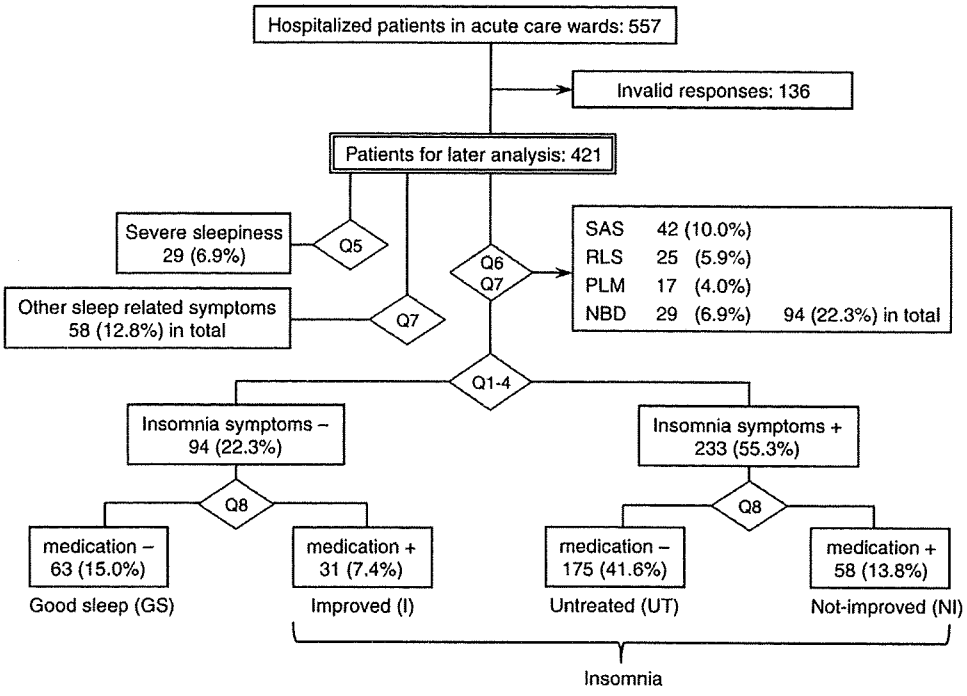

Fig. 1. Diagnostic flow of the subjects in this study. See text and Table 2 for explanation.

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 $\pm$ 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 $\pm$ SD = 19.8 ± 2.8); and (iii) D_{26} group having severe depressive symptoms with a score of ≥ 26 on the CES-D (mean $\pm$ 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 $\times$ 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 $\geq 150\,000$ 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).

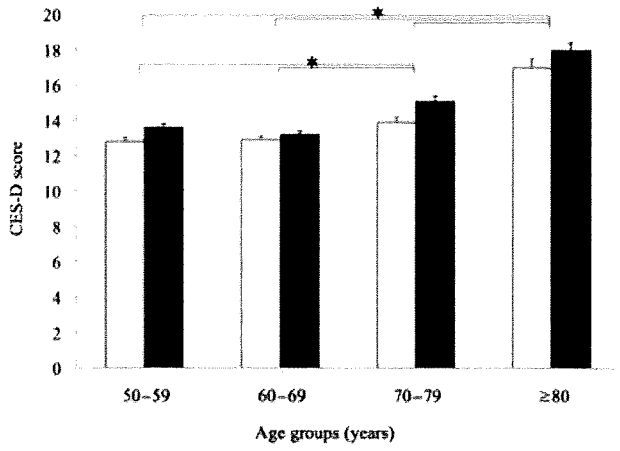

Figure 1. Center for Epidemiologic Studies Depression Scale (CES-D) score vs age group and gender: (□) male; (■) female. Data are given as average ± SEM. Increased age was associated with higher CES-D scores. Compared with men, women scored significantly higher on the CES-D (*$P < 0.001$).

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 $\geq$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 $\geq$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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Coping strategies and their correlates with depression in the Japanese general population

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Abstract

This study's aim was to examine the relation between depression and stress-coping strategy among the general population. The survey was conducted in June 2000, using a large sample representative of the Japanese general population. A total of 24,551 responses from individuals aged 20 years or older were analyzed. The Center for Epidemiologic Studies Depression Scale (CES-D) was used to assess the prevalence of depression with two different cut-off points; 16 and 26. Stress-coping strategies were asked based on given examples of actual behaviors covering problem-focused, emotion-focused, and avoidant ones. There was no marked gender difference in the prevalence of a problem-solving strategy, while various types of gender differences were found with respect to the prevalence of emotion-focused and avoidant strategies. In relation to depression, multivariate logistic regression analyses revealed the significantly highest odds ratios (OR) for avoidant coping strategies and the lowest OR for problem-focused ones in both genders. The fact that depression was associated positively with avoidant strategies but negatively with problem-solving strategies indicates that individual stress-coping strategies have their own significance with respect to depression, and may be utilized in establishing an evidence-based cognitive behavioral approach to depressive patients.

Keywords: Mood disorders; Stress; Avoidant; Cognitive; Behavioral; Epidemiology; Japan; Problem-focused; Emotion-focused

1. Introduction

Stress and coping are essential determinant factors to mental health, and coping styles play an important role in individual well-being. Coping has been described as an individual's attempts to use cognitive and behavioral strategies to manage and regulate pressures, demands and emotions in response to stress (Folkman and Lazarus, 1980; Lazarus and Folkman, 1984; Folkman et al., 1986). It has been described extensively in the literature that some coping strategies are associated with successful outcomes (Ravindran et al., 1996; Kohn et al., 1994;

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Roy-Byrne et al., 1980; Whatley et al., 1998), but that others are not (Ravindran et al., 1996; Kohn et al., 1994; Roy-Byrne et al., 1980; Whatley et al., 1998). Failure of coping to deal adaptively with stress may lead to mental problems (Lazarus and Folkman, 1984; Folkman et al., 1986). Therefore, an epidemiological survey on coping strategy gives important information on mental health status in the targeted population.

Previous studies have pointed out many factors that potentially cause depression: neurotransmitter abnormalities, disturbed sleep patterns, gender hormone imbalance, use of medication, chronic illness, stressful life event, life style, and premorbid personality (Ebmeier et al., 2006; Sadock and Sadock, 2002; Tamres, 2002). However, the causal relationship with these factors is still unknown, since it is difficult to identify the cause of the condition. Therefore, the social, psychological and biological etiology of depression remains to be clarified. Among the various hypothetical etiologies (Kohn et al., 1994), a diathesis-stress model is most widely accepted, in which an underlying trait such as personality, behavioral characteristics, or cognitive patterns interacts with life events or stress to lead to depressive illness. This model can answer in part the question why some people experience depression in relation to a stressful life event, but others do not.

It is widely documented that successful adaptation to the environment in an individual requires strategies to cope with stressful situations (Taylor and Stanton, 2007). Depression, as a final consequence of poor stress management, may be related to certain coping behaviors (Christensen and Kessing, 2005). Types of stress-coping strategies are likely to be associated with susceptibility to depression. Several studies conducted in the clinical settings reported that approach/problem-solving coping strategies were associated with decreased risk of depression, and avoidant/emotion-focused coping strategies were associated with increased risk of depression (Beck et al., 1979; Billings and Moss, 1984; Nolen-Hoeksema, 1987; Uehara et al., 1999; Dekker and Ormel, 1999; Piccinelli and Wilkinson, 2000; Tamres, 2002; Lam et al., 2003). Cognitive behavioral therapy (CBT) for depression is based on the assumption that re-achievement of proper skills to cope with life stress prevents one from suffering from depression (Beck et al., 1979; Gloaguen et al., 1998; Scott, 2001). However, the prior clinical studies did not provide evidence concerning the question of which types of coping strategy may prevent or facilitate depression among the general population.

An epidemiological survey on depression and stress-coping strategies was conducted among a large sample from the general population of Japan. We here investigate whether there is any correlation between depression and stress-coping strategy among the general population in Japan. To identify characteristic coping strategies positively or negatively associated with depression was our particular interest.

2. Methods

2.1. Subjects

The present study was part of a national survey (Active Survey of Health and Welfare) conducted by the Ministry of Health, Labor and Welfare of Japan in June 2000. The Active Survey of Health and Welfare was conducted in 1996, 1997, 1999 and 2000 to provide the information required to establish governmental health and welfare policies. To ensure that the survey sample was representative of the general population, study participants were selected from residents, aged 12 years or over, living in 300 target areas. These areas were selected randomly, through stratified sampling, from 881,851 areas in the national census (2000). Part-time investigators paid by the public health center of each area delivered self-administered questionnaires to the subjects and collected the completed questionnaires a few days later. Verbal informed consent to participate was obtained from all subjects.

2.2. Procedures

The self-administered questionnaire consisted of 44 items including: (1) sociodemographic information such as age, gender, and size of the community, (2) general health status, (3) physical and psychological complaints, (4) information on mental stress, (5) sleep habits and sleep problems, and (6) the Japanese version of the Center for Epidemiologic Studies Depression Scale (CES-D) (Shima et al., 1985).

The CES-D, a 20-item inventory designed specifically to assess symptoms of depression in the general population, was used to screen for current depressive states during the 1-week period leading up to the survey (Radloff, 1977). This questionnaire is adequately reliable and valid for use in a general population. The CES-D yields an item score (range: 0–3) and the sum of the 20 item scores (range: 0–60). Higher scores indicate increasing severity of depression. Although this scale was designed to screen for, but not diagnose, major depression, a score of 16 or higher is highly suggestive of depression. In addition, we set another higher cut-off point, a score of 26 or higher to define a more severe depression, because using the cut-off score of 16 led to nearly 30% of the Japanese adult population being defined as depressed (Kaneita et al.,

2006), indicating an overestimate of the prevalence compared with that obtained in Western countries (20% or less) (Eaton and Kessler, 1981; Hsu and Marshall, 1987; Barnes et al, 1988).

To explore the stress-coping strategies of the participants, the following 14 questions were embedded in the questionnaire, which were taken from questionnaires used in the prior epidemiological surveys conducted by the Japanese Government. Those 14 items differentiated between three different coping strategies: problem-focused (1 and 2), emotion-focused (3~12) and avoidant (13 and 14). The participants were asked to answer the following questions: "Do you use the following coping strategy when you feel dissatisfied or distressed, or have difficulties or stress?" 1. Making an effort to solve the problems actively (yes/no); 2. Making plans to take time off (yes/no); 3. Venting his/her emotion by talking to others (yes/no); 4. Engaging himself/herself in leisure activities or sports (yes/no); 5. Playing with pet animals (yes/no); 6. Eating something (yes/no); 7. Going shopping (yes/no); 8. Watching TV/listening to the radio (yes/no); 9. Taking his/her ease (yes/no); 10. Gambling (yes/no); 11. Smoking (yes/no); 12. Drinking alcoholic beverages (yes/no); 13. Bearing without action (yes/no); 14. Lying down on the bed (yes/no).

For the presence of stress, the following question was embedded in the questionnaire: "Did you feel dissatisfied or distressed, or have difficulties and stress for the previous month?" The answer to the question included the following items (much/some/little/none). Those who answered "much" were defined as stressed, while those who answered "some/little/none" were defined as unstressed.

Sociodemographic variables included gender, age (20–39 years: younger group; 40–59 years: middle-aged group; 60 years and over: old-aged group), community size (a city with a population of ≧150,000 was defined as a big city, a city with a population of <150,000 was defined as a town or village), and geographical region (north/east/west/south).

2.3. Statistical analysis

For the statistical analysis, the CES-D scores were first calculated. The prevalence of depression was calculated using two different cut-off points; 16 (CES-D-16 depression) and 26 (CES-D-26 depression). The effects of age and gender on the prevalence of depression were examined by χ^2 test. The mean value and standard deviation (S.D.) of the CES-D scores were calculated according to age groups and gender. The presence of stress-coping strategies was examined by age groups and gender. The associations of individual stress-coping strategy with CES-D-16 depression and with CES-D-26 depression were examined. Logistic regression analyses were utilized to examine the associations between depression and stress-coping strategies. In these analyses, CES-D-16 depression and CES-D-26 depression were separately taken as a response variable, and the following parameters were used as covariates: stress-coping strategies, gender, age groups, community size, geographic region and presence of stress. Odds ratios were calculated from both the univariate analysis and the multivariate logistic regression analysis with 95% confidence intervals. All analyses were performed using SPSS11.5 for Windows.

3. Results

Questionnaires were returned by 32,729 subjects. The Ministry of Health, Labor, and Welfare did not publish the number of residents contacted in the target areas, and so it was not possible to calculate the response rate for the present survey. The collection rates of similar investigations carried out 3 and 4 years earlier were 87.1% and 89.6%, respectively, and since the present survey was performed using similar methods, the response rate was

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

Age group (year)	Present study		Census (2000)	
	Male (%)	Female (%)	Male (%)	Female (%)
20–29	18	18	19	17
30–39	18	18	18	16
40–49	19	18	17	16
50–59	21	20	20	19
60–69	15	14	15	15
70-	9	12	12	17
Total	100	100	100	100
N	11,689	12,862	48,669 (thousands)	52,067 (thousands)

estimated to be similar (Kaneita et al., 2006). Before analysis, 707 subjects who submitted blank answer forms were excluded from the study. Subjects below 20 years of age (n=3284) were excluded, because this study was aimed at adults. In addition, subjects who had not responded to the questions on gender and/or age were also excluded (n=208). Furthermore, subjects who had omitted five or more answers on the CES-D questionnaire were excluded from the analysis (n=7471). Finally, data from 24,551 adults were analyzed.

Although the percentages of both men and women aged 70 years or older were slightly lower than those revealed by the census, the percentages of other age groups were similar (Table 1).

The prevalence of CES-D-16 depression and that of CES-D-26 depression, together with the mean value and standard deviation (S.D.) of the CES-D scores sorted by age groups and gender, are shown in Table 2. Both CES-D-16 depression and CES-D-26 depression were more prevalent in women than in men (χ^2=59.26, df=1, P<0.01). By age groups, both CES-D-16 depression and CES-D-26 depression were most frequent in those aged 70 years or older (χ^2=121.40, df=5, P<0.01 for CES-D-16 depression and χ^2=183.48, df=5, P<0.01 for CES-D-26 depression). The mean CES-D score and S.D. was slightly higher in women than in men (women 13.7±8.4, men 13.0±8.0, t=54.89, df=1, P<0.01).

The percentage of stress-coping strategies by gender and age group is shown in Table 3. The prevalence of "Making an effort to solve the problems actively" did not differ between men and women. By contrast, various types of gender differences were found with respect to the prevalence of emotion-focused and avoidant strategies. Male dominance was marked in "Gambling", "Smoking" and "Drinking alcoholic beverages", whereas female dominance was apparent in "Venting his/her emotion by talking to others" and "Going shopping".

Table 4 shows the association between individual stress-coping strategies and the depressions in men. For CES-D-16 and CES-D-26 depressions, after adjusting the confounding effects of sociodemographic factors, presence of stress and other stress-coping strategies, multivariate logistic regression analyses revealed various types of associations between depression and coping strategies. For both cut-off points, the strongest positive associations were found for the two avoidant strategies, while negative associations were found for "Making an effort to solve the problem actively", "Taking his/her ease" and "Engaging himself/herself in leisure activities or sports".

Table 5 shows the association between individual stress-coping strategies and the depressions in women. After multivariate logistic regression analyses were performed for both cut-off points, the strongest positive associations were found for "Bearing without action" and "Smoking", while negative associations were marked for "Making an effort to solve the problem actively" and "Venting his/her emotion by talking to others".

4. Discussion

4.1. Prevalence of coping strategies

In the present study, we first documented the prevalence of coping strategies and their gender differences among a large cohort of the general population by asking the subjects to choose the preferable coping strategies from 2 problem-solving, 10 emotion-focused and 2 avoidant ones. We found that there were no marked gender differences in the problem-solving strategies or avoidant coping strategies, while various type of gender differences were found with respect to emotion-focused strategies. Among the emotion-focused strategies, "Engaging himself/herself in leisure activities or sports", "Gambling", "Smoking" and "Drinking alcoholic

Table 2
Prevalence of depressive symptoms by age groups and gender.

Age group (years)	CES-D-16			CES-D-26			Mean±S.D.
	Total (%)	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)	CES-D
20–29	31.8	30.3	33.2	8.8	7.6	9.9	13.5±8.4
30–39	28.1	25.2	30.7	6.6	5.6	7.6	12.6±8.0
40–49	29.4	28.1	30.8	7.8	7.0	8.5	13.2±8.2
50–59	28.5	26.0	30.9	6.9	6.0	7.8	13.2±7.7
60–69	26.7	24.8	28.4	6.5	6.9	6.2	13.1±7.8
70–	38.3	34.3	41.0	14.7	13.1	15.7	15.4±9.5
Total	29.9	27.6	32.1	8.1	7.1	9.0	13.4±8.2

Significant differences were found for both cut-off points with respect to gender and age (χ^2 test, P<0.01).

Table 3
Percentage of responders for stress-coping questionnaires by age groups and gender.

	Gender(%)				Age group (%)						Total	95%CI
Stress-coping strategies	Male	95%CI	Female	95%CI	20–29 years	30–39 years	40–49 years	50–59 years	60–69 years	70+ years		
Problem-solving strategy												
Making an effort to solve the problems actively[a]	14.7	14.1–15.3	14.2	13.6–14.8	14.6	17.9	17.1	15.6	11.9	8.6	14.5	14.0–14.9
Making plans to take time off[a,b]	7.1	6.7–7.6	5.4	5.0–5.8	7.7	8.7	7.3	6.5	4.2	2.4	6.2	5.9–6.5
Emotional distraction strategy												
Venting his/her emotion by talking to others[a,b]	23.1	22.4–23.8	53.1	52.2–53.8	51.9	47.9	42.0	37.5	28.3	24.1	38.8	38.3–39.4
Engaging himself/herself in leisure activities or sports[b,a]	33.2	32.4–40.0	23.1	22.8–23.8	33.1	28.8	30.5	30.0	26.6	16.7	27.9	27.4–28.4
Playing with pet animals[a,b]	5.9	5.6–6.3	9.3	8.8–9.7	8.7	6.4	9.2	9.9	6.1	4.9	7.7	7.4–8.0
Eating something[b,a]	6.7	6.2–7.1	17.5	16.9–18.1	20.1	17.7	13.2	9.8	7.1	6.3	12.4	12.0–12.8
Going shopping[a,b]	5.7	5.3–6.1	26.7	26.0–27.4	24.8	21.2	16.6	14.7	13.8	9.0	16.7	16.3–17.2
Watching TV/listening to the radio[a,b]	29.2	28.4–30.0	31.2	30.4–31.9	26.2	24.0	26.5	28.2	36.8	41.6	30.2	29.7–30.8
Taking his/her ease[a,b]	33.0	32.2–33.8	31.0	30.3–31.9	36.4	34.9	34.3	31.6	29.3	24.4	31.9	31.4–32.5
Gambling[a,b]	11.4	10.9–11.9	1.9	1.7–2.1	8.7	8.2	8.0	7.2	4.3	1.2	6.4	6.1–6.7
Smoking[a,b]	24.8	24.1–25.6	7.7	7.3–8.1	22.3	20.2	18.8	14.5	10.9	7.1	15.8	15.3–16.2
Drinking alcoholic beverages[a,b]	31.7	31.0–32.5	9.3	8.8–9.8	20.1	24.0	26.8	22.7	15.2	8.7	19.9	19.5–20.4
Avoidant strategy												
Bearing without action[a,b]	9.5	9.0–10.0	11.5	11.0–12.0	8.7	10.9	11.8	11.9	9.9	9.7	10.6	10.2–10.9
Lying down on the bed[a,b]	22.3	21.6–23.0	20.4	20.1–21.4	31.9	27.7	23.4	17.4	12.5	15.9	21.4	21.0–21.9

[a:] Significant difference among age groups (χ^2 test, $P<0.01$).
[b:] Significant difference between gender (χ^2 test, $P<0.01$).

Table 4
Association between depressive symptoms and each of stress-coping strategies in men.

Stress-coping strategies	CES-D-16 depression				CES-D-26 depression			
	Crude		Adjusted[a]		Crude		Adjusted[a]	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Problem-solving strategy								
Making an effort to solve the problems actively	0.55*	0.48–0.62	0.52*	0.46–0.60	0.45*	0.35–0.58	0.45*	0.35–0.59
Making plans to take time off	–	–	–	–	0.60*	0.43–0.82	–	–
Emotional distraction strategy								
Venting his/her emotion by talking to others	–	–	–	–	–	–	–	–
Engaging himself/herself in leisure activities or sports	0.74*	0.68–0.81	0.81*	0.73–0.89	0.57*	0.49–0.68	0.68*	0.57–0.82
Playing with pet animals	–	–	–	–	–	–	–	–
Eating something	1.81*	1.57–2.09	–	–	2.16*	1.75–2.68	–	–
Going shopping	1.63*	1.39–1.91	1.37*	1.14–1.64	1.87*	1.47–2.37	1.56*	1.17–2.10
Watching TV/listening to the radio	1.56*	1.43–1.70	1.37*	1.24–1.51	1.76*	1.51–2.02	1.49*	1.26–1.77
Taking his/her ease	0.86*	0.80–0.95	0.86*	0.78–0.94	0.67*	0.57–0.79	0.67*	0.56–0.81
Gambling	1.53*	1.36–1.72	1.27*	1.11–1.45	1.30*	1.07–1.58	1.17*	1.05–1.35
Smoking	1.73*	1.58–1.89	1.35*	1.22–1.50	1.53*	1.32–1.40	–	–
Drinking alcoholic beverages	1.39*	1.28–1.51	1.19*	1.08–1.31	–	–	–	–
Avoidant strategy								
Bearing without action	3.00*	2.65–3.39	2.20*	1.92–2.52	3.84*	3.25–2.15	2.08*	1.71–2.53
Lying down on the bed	1.71*	1.56–1.87	1.48*	1.34–1.64	1.86*	1.60–2.15	1.61*	1.35–1.91

*$P<0.01$.
[a] Adjusted with age group, degrees of having stress, community size and location.
OR: Odds ratio.
CI: Confidence interval.

beverages" were found to be more prevalent in men compared with women, gender differences ranging from 9.5% to 22.5%. More detailed comparisons focusing on age groups revealed that these male dominances were not attributed to differences in special age groups.

In contrast, "Venting his/her emotions by talking to others", "Eating something" and "Going shopping" were more prevalent in women than in men, gender differences ranging from 10.8% to 21.0%. Most of these female dominances seemed to be attributed to higher prevalence in the younger age groups.

There have been no studies which surveyed coping strategies among a large cohort from the general population. Several previous studies (Hänninen and Aro, 1996; Tamres, 2002; Goodwin, 2006), though their sample sizes were relatively small compared to the present study, reported gender differences in coping strategies. Goodwin (2006) surveyed 9938 US youths in grades 6 through 10 and found that women were more likely to talk to someone, whereas men preferred physical exercise and drinking alcohol. Tamres (2002) conducted a meta-analysis of recent studies on the prevalence of emotion-focused coping strategies and found that men preferred a more active-type coping strategy compared with women. In addition, they surveyed 172 men and 90 women from a clinical population suffering from cardiac diseases and found a tendency for women to engage in more mental disengagements and ventings compared to men. Hanninen and Aro (1996) surveyed 766 male and 890 female undergraduate students, 22 years of age, and reported that venting anger on other people was more common among female students compared to males.

The present study was comparable with previous results obtained from studies of a small special population, which were conducted in Western countries, suggesting that there were no marked cultural differences between those previous studies and ours with respect to coping strategies.

4.2. Coping strategies and depression

We defined depression on the basis of CES-D cut-off scores and examined the relation between depression and stress-coping strategies. For men, a positive association with depression was found in two avoidant coping strategies and two emotion-focused strategies. Similarly for women, a positive association with depression was found in two avoidant coping strategies and two emotion-focused strategies. The two avoidant and one emotion-focused coping strategies were common in both genders. "Going shopping" was positively associated with