conducting analyses, data from 707 participants were excluded for submitting blank survey sheets. Minors aged <20 years (n = 3284) were excluded because this study focused on adults. Additionally, data from respondents who did not answer questions regarding sex and age (n = 208) and data from those who did not answer >6 items on the CES-D were excluded (n = 3979). Thus, the final sample for analysis comprised 24 551 adults: 11 689 (47.7%) men and 12 862 (52.3%) women, with a mean age of 47.1 years (range 20–100 years). Demographic data of the study sample are shown in Table 1.

Compared with the national census data collected around the same time, our study sample included a smaller proportion of adults aged ≥70, but the rates for the other age groups were similar. The national census data were based on all residents of Japan on October 1, 2000, and Table 1 indicates that our study sample was a representative sample of the general population of Japan. Because the total number of residents recruited in each target area was not made public by the Ministry of Health, Labour and Welfare, we were unable to compute the response rate. The Active Surveys of Health and Welfare conducted 3, 4, and 6 years prior to 2000 had response rates of 87.1%, 89.6%, and 87.3%, respectively. Since the methodology of the survey has remained the same over the years, we postulated that the response rate for our study sample was similar to those from previous surveys.[46]

Table 2 Presence of insomnia and insomnia comorbid with depression, by age group and sex

	Insomnia			Insomnia comorbid with depression		
Age class (years)	Subtotal % (*n*)	Male % (*n*)	Female % (*n*)	Subtotal % (*n*)	Male % (*n*)	Female % (*n*)
20–29	37.1 (1661)	33.4 (716)	40.7 (945)	5.6 (252)	4.9 (106)	6.3 (146)
30–39	41.7 (1881)	38.8 (834)	44.4 (1047)	4.4 (198)	3.3 (72)	5.3 (126)
40–49	41.5 (1911)	42.3 (953)	40.6 (958)	5.1 (236)	4.5 (102)	5.7 (134)
50–59	45.5 (2290)	45.1 (1107)	45.8 (1183)	5.0 (253)	4.6 (112)	5.5 (141)
60–69	48.1 (1653)	46.1 (780)	50.0 (873)	4.5 (155)	4.6 (78)	4.4 (77)
≤70	50.3 (1257)	48.8 (488)	51.3 (769)	10.5 (263)	9.0 (90)	9.8 (173)
Total	43.4 (10653)	41.7 (4878)	44.9 (5775)†	5.5 (1357)	4.8 (560)	6.2 (797)†

†Significant difference between men and women ($P < 0.001$, chi-square test).

Prevalence of insomnia

Prevalence of insomnia in the study sample by sex and age group is summarized in Table 2. In the entire sample, the prevalence was 43.4% (n = 10 653). The rate was significantly higher in women than in men: 44.9% (5775/12 862) versus 41.7% (4878/11 689), $\chi^2 = 25.02$, $P < 0.001$. The prevalence comorbid with depression (i.e. people with insomnia who scored ≥26 on the CES-D Japanese version) was 5.5% (n = 1357) of the entire sample and 12.7% of the sample of people with 1-month insomnia. The prevalence was significantly higher in women than in men: 6.2% (797/12 862) versus 4.8% (560/11 689), $\chi^2 = 23.17$; $P < 0.001$.

Percentage of SCBs and SHPs

The frequencies of each SCB and SHP item among people with insomnia and insomnia comorbid with depression are shown in Table 3.

SCB factors associated with insomnia

Table 3 shows the SCB factors associated with insomnia and their ORs. In multivariable logistic regression, incidence was significantly positively associated with four SCB factors: Bearing (OR = 1.69), Smoking (OR = 1.26), Eating (OR = 1.22), and TV/Radio (OR = 1.18), all $P <$ 0.01. Conversely, Problem-solving was the only SCB with a significantly negative correlation (OR = 0.87). Time off and Ease showed no significant association.

SHP factors associated with insomnia

Table 3 also shows the SHP factors associated with insomnia and their ORs. In multivariable logistic regression, insomnia was significantly positively associated with three of the SHP factors: Alcohol (OR = 1.27), Books/Music (OR = 1.24), and Bath (OR = 1.09), all $P < 0.01$. Regularity and Exercise were not significantly correlated. None of the SHPs was negatively correlated.

SCB factors associated with insomnia comorbid with depression

Table 3 shows the SCB factors associated with insomnia comorbid with depression and their odds ratios. Multivariate logistic analysis showed the following four SCB factors had significant positive relations with insomnia comorbid with depression in descending order: Bearing (OR = 3.44), Smoking (OR = 1.73), TV/Radio (OR = 1.52), and Eating (OR = 1.51). Conversely, SCB factors with significant negative relations with insomnia comorbid with depression included Problem-solving (OR = 0.50) and Ease (OR = 0.74). Time off was not significantly related to insomnia comorbid with depression.

SHP factors associated with insomnia comorbid with depression

The SHPs associated with insomnia comorbid with depression and their odds ratios are also shown in Table 3. Multivariate logistic analysis showed insomnia comorbid with depression was significantly and positively related only to Books/Music (OR = 1.36). Conversely, the only factor with a significant negative relationship with insomnia comorbid with depression was Regularity. The individual factors of Alcohol, Bath, and Exercise showed no significant relationship with incidence comorbid with depression.