# Subjective symptoms related to depression and suicidal risk in a Japanese community: a cross-sectional study[*]

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## ABSTRACT

**BACKGROUND: This cross-sectional study aimed to assess the association between self-reported somatic and mental symptoms and the presence of major depressive disorder (MDD) and suicidal risk among community dwellers in Japan. METHODS: From two locations in Japan, we recruited 732 community dwellers who underwent an annual health screening. Basic symptoms of MDD, dysthymia, and the presence of associated suicidal risk were determined using a brief structured diagnostic psychiatric interview, Mini International Neuropsychiatric Interview (MINI). Information regarding self-reported somatic and mental symptoms was obtained from a self-administered questionnaire used in the annual health check-up. Suicidal risk was evaluated on the basis of six relevant questions asked in MINI. Logistic regression model was used to calculate age- and gender-adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for MDD. Further adjustment for basic symptoms of MDD was performed to calculate ORs and CIs for suicidal risk. RESULTS: A myriad of somatic symptoms, including headache, heavy headedness, eye strain, and shoulder stiffness [adjusted OR (95% CI), 11.4 (1.22 - 107) at location 1; 5.17 (1.23 - 21.7) at location 2], were associated with the presence of MDD. Dysmenorrhea [6.07 (1.14 - 32.3) at location 1] and dysesthesia, arthralgia, and swelling in the extremities [2.72 (1.14 - 6.47) at location 2] were significantly associated with an increase in suicidal risk, independent of the presence of basic symptoms of MDD. CONCLUSION: Several somatic symptoms, especially pain-related ones, may serve as possible signs of depression and suicidal risk among community dwellers.**

## 1. INTRODUCTION

More than 30,000 Japanese people die from suicide every year, and suicide is becoming a serious public health problem. Several epidemiological studies in general populations have indicated personal and social risk factors for suicide such as depression, severe anxiety, substance abuse, and poor interpersonal relationships including social isolation, inability to maintain a job, anhedonia, somatic diseases, financial problems, and personal or familial history of suicide [1-7]. Suicide is attributed to many causes including depression and other emotional disorders [8]. Mood disorders account for 30.2% of completed suicide cases [9].

Depressive symptoms are accompanied by several somatic symptoms such as fatigue, insomnia, nausea/vomiting, back pain and so forth [10]. Among these symptoms, pain-related symptoms have been associated with depression [11-15] and suicide [11,16-20]. According to a Japanese government survey, the prevalence of somatic symptoms, particularly pain-related symptoms, is higher among older Japanese people. Moreover, suicides in people aged≥40 years account for >70% of all suicide cases in Japan, with the highest suicide rate in the sixth decade among men.

The relationship between somatic symptoms and depression/suicidal risk can be explained with two assumptions. One is that people suffering from somatic disorders tend to develop depression or suicidal ideation. The other is that those who have depression or suicidal ideation with non-severe somatic disorders are likely to express their mental strain as transformed somatic symptoms. Although several studies support both these assumptions [21-24], we adopted the latter one for the present study for the following reasons.

About two-thirds of patients with depression first

seek help from a primary care physician rather than a psychiatrist because they develop both somatic and mental symptoms [25]. Nevertheless, physicians do not always evaluate the risk of depression or suicide among their patients for fear of reinvoking patients' suicidal ideation or making them feel guilty of thinking about suicide, which is considered a sin in many religions [26]. Moreover, Japanese patients feel hesitant to consult a psychiatrist because compared to Westerners, they are generally more likely to share a feeling of stigmatization toward mental disorders or suicidal ideation [27], and to suppress their emotions accordingly. This observation was partially supported by the World Mental Health Japan Survey, showing a lower prevalence of mood and anxiety disorders in Japan than in the United States or Europe [28]. Hence, detection of people at a high risk of depressive disorder or suicide will be delayed in Japan.

Together with the above-mentioned situations, early detection of mental health-related somatic symptoms may help promote not only the secondary prevention of depressive disorders but also the primary prevention of suicide. However, evidence has been chiefly obtained in clinical settings, which may not apply to community dwellers.

The purpose of this study was to evaluate the associations between various mental and somatic symptoms and MDD and suicidal risk in a Japanese community, and to establish the key contributing elements that would aid in detecting signs of MDD and suicidal risk in community dwellers at the preclinical stage.

## 2. METHODS

### 2.1. Study Population

We conducted a cross-sectional study in the following two settings.

(Location 1: Health check-up services, A City)

A private medical corporation in A City (total population, approximately 26,000) located in the middle of Wakayama Prefecture, provides health check-up services for community dwellers and local company employees. Six hundred and seventy-six people underwent a health check-up at this service from January through March 2008. Out of them, 294 people were contacted and 280 people agreed to participate in the study.

(Location 2: B and C Towns)

B Town (total population, approximately 8000) and C Town (total population, approximately 7000) are both located in the middle of Wakayama Prefecture. To detect chronic diseases including metabolic syndrome, these towns provide a health check-up program every year for self-employed community dwellers and their family members each aged 40 - 74 years. In 2008, 3656 people aged 40 - 74 years (1809 in B Town; 1847 in C

Town) were eligible for the annual health check-up program, and 686 (177 in B Town; 509 in C Town) underwent a health check-up from May through August, 2008. Of these, 452 people (146 in B Town; 306 in C Town) agreed to participate in the study.

Those who underwent a health check-up were asked to participate in the study via posters displayed at the check-up site. Later, they were led one-by-one to the interview room where the structured interviews were conducted. The participants received a detailed oral and written explanation of the study, *i.e.*, regarding the purpose of the study, voluntary of participation, and principal investigator's contact address, from the interviewers. If they agreed to participate in the study, they gave written informed consent.

This study was approved by the ethics committee of Wakayama Medical University.

### 2.2. Data Collection

#### 2.2.1. Psychiatric Structured Interview

Mini-International Neuropsychiatric Interview (MINI) Japanese version 5.0.0 (2003) [29,30], a convenient structured diagnostic interview for mental disorders, was used for the interview survey. All questions included in MINI were coded as two categories on the basis of the respondents' answers of yes/no. Reliability and validity of the Japanese version of MINI is satisfactory [31]. Nine interviewers (three at location 1 and nine at location 2), all of who were licensed physicians or nurses, were enrolled as competent interviewers. They were trained by the second author (KY), a psychiatrist, for essential interview skills including didactic sessions of a general interview and a review of the instrument sections. Furthermore, the second author checked the interviewers and corrected them as the need arose during the interview sessions so that the interview could be appropriately conducted.

MINI considers 17 Axis I mental disorders based on the standard 12-month prevalence $\geq 0.5\%$ [29]. Among these 17 disorders, we chose MDD, dysthymia, and suicidal ideation and attempts as candidate disorders strongly associated with increasing suicidal risk among community dwellers.

Basic questions essential for a diagnosis of MDD (two questions) and dysthymia (one question) were asked to all subjects. If their answers to the basic questions implied the possible presence of MDD or dysthymia, more detailed questions were asked for a final diagnosis (seven more questions for MDD and up to nine more questions for dysthymia).

Suicidal risk was measured on the basis of six relevant items included in MINI. Of these, five items considered suicidal ideation and attempts within the pre-

vious month ([1] thinking that he/she would be better off dead, [2] thinking about self-harm, [3] thinking about suicide, [4] planning of suicide, and [5] experiences of suicide attempts), and the sixth item considered lifetime experiences of suicide attempts. According to the weighted value of each question, points 1, 2, 6, 10, and 10 were allotted to each response to the former five questions, and point 4 was allotted to the last response regarding lifetime experiences of suicide attempts. Thus, a score of 33 was the maximum number of points for suicidal risk. A higher score indicates the presence of higher suicidal risk.

### 2.2.2. Medical Examinations

Each participant at both locations was asked to complete a self-administered questionnaire. This questionnaire contained items regarding lifestyle factors, the presence or history of chronic diseases as well as their treatment status, and self-reported somatic and mental symptoms. The questionnaire was designed on the basis of a questionnaire proposed by the Ministry of Health, Labor, and Welfare, Japan [32]. Fasting blood samples were collected for biochemical examinations such as plasma glucose, serum LDL or HDL cholesterol, triglycerides, and hemoglobin. A urine test and chest radiography were also conducted.

A checklist for the self-reported symptoms included various somatic symptoms, such as respiratory, cardiovascular, digestive, musculoskeletal, nervous, and urogenital symptoms (21 items for location 1 and 18 items for location 2), and one mental symptom regarding agitation or anxiety. Because this checklist was a ready-made review of systems with current symptoms developed by the health check-up service provider, details such as precise duration or frequency and severity of these symptoms could not be obtained. However, this checklist included two questions about anxiety-related mental and somatic symptoms and one question about general somatic symptoms from the Hamilton Depression Rating Scale (HAM-D17) [33]. Although these symptoms were mainly checked for the secondary prevention of chronic diseases, some of them were also considered to reflect the symptoms of somatoform autonomic dysfunction, which might be related to depression. According to the corresponding responses, the status of these symptoms was simply divided into presence or absence categories.

These medical examinations were conducted by a private medical corporation or a local health authority. Psychiatric interviewers were not involved in the medical examinations.

### 2.3. Statistical Analysis

The frequency of subjective symptoms and MDD/suicidal risk were calculated. Then logistic regression analysis was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs). In the logistic regression analysis, the dependent variables were MDD and suicidal risk. The status of MDD was divided into positive and negative categories on the basis of MINI results. The status of suicidal risk was also divided into positive and negative categories on the basis of the total score on the corresponding questions included in MINI. Subjects with a zero score were regarded as negative, and those with a score more than zero were regarded as positive. In the same manner, the independent variable was each subjective symptom or mental disorders including MDD. The subjective symptom was divided into positive or negative categories. Each subjective symptom was regarded as positive if a subject reported the symptom.

Univariate models were created to evaluate the associations between each symptom and MDD/suicidal risk. We adjusted for gender and age in the multivariate analysis of MDD. Age in years was divided into tertiles according to the distribution of age in each location. For suicidal risk, we further adjusted for gender, age, and the presence of loss of interest or depressed mood, which are basic symptoms of MDD. These depression-related mental symptoms might be potential confounding factors regarding the association between somatic symptoms and suicidal risk.

*P* values (two-sided) less than 0.05 were considered statistically significant. All computations were performed using the SAS software package, version 9.1.3 (SAS Institute Inc., Cary, NC, USA).

## 3. RESULTS

**Table 1** shows characteristics of the study subjects. The average age was 45.4 years (range, 17 - 86) at location 1 and 62.5 years (range, 39 - 74) at location 2. The proportion of female subjects was 46% and 60% at locations 1 and 2, respectively. Of all symptoms, headache, heavy headedness, eye strain, and shoulder stiffness were highest in frequency at both locations (26%).

**Table 2** illustrates the MINI results. The prevalence of MDD was approximately 2% at both locations. The frequency of subjects with at least one of the two basic depressive symptoms was approximately 3% at both locations. Only three subjects (two at location 1 and one at location 2) were positive for dysthymia. Approximately 6% of all study subjects showed suicidal risk.

**Table 3** reveals age- and gender-adjusted ORs of MDD and dysthymia for suicidal risk. Both depressed mood and loss of interest were significantly associated with suicidal risks at both locations. Melancholic depression and dysthymia were also strongly associated

**Table 1.** Characteristics of the study subjects.

| | Location 1[a] | | Location 2[a] | |
| --- | --- | --- | --- | --- |
| | (N = 280) | | (N = 452) | |
| **Gender** | | | | |
| Men | 164 | (58.6) | 183 | (40.5) |
| Women | 116 | (41.4) | 269 | (59.5) |
| Age (years) | 45.4 | (17 - 86) | 62.5 | (39 - 74) |
| **Symptoms** | | | | |
| Fatigue | 14 | (5.0) | 79 | (17.5) |
| Insomnia | 17 | (6.1) | 36 | (8.0) |
| Stress | 46 | (16.4) | 34 | (7.5) |
| Abdominal pain | 6 | (2.1) | 10 | (2.2) |
| Heavy stomach | 21 | (7.5) | 28 | (6.2) |
| Nausea/heartburn | 14 | (5.0) | 18 | (4.0) |
| Diarrhea/constipation | 49 | (17.5) | 38 | (8.4) |
| Hemorrhoid | 19 | (6.8) | | |
| Bleeding at evacuation | 11 | (3.9) | 5 | (1.1) |
| Acute decrease in body weight | 1 | (0.4) | 10 | (2.2) |
| Thirst | 14 | (5.0) | 35 | (7.7) |
| Headache, heavy headedness, eye strain, and shoulder stiffness | 73 | (26.1) | 116 | (25.7) |
| Vertigo/dizziness | 17 | (6.1) | 33 | (7.3) |
| Palpitation/shortness of breath | 7 | (2.5) | 20 | (4.4) |
| Pain or constriction in the chest | 7 | (2.5) | 6 | (1.3) |
| Back pain | 39 | (13.9) | 98 | (21.7) |
| Cough/sputum | 17 | (6.1) | 39 | (8.6) |
| Dysesthesia, arthralgia, and swelling in the extremities | 28 | (10.0) | 95 | (21.0) |
| Difficulty in urinating/hematuria | 5 | (1.8) | 14 | (3.1) |
| Dysmenorrhea/irregular bleeding (women only) | 13 | (11.2) | | |
| Pregnancy (women only) | 3 | (2.6) | | |

a. Figures denote the number of subjects (%) or the average (min.-max.).

with an increased suicidal risk, but the CI range was wide because there were very few subjects with these conditions. A history of MDD was insignificantly related to suicidal risk.

**Table 4** presents adjusted ORs of somatic factors for MDD at locations 1 and 2. At location 1, headache and dysesthesia, arthralgia, and swelling in the extremities were significantly associated with MDD in univariate analyses. After adjusting for age and gender, only headache remained significantly associated with MDD in univariate analyses. At location 2, fatigue, insomnia, stress, abdominal pain, nausea/heartburn, headache, palpitation/shortness of breath, vertigo/dizziness, back pain, and dysesthesia, arthralgia, and swelling in the extremities were associated with MDD in univariate analyses. A heavy feeling in the stomach was also associated with MDD in age- and gender-adjusted analyses.

**Table 5** demonstrates the adjusted ORs of somatic factors for suicidal risk at locations 1 and 2. No somatic symptom was associated with suicidal risk at location 1,

in univariate analyses, while an increase in suicidal risk was observed among women with dysmenorrhea/irregular bleeding in age- and gender-adjusted analyses. Dysesthesia, arthralgia, and swelling in the extremities were a significant risk factor for suicidal risk at location 2 in univariate and age- and gender-adjusted analyses. Fatigue, stress, vertigo, and chest pain were significantly associated with suicidal risk only in univariate analyses.

## 4. DISCUSSION

The prevalence of MDD and suicidal risk in a Japanese community was about 2% and 6%, respectively. We also demonstrated the association of various pain-related somatic symptoms with MDD and suicidal risk in a community setting. In particular, headache, heavy headedness, eye strain, and shoulder stiffness were associated with MDD at both locations. Dysmenorrhea at location 1 and dysesthesia, arthralgia, and swelling in the extremities at location 2 were associated with suicidal risk. One of the advantages of this study is that we evaluated mental status by administering a structured questionnaire whose reliability and validity have been evaluated in Japan [31]. Another advantage is that we identified somatic symptoms related to MDD and suicidal risk among community dwellers.

The presence of pain is associated with not only depression [11-15] but also suicidal risk [11,16-20]. These findings have been confirmed in clinical and community settings. However, to the best of our knowledge, this is the first study investigating the relationship between a broader spectrum of somatic symptoms and depression/suicidal risk among community dwellers in Japan.

Some previous studies in Japan have shown that a variety of somatic symptoms are associated with depression and suicidal risk. In a Japanese psychosomatic outpatient clinic, fatigue, insomnia, nausea/vomiting and back pain were more prevalent among outpatients with major depression than among other outpatients [10]. In another Japanese clinic, diarrhea, excessive sweating and weight loss in men, and headache, dysesthesia and grief in women, as well as sleep disturbance, loss of appetite, general fatigue, loss of interest and agitation in both sexes, were significantly associated with depression [22]. Besides, symptoms related to depression were associated with suicidal ideation [21]. Some kinds of symptoms such as fatigue were common to previous studies in the clinical settings and the present study in the community setting, but others were not. This discrepancy may reflect the temporal change of subjective symptoms of depressive disorders. To further investigate the temporal change of depressive symptoms, longitudinal follow-ups will be needed.

**Table 2.** The number of outcomes from the MINI

| | Location 1 (*N* = 280) | | | | Location 2 (*N* = 452) | | | |
|---|---|---|---|---|---|---|---|---|
| | Yes | (%) | No | (%) | Yes | (%) | No | (%) |
| (A) Presence of MDD[a] | 5 | (1.8) | 275 | (98.2) | 9 | (2.0) | 442 | (98.0) |
| (B) 2-item MDD screening | | | | | | | | |
| (B1) Depressed mood | 5 | (1.8) | 275 | (98.2) | 7 | (1.5) | 445 | (98.5) |
| (B2) Loss of interest[a] | 5 | (1.8) | 275 | (98.2) | 9 | (2.0) | 442 | (98.0) |
| (B3) (B1), (B2), or both[a] | 8 | (2.9) | 272 | (97.1) | 13 | (2.9) | 438 | (97.1) |
| (C) History of MDD[a] | 1 | (0.4) | 279 | (99.6) | 3 | (0.7) | 448 | (99.3) |
| (D) Presence of melancholic depression[ab] | 1 | (0.4) | 279 | (99.6) | 4 | (0.9) | 446 | (99.1) |
| (E) Presence of dysthymia[cd] | 2 | (0.7) | 272 | (99.3) | 1 | (0.2) | 442 | (99.8) |
| (F) Presence of suicidal risk | 17 | (6.1) | 263 | (93.9) | 28 | (6.2) | 424 | (93.8) |

MDD: major depressive disorder. [a]One subject in location 2 was excluded because of missing data on the basic symptoms of MDD; [b]One subject in location 2 was excluded because of missing data on MDD with melancholic features (melancholic depression); [c]Five subjects with MDD and one more subject with missing data on dysthymia in location 1 were excluded; [d]Nine subjects with MDD in location 2 were excluded.

**Table 3.** Odds ratios (ORs) and 95% confidence intervals (CIs) of major depressive disorder and dysthymia for suicidal risk in the community.

| | Location 1 (*N* = 280) | | | | | | Location 2 (*N* = 452) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Crude model | | | Adjusted model[e] | | | Crude model | | | Adjusted model[e] | | |
| | OR | (95% CI) | *P* | OR | (95% CI) | *P* | OR | (95% CI) | *P* | OR | (95% CI) | *P* |
| (A) Presence of MDD[a] | 28.0 | (4.32 - 181) | 0.001 | 26.2 | (3.54 - 194) | 0.001 | 22.8 | (5.73 - 90.5) | 0.000 | 21.9 | (5.24 - 91.3) | 0.000 |
| (B) 2-item MDD screening | | | | | | | | | | | | |
| (B1) Depressed mood | 11.6 | (1.79 - 74.5) | 0.010 | 9.57 | (1.33 - 69.1) | 0.025 | 12.6 | (2.67 - 59.4) | 0.001 | 11.7 | (2.39 - 57.2) | 0.002 |
| (B2) Loss of interest[a] | 28.0 | (4.32 - 181) | 0.001 | 37.5 | (4.77 - 295) | 0.001 | 38.2 | (8.95 - 163) | 0.000 | 41.6 | (9.01 - 192) | 0.000 |
| (B3) (B1), (B2), or both[a] | 11.1 | (2.40 - 51.0) | 0.002 | 10.6 | (2.09 - 54.3) | 0.004 | 23.2 | (7.15 - 75.0) | 0.000 | 24.7 | (7.12 - 85.4) | 0.000 |
| (C) History of MDD[a] | - | - | -[f] | - | - | -[f] | 7.80 | (0.69 - 88.8) | 0.098 | 6.37 | (0.54 - 75.5) | 0.142 |
| (D) Presence of melancholic depression[ab] | - | - | -[f] | - | - | -[f] | 50.5 | (5.07 - 503) | 0.001 | 43.9 | (4.23 - 456) | 0.002 |
| (E) Presence of dysthymia[cd] | 19.9 | (1.18 - 337) | 0.038 | 20.2 | (1.01 - 402) | 0.049 | - | - | -[f] | - | - | -[f] |

MDD: major depressive disorder. [a]One subject in location 2 was excluded because of missing data on the basic symptoms of MDD; [b]One subject in location 2 was excluded because of missing data on MDD with melancholic features (melancholic depression); [c]Five subjects with MDD and one more subject with missing data on dysthymia in location 1 were excluded; [d]Nine subjects with MDD in location 2 were excluded; [e]Adjusted for gender and age; [f]The model did not converge because there were very few subjects with dysthymia.

In large-scale population-based studies, people with migraine are 2.2 - 4.0 times more likely to have depression [11]. A significant association between severe headaches and suicidal ideation or behaviors has been confirmed among community-dwelling adults [16]. In our study, headache, heavy headedness, eye strain, and shoulder stiffness were significantly associated with MDD but not with suicidal risk. This discrepancy may be due to the small number of subjects in our study and the relatively low suicidal risk among the study

         

**Table 4.** Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for major depressive disorder.

| | Location 1[b] | | | Location 2[b] | | |
|---|---|---|---|---|---|---|
| | OR | (95% CI) | *P* | OR | (95% CI) | *P* |
| Women (vs. Men) | 2.21 | (0.36 - 13.6) | 0.394 | 2.65 | (0.54 - 13.0) | 0.230 |
| Age (years)[a] Tertile 1 | 1.00 | (reference) | | 1.00 | (reference) | |
| Tertile 2 | 2.05 | (0.18 - 23.1) | 0.561 | 3.10 | (0.82 - 11.8) | 0.097[c] |
| Tertile 3 | 2.16 | (0.19 - 24.4) | 0.535 | | | |
| | | (Trend *P* = 0.545) | | | | |
| Symptoms | | | | | | |
| Fatigue | - | - | -[d] | 5.50 | (1.42 - 21.3) | 0.014 |
| Insomnia | 3.96 | (0.38 - 41.8) | 0.253 | 4.91 | (1.11 - 21.7) | 0.036 |
| Stress | 3.63 | (0.57 - 23.0) | 0.171 | 30.1 | (6.31 - 143) | 0.000 |
| Abdominal pain | - | - | -[d] | 20.3 | (3.20 - 129) | 0.001 |
| Heavy stomach | 2.98 | (0.29 - 30.4) | 0.357 | 6.30 | (1.16 - 34.3) | 0.034 |
| Nausea/heartburn | 5.79 | (0.58 - 57.9) | 0.135 | 5.79 | (1.07 - 31.4) | 0.042 |
| Diarrhea/constipation | 0.97 | (0.10 - 9.36) | 0.976 | 1.28 | (0.15 - 10.6) | 0.821 |
| Hemorrhoid | 4.18 | (0.43 - 40.9) | 0.219 | | | |
| Bleeding at evacuation | 11.0 | (0.87 - 139) | 0.065 | - | - | -[d] |
| Acute decrease in body weight | - | - | -[d] | - | - | -[d] |
| Thirst | - | - | -[d] | 3.43 | (0.64 - 18.3) | 0.149 |
| Headache, heavy headedness, eye strain, and shoulder stiffness | 11.4 | (1.22 - 107) | 0.033 | 5.17 | (1.23 - 21.7) | 0.025 |
| Vertigo/dizziness | 4.06 | (0.37 - 44.2) | 0.251 | 45.6 | (9.56 - 217) | 0.000 |
| Palpitation/shortness of breath | - | - | -[d] | 12.5 | (2.78 - 56.5) | 0.001 |
| Pain or constriction in the chest | - | - | -[d] | 11.0 | (1.08 - 112) | 0.043 |
| Back pain | 1.41 | (0.15 - 13.1) | 0.760 | 2.89 | (0.74 - 11.2) | 0.125 |
| Cough/sputum | - | - | -[d] | 1.54 | (0.17 - 13.7) | 0.699 |
| Dysesthesia, arthralgia, and swelling in the extremities | 5.27 | (0.76 - 36.4) | 0.092 | 6.77 | (1.63 - 28.1) | 0.009 |
| Difficulty in urinating/hematuria | - | - | -[d] | 8.68 | (0.74 - 101) | 0.085 |
| Dysmenorrhea /irregular bleeding (women only) | - | - | -[d] | | | |
| Pregnancy (women only) | - | - | -[d] | | | |

[a]Age in years was divided into tertiles: 17 - 40, 41 - 51, and 52 - 86 in location 1; and 39 - 61, 61 - 67, and 68 - 74 in location 2; [b]Adjusted for gender and age; [c]Tertiles 2 and 3 were combined into a single category in the multivariate model; [d]Not calculated because of a very small sample size.

subjects."

On the other hand, chronic pain doubles the suicidal risk [17]. A previous study showed an association between body pain from a duodenal ulcer and uterine illness and suicide [18]. Another study revealed that menstrual disorders are significantly more common in female adolescents with a smoking habit and suicidal behaviors [19]. In our study sample, a significantly higher suicidal risk was observed among women with dysmenorrhea/irregular bleeding (**Table 5**) and those with a history of malignancy (data not shown).

Given that dysmenorrhea is accompanied by chronic pain and irregular bleeding among middle to elderly women, and that it is also associated with malignancy in the reproductive system, this result may support the existence of a relationship between dysmenorrhea and suicidal risk. However, the type of malignancy was not identified in our sample. Moreover, one of the reported adverse effects of oral contraceptives is a suicide attempt [20]. Further investigations on MDD and suicide should be conducted among women, considering malignancy in the reproductive system and oral contraceptive use.

Patients with rheumatoid arthritis, having chronic arthralgia, are also known to have depression [12]. In a study that was a part of a clinical trial for MDD treatment, the number of pain-related symptoms (including

**Table 5.** Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for suicidal risk.

| | Location 1[b] | | | Location 2[b] | | |
|---|---|---|---|---|---|---|
| | OR | (95% CI) | *P* | OR | (95% CI) | *P* |
| Women (vs. Men) | 3.67 | (1.21 - 11.1) | 0.022 | 1.36 | (0.57 - 3.22) | 0.489 |
| Age (years)[a] Tertile 1 | 1.00 | (reference) | | 1.00 | (reference) | |
| Tertile 2 | 1.59 | (0.43 - 5.88) | 0.491 | 0.83 | (0.31 - 2.20) | 0.705 |
| Tertile 3 | 1.58 | (0.42 - 5.98) | 0.502 | 0.68 | (0.24 - 1.89) | 0.460 |
| | (Trend *P* = 0.509) | | | (Trend *P* = 0.457) | | |
| Symptoms | | | | | | |
| Fatigue | 1.51 | (0.17 - 13.2) | 0.707 | 1.49 | (0.56 - 3.97) | 0.426 |
| Insomnia | - | - | -[c] | 0.76 | (0.17 - 3.44) | 0.719 |
| Stress | 1.45 | (0.42 - 5.03) | 0.561 | 0.85 | (0.20 - 3.65) | 0.831 |
| Abdominal pain | - | - | -[c] | 0.50 | (0.04 - 6.34) | 0.594 |
| Heavy stomach | 1.22 | (0.22 - 6.79) | 0.820 | 0.21 | (0.02 - 2.16) | 0.188 |
| Nausea/heartburn | 0.88 | (0.08 - 10.0) | 0.920 | 0.76 | (0.11 - 5.16) | 0.781 |
| Diarrhea/constipation | 1.27 | (0.39 - 4.18) | 0.696 | 1.72 | (0.51 - 5.81) | 0.382 |
| Hemorrhoid | 0.40 | (0.03 - 4.92) | 0.477 | | | |
| Bleeding at evacuation | 1.48 | (0.12 - 18.1) | 0.760 | - | - | -[c] |
| Acute decrease in body weight | - | - | -[c] | - | - | -[c] |
| Thirst | 0.99 | (0.11 - 8.58) | 0.992 | 1.64 | (0.44 - 6.05) | 0.458 |
| Headache, heavy headedness, eye strain, and shoulder stiffness | 0.99 | (0.32 - 3.12) | 0.992 | 1.42 | (0.58 - 3.47) | 0.440 |
| Vertigo/dizziness | 0.51 | (0.05 - 5.24) | 0.574 | 0.93 | (0.21 - 4.09) | 0.926 |
| Palpitation/shortness of breath | - | - | -[c] | 0.66 | (0.10 - 4.36) | 0.667 |
| Pain or constriction in the chest | - | - | -[c] | 5.98 | (0.80 - 44.6) | 0.081 |
| Back pain | 0.27 | (0.03 - 2.37) | 0.238 | 1.30 | (0.51 - 3.32) | 0.589 |
| Cough/sputum | 1.14 | (0.14 - 9.55) | 0.906 | 1.63 | (0.41 - 6.50) | 0.492 |
| Dysesthesia, arthralgia, and swelling in the extremities | 1.07 | (0.24 - 4.74) | 0.929 | 2.72 | (1.14 - 6.47) | 0.024 |
| Difficulty in urinating/hematuria | - | - | -[c] | 0.90 | (0.08 - 10.6) | 0.935 |
| Dysmenorrhea /irregular bleeding (women only) | 6.07 | (1.14 - 32.3) | 0.034 | | | |
| Pregnancy (women only) | - | - | -[c] | | | |

[a]Age in years was divided into tertiles: 17 - 40, 41 - 51, and 52 - 86 in location 1; and 39 - 61, 61 - 67, and 68 - 74 in location 2; [b]Adjusted for gender, age, and the presence of loss of interest or depressed mood, which are basic symptoms of major depressive disorder; [c]Not calculated because of a very small sample size.

arthralgia) experienced was moderately related to severity of depression (*r* = 0.35) [13]. The relationship between chronic pain and depression may apply to community dwellers in relatively better health. Although the cause of pain in our study subjects was not specified, identifying the symptoms may contribute to early detection of MDD and suicidal risk.

Some limitations of this study should be mentioned. First, the prevalence of MDD and suicide was estimated using point prevalence. The severity of depressive symptoms fluctuates with time, which could not be detected with MINI. Second, there are some difficulties generalizing our results. Because the study subjects were derived from a population of voluntary health check-up receivers, many of them were probably health-oriented and in better health. The participation rate in this study was not sufficiently high at either location. In addition, the prevalence of MDD in our sample was lower than the 12-month prevalence of MDD in a previous survey in Japan (2.9%) [34]. Third, this was a cross-sectional study; therefore, the causality of somatic symptoms and mental symptoms is unknown. The relationship between headache and depression is bidirectional [35,36]. Last, socioeconomic factors such as household income, job status and family structure were unknown. Further investigations will be necessary with full adjustment for

those factors and with longitudinal follow-ups.

In conclusion, a strong link between various somatic symptoms, including pain-related symptoms, and MDD and/or suicidal risk was observed among community dwellers. Early detection of depressive symptoms in the community or in primary care may have an impact on the prevalence of MDD and suicide rates in Japan. Given that a large proportion of patients with depression visit a physician rather than a psychiatrist, our findings may help physicians engaged in primary care to identify patients with MDD or suicidal risk.

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