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The Relationship Between Suicidal Ideation and Symptoms of Depression in Japan

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Author Contribution

Takeaki Takeuchi and Mutsuhiro Nakao collected and analyzed the data; Takeaki Takeuchi wrote the manuscript; Mutsuhiro Nakao reviewed and edited the manuscript and helped in its analysis. All authors contributed to the discussion. No author has any conflicts of interest to declare.

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Abstract

Objectives: The prevalence of and potential for suicidal ideation among Japanese workers is unknown, although the prevalence of suicide among patients was reported by our previous study. Hence, we evaluated the prevalence of suicidal ideation and its relationship with depressive symptoms among Japanese workers.

Methods: For this purpose, a cross-sectional design was used. Major depressive disorder (MDD) and suicidal ideation in 1,266 workers (1100 men and 166 women, aged 20–69 years) were assessed through clinical interviews conducted in accordance with the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders.

Results: A total of 34 and 70 participants were diagnosed with suicidal ideation and MDD, respectively. Suicidal ideation was especially prevalent in 40–49-year-olds. Six out of the eight symptoms of MDD (depressive mood, loss of interest, weight loss, psychomotor agitation, worthlessness, and concentration loss) were related to suicidal ideation. Depressive mood had the strongest relationship with suicidal ideation, followed by worthlessness and concentration loss. Worthlessness had the highest area under the curve in predicting suicidal ideation, followed by concentration loss and depressive mood.

Conclusions: We conclude that MDD symptoms—particularly depressive mood, worthlessness, and concentration loss—are potential predictors of suicidal ideation in Japanese workers.

Article focus

- To determine the prevalence of suicidal ideation in Japanese workers because of the lack of data in the working population.
- To examine the symptoms of major depressive disorder (MDD) that relate to suicidal ideation hypothesizing that these serve as possible predictors of suicide.

Key messages

- The prevalence of suicidal ideation was 2.7% in Japanese workers.
- Six symptoms of MDD, particularly depressive mood, worthlessness and concentration loss were related to suicidal ideation.
- These seem to be potential predictors that can be used in identifying suicidal ideation among Japanese workers, treating these symptoms as clear warning signs for dealing with suicidal risk

Strengths and limitations of this study

- This is the first evaluation of suicidal ideation among workers in Japan, which has one of the highest rates of suicide worldwide.
- Assessment of MDD including suicidal ideation were made by clinical interviews based on the Diagnostic Statistical Manual of Mental Disorders Fourth Edition, Text Revision.
- Results do not directly imply that symptoms of MDD and suicidal ideation are part of a clinical continuum because of its cross-sectional nature.
- Results do not directly represent the general population of Japanese workers because of the small sample size.

Although Japan has the highest global ranking for longevity, it also has one of the highest suicide rates, being ranked 9th for men and 3rd for women in the world[1]. From 1995 to 1998, the incidence of reported suicide rose dramatically from 17 to 25 per 100,000 people, and that high rate continued even in 2010[2,3]. Since 2005, the Japanese Cabinet Office and the Ministry of Health, Labour and Welfare have been attempting to reduce the suicide rate; however, outcome has yet been observed clearly.

To reduce the number of suicides, collaborative care models for treating depression have shown potential in both improving depression outcomes and decreasing suicide risk[4]. However, with the exception of psychiatrists or psychological specialists, most doctors find it difficult to diagnose depression because of the complexities involved in administering clinical interviews. In addition, doctors must pay attention to those who do not perfectly match the diagnostic criteria[5]. If depression is not diagnosed appropriately, it might be difficult to find the pathway that leads to suicide.

Thus, instead of investigating the potential for depression, it would be much simpler and more useful to determine the presence of suicidal ideation in individuals to assess their suicide risk. Suicidal ideation, which refers to wishing that one's life would end or thoughts of harming or killing oneself, represents an important phase in the suicidal process and often precedes suicidal attempts or death by suicide. In clinical settings, it is relatively straightforward to ask patients whether they have suicidal ideation, because this is one of the most important routine questions in mental health[6]. Our previous study reported the prevalence of suicidal ideation among clinics[7]. Naturally, attempted suicide is one of the strongest risk factors for death by suicide[9-11], and 60% of planned first attempts occur within the first year of ideation onset[9]. Therefore, identifying those people with suicidal ideation would be logically the first step in

reducing the incidence of suicide.

One problem is that, in screening process such as workplaces, it might be difficult to identify people with suicidal ideation because asking workers whether they had suicidal ideation could lead to conflicts in their relationships. In addition, people from Asian countries are sometimes reluctant to speak about their mental condition, including suicidal ideation, even to their physicians, because it is considered taboo[2]. The Japanese in particular are less willing to express emotional distress or feelings such as suicidal ideation compared with Westerners[12,13]. Therefore, instead of identifying suicidal ideation, identifying the symptoms closely related to suicidal ideation would be useful in determining an individual's risk of suicide.

In Japan, more than 30,000 people have committed suicide each year for the past 10 years, and 27% of them were working people[3]. Thus, we thought that it was highly important to identify the prevalence of suicidal ideation and the symptoms that are closely related to suicidal ideation in the working population in Japan.

The aims of this study were twofold. First, we attempted to determine the prevalence of suicidal ideation in Japanese workers because of the lack of data at present on the prevalence of suicidal ideation in working population. Second, we examined the symptoms of major depressive disorder (MDD), hypothesizing that some of these symptoms would be strongly related to suicidal ideation, and thus serve as possible predictors.

Methods

Participants and ethical considerations

A cross-sectional design was used. Data were obtained from 1,314 full-time office workers attending health examinations in an enterprise in Tokyo, Japan. Due to missing health

examination data, we excluded 48 participants, and thus, we analyzed the data from 1,266 Japanese workers (96% of the total number of employees, 1100 men and 166 women aged 20–69 years). All participants provided written informed consent after receiving a complete explanation regarding the purpose, nature, and risks of the procedures used. This study was performed in accordance with the World Medical Association's Declaration of Helsinki, and its protocol was approved by the Ethics Committee of the Teikyo University School of Medicine and the company's labor safety committee.

Assessment of major depressive disorder including suicidal ideation

To ascertain whether each participant met the Diagnostic Statistical Manual of Mental Disorders Fourth Edition, Text Revision (DSM-IV) criteria for MDD, clinical interviews for DSM-IV axis I disorders were conducted by two study physicians specializing in both psychiatry and psychosomatic medicine, assisted by a researcher trained in psychology. Suicidal ideation was also evaluated during the interviews. To confirm the diagnosis of suicidal ideation, interviewees underwent additional independent interviews that specifically focused on suicidal ideation.

Assessment of lifestyle factors

A structured questionnaire administered by the physician was used to assess lifestyle factors, including smoking status, alcohol consumption, exercise, and sleep disturbances[14]. Based on their smoking history, the subjects were classified into three categories: current smokers, past smokers, and non-smokers (no history of smoking). Alcohol consumption was classified into three categories based on the weekly frequency of consumption: 6–7 times/week, 1–5 times/week, and occasional drinking. Exercise was classified into two categories: regular or irregular. Sleep disturbances were assessed on a subjective basis, and anxiety was scored as

present or absent, based on answers to additional questions during the DSM-IV interview.

Sample size

Based on our previous study[7,8], we expected to find a difference of 30% in the rate of each symptom between both groups with and without suicidal ideation. To achieve a power of 0.90 given a two-sided α of 0.05, and a ratio of our exposed sample to our control sample of 1:25, we needed at least 32 participants in the group with suicidal ideation and 800 participants without suicidal ideation. Finally, through the actual data collection we collected 34 participants with suicidal ideation and 1232 participants without suicidal ideation.

Statistical analysis

After the characteristics of the study population were descriptively evaluated according to the presence of suicidal ideation, multiple logistic regression analyses were used to evaluate the association between suicidal ideation and MDD, by calculating crude and adjusted odds ratios (ORs). The ratios were adjusted for potential confounding factors to depression and suicide, such as sex, age, and three lifestyle factors (smoking status, alcohol consumption, and exercise). Finally, receiver operating curve (ROC) analyses were performed to examine the predictive potentials of MDD symptoms for suicidal ideation. Statistical significance was inferred at $p < 0.05$ (two-tailed) for both the crude and adjusted ORs of the logistic analyses and the test equality of the area under the curve (AUC). All analyses were performed using STATA version 11.

Results

A total of 34 (2.7%, 95% confidence interval [1.8, 3.8]) and 70 (5.5%, 95% CI [4.3, 6.8]) people were diagnosed with having suicidal ideation and MDD, respectively. Those with suicidal ideation were more likely to be women, aged between 40 and 49 years, drinkers, and not exercising regularly (Table 1). Only the age factor (i.e., being in one's 40s) significantly differed between participants with and without suicidal ideation. Six out of the eight symptoms of MDD (depressive mood, loss of interest, weight loss, psychomotor agitation, worthlessness, and concentration loss) were related to suicidal ideation in both the crude and adjusted analyses (Table 2).

Depressive mood had the strongest relationship to suicidal ideation (OR 11.2, 95% CI [5.4, 23.0]), followed by worthlessness (OR 8.5, 95% CI [4.1, 17.4]) and then concentration loss (OR 6.1, 95% CI [4.1, 17.4]).

Worthlessness had the highest AUC (0.73, 95% CI [0.71, 0.76]) in predicting suicidal ideation, followed by concentration loss (0.71, 95% CI [0.62, 0.79]) and then depressive mood (0.69, 95% CI [0.66, 0.71]).

Discussion

Our study revealed that the prevalence of suicidal ideation was 2.7% in Japanese workers. In addition, we found that six symptoms of depression, particularly depressive mood, worthlessness, and concentration loss, were related to suicidal ideation. These are potential predictors that can be used in identifying suicidal ideation among Japanese workers. As we expected, suicidal ideation was less prevalent in Japanese workers than in Western populations[15]. We may have to consider that this low prevalence of suicidal ideation is not reflective of a low prevalence in the general population, because some Japanese people are reluctant to speak about their mental condition. While we will need to reconsider this prevalence rate in the near future,

this rate is useful as one of the first evaluations of suicidal ideation among workers in Japan, which has one of the highest rates of completed suicide worldwide.

Although there is no way to predict who will eventually die by suicide, treating the clear warning signs for suicide can reduce patients' suffering. This study revealed a significantly positive association between some symptoms of depression and suicidal ideation. In countries like Japan, where people are reluctant to express their feelings, these symptoms might be useful in estimating an individual's risk of suicidal ideation and eventual suicide[4,15].

Some of the above symptoms (depressive mood, worthlessness, and concentration loss) are similar to symptoms found to be predictors of suicidal ideation in previous studies[15,16]. Only concentration loss was a new predictor, which might be due to the characteristics of our study sample. For workers, concentration loss would be a particularly salient symptom due to its interruption of their daily work.

Our results also showed that while participants who were women, between 40 and 49 years old, drinkers, and not exercising regularly had a higher tendency for suicidal ideation, only being in one's 40s was statistically significant in this study. This finding would be reasonable because the greatest increase in the number of deaths by suicide in the last decade in Japan occurred among 40–49-year-old workers[3]. Although not statistically significant, heavy drinking has been shown to be associated with a higher risk of alcohol abuse, and not exercising regularly is associated with a greater risk of poor mental health[1]. We believe that completed suicides are likely to have a background of suicidal ideation. Thus, our recommended strategy to reduce suicide based on this research is to identify its potential risk by asking indirect questions related to suicidal ideation, including questions related to depressive mood, worthlessness, and concentration loss, because these symptoms appear to be related to the presence of suicidal

ideation, which in turn increases the likelihood of completed suicide.

Several limitations of this study warrant consideration. First, because of its cross-sectional nature, our results do not directly imply that symptoms of MDD and suicidal ideation are part of a clinical continuum, but rather that a simple statistical association exists after adjusting for important confounding factors. Second, because of the small sample size, the results do not directly represent the general population of Japanese workers. However, this is one of the first studies to report the prevalence of suicidal ideation in Japanese workers. Thus, this report could be of paramount importance in Japan, where many people are reluctant to discuss their mental condition.

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Contributorship

Takeaki Takeuchi and Mutsuhiro Nakao collected and analyzed the data; Takeaki Takeuchi wrote the manuscript; Mutsuhiro Nakao reviewed and edited the manuscript and helped in its analysis. All authors contributed to the discussion.

Data sharing statements

There is no additional data available.

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Competing Interests None

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Table 1

Prevalence of suicide ideation and sociodemographic characteristics of individuals with and without suicide ideation (N = 1266)

Variable	Suicidal ideation + (*n* = 34)		Suicidal ideation - (*n* = 1232)			
	%	95% CI	%	95% CI	OR	95% CI
Sex						
Male	79.4	[62.1, 91.3]	87.1	[85.1, 88.9]	0.6	[0.2, 1.3]
Female	21.6	[8.7, 37.9]	12.9	[11.1, 14.9]	1.0	[1.0, 1.0]
Age						
20–29	14.7	[2.6, 26.8]	9.3	[7.6, 10.9]	1.6	[1.0, 2.5]
30–39	26.5	[11.4, 41.5]	29.9	[27.3, 32.4]	1.5	[0.8, 2.8]
40–49	47.1	[30.0, 64.1]	29.9	[27.3, 32.4]	4.2	[1.4, 12.5]
50+	11.7	[0.4, 23.2]	30.9	[28.4, 33.6]	1.0	[1.0, 1.0]
Smoking status						
Current	38.2	[21.6, 54.8]	36.4	[33.6, 39.1]	1.0	[0.7, 1.5]
Past	26.5	[11.4, 41.5]	31.0	[28.4, 33.6]	0.8	[0.3, 1.9]
Never	35.3	[19.0, 51.6]	32.6	[30.0, 35.3]	1.0	[1.0, 1.0]
Alcohol consumption						
Every day (6–7 times/week)	29.4	[13.9, 45.0]	18.8	[16.6, 20.9]	0.7	[0.4, 1.1]
Often (1–5 times/week)	47.1	[30.0, 64.1]	46.5	[43.7, 49.3]	0.6	[0.3, 1.4]
No regular drinking	23.5	[9.0, 38.0]	34.7	[32.1, 37.4]	1.0	[1.0, 1.0]
Exercise						
Irregular	70.6	[52.5, 84.9]	62.1	[59.3, 64.8]	1.5	[0.7, 3.1]
Regular	29.4	[15.1, 47.5]	37.9	[35.2, 40.7]	1.0	[1.0, 1.0]

Table 2

Association of MDD symptoms with suicidal ideation (N = 1266)

MDD symptoms	*n* (%)	Suicidal ideation (*n* = 34)			Sensitivity, %	Specificity, %	AUC (95% CI)
		Model 1* (Non-adjusted)	Model 2† (Adjusted)	Model 3‡ (Adjusted)			
		OR (95% CI)	OR (95% CI)	OR (95% CI)			
Depressive mood	92 (7.3)	11.8 [5.8, 24.2]	11.5 [5.6, 23.6]	11.2 [5.4, 23.0]	44.1	93.8	0.69 [0.66, 0.71]
Loss of interest	117 (9.2)	3.2 [1.4, 7.2]	3.5 [1.5, 7.9]	3.5 [1.5, 8.0]	23.5	91.2	0.57 [0.55, 0.60]
Weight loss	48 (3.8)	4.8 [1.8, 12.9]	4.9 [1.8, 13.5]	5.0 [1.8, 13.8]	14.7	96.5	0.56 [0.53, 0.58]
Insomnia	455 (35.9)	2.0 [1.0, 4.1]	1.9 [1.0, 3.8]	1.8 [0.9, 3.7]	52.9	64.5	0.59 [0.56, 0.61]
Psychomotor agitation	741 (58.5)	2.4 [1.1, 5.2]	2.2 [1.0, 5.0]	2.2 [1.0, 4.9]	76.5	42.0	0.59 [0.56, 0.62]
Fatigue	920 (72.7)	2.9 [1.0, 8.2]	2.6 [0.9, 7.6]	2.6 [0.9, 7.5]	61.8	84.7	0.58 [0.55, 0.61]
Worthlessness	210 (16.6)	8.9 [4.4, 18.1]	8.6 [4.2, 17.5]	8.5 [4.1, 17.4]	61.8	84.7	0.73 [0.71, 0.76]
Concentration loss	274 (21.6)	6.3 [3.1, 12.7]	6.3 [3.1, 12.8]	6.1 [3.0, 12.5]	61.8	79.5	0.71 [0.62, 0.79]

*Model 1 was the crude analysis. †Model 2 was adjusted for sex and age (used as categorical variables). ‡Model 3 was adjusted for sex, age (used as categorical variables), and lifestyle factors (smoking status, alcohol consumption, and exercise).

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Author Contribution

Takeaki Takeuchi and Mutsuhiro Nakao collected and analyzed the data; Takeaki Takeuchi wrote the manuscript; Mutsuhiro Nakao reviewed and edited the manuscript and helped in its analysis. All authors contributed to the discussion. No author has any conflicts of interest to declare.

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Keywords: Japan; Major depressive disorder; Suicidal ideation; Workers

Abstract

Objectives: The prevalence of **suicidal ideation** and **predictors** for suicidal ideation among Japanese workers is unknown, **although a previous study reported a 30 % prevalence rate of suicide in a psychosomatic clinical setting.** Hence, we evaluated the prevalence of suicidal ideation and its relationship with depressive symptoms among Japanese workers.

Methods: For this purpose, a cross-sectional design was used. Major depressive disorder (MDD) and suicidal ideation in 1,266 workers (1100 men and 166 women, aged 20–69 years) were assessed through clinical interviews conducted in accordance with the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders.

Results: A total of 34 and 70 participants were diagnosed with suicidal ideation and MDD, respectively. Suicidal ideation was especially prevalent in 40–49-year-olds. Six out of the eight symptoms of MDD (depressive mood, loss of interest, weight loss, psychomotor agitation, worthlessness, and concentration loss) were related to suicidal ideation. Depressive mood had the strongest relationship with suicidal ideation, followed by worthlessness and concentration loss. Worthlessness had the highest area under the curve in predicting suicidal ideation, followed by concentration loss and depressive mood.

Conclusions: We conclude that MDD symptoms—particularly depressive mood, worthlessness, and concentration loss—are potential predictors of suicidal ideation in Japanese workers.

Article focus

- To determine the prevalence of suicidal ideation in Japanese workers because of the lack of data in the working population.
- To examine the symptoms of major depressive disorder (MDD) that relate to suicidal ideation hypothesizing that these serve as possible predictors of suicide.

Key messages

- The prevalence of suicidal ideation was 2.7% in Japanese workers.
- Six symptoms of MDD, particularly depressive mood, worthlessness and concentration loss were related to suicidal ideation.
- These seem to be potential predictors that can be used in identifying suicidal ideation among Japanese workers, treating these symptoms as clear warning signs for dealing with suicidal risk

Strengths and limitations of this study

- This is the first evaluation of suicidal ideation among workers in Japan, which has one of the highest rates of suicide worldwide.
- Assessment of MDD including suicidal ideation were made by clinical interviews based on the Diagnostic Statistical Manual of Mental Disorders Fourth Edition, Text Revision.
- Results do not directly imply that symptoms of MDD and suicidal ideation are part of a clinical continuum because of its cross-sectional nature.
- Results do not directly represent the general population of Japanese workers because of the small sample size.

Although Japan has the highest global ranking for longevity, it also has one of the highest suicide rates, being ranked 9th for men and 3rd for women in the world[1]. From 1995 to 1998, the incidence of reported suicide rose dramatically from 17 to 25 per 100,000 people, and that high rate continued even in 2010[2,3]. Since 2005, the Japanese Cabinet Office and the Ministry of Health, Labour and Welfare have been attempting to reduce the suicide rate; **however the suicide rate in Japan has not decreased.**

To reduce the number of suicides, **collaborative care, that is, structured care involving a greater role of nonmedical specialists for treating depression** have shown potential in both improving depression outcomes and decreasing suicide risk[4]. However, with the exception of psychiatrists or psychological specialists, most doctors find it difficult to diagnose depression because of the complexities involved in administering clinical interviews. In addition, doctors must pay attention to those who do not perfectly match the diagnostic criteria[5]. If depression is not diagnosed appropriately, it might be difficult to find the pathway that leads to suicide.

In addition to investigating the potential for depression, it would be much simpler and more useful to determine the presence of suicidal ideation in individuals to assess their suicide risk. Suicidal ideation, which refers to wishing that one's life would end or thoughts of harming or killing oneself, represents an important phase in the suicidal process and often precedes suicidal attempts or death by suicide. In clinical settings, it is relatively straightforward to ask patients whether they have suicidal ideation, because this is one of the most important routine questions in mental health[6]. Our previous study reported the prevalence of suicidal ideation **(30%) in a psychosomatic clinical setting**[7]. Naturally, attempted suicide is one of the strongest risk factors for death by suicide[8-11], and 60% of planned first attempts occur within the first year of ideation onset[9]. Therefore, identifying those people with suicidal ideation would be logically

the first step in reducing the incidence of suicide.

One problem is that, in screening process such as workplaces, it might be difficult to identify people with suicidal ideation because asking workers whether they had suicidal ideation could lead to conflicts in their relationships. In addition, people from Asian countries are sometimes reluctant to speak about their mental condition, including suicidal ideation, even to their physicians, because it is considered taboo[2]. The Japanese in particular are less willing to express emotional distress or feelings such as suicidal ideation compared with Westerners[12,13]. Therefore, **we try to identify both suicidal ideation and the symptoms closely related to suicidal ideation in determining an individual's risk of suicide.**

In Japan, more than 30,000 people**, 25 per 100,000 people,** have committed suicide each year for the past 10 years, and 27% of them were working people[3]. Thus, we thought that it was highly important to identify the prevalence of suicidal ideation and the symptoms that are closely related to suicidal ideation in the working population in Japan.

The aims of this study were twofold. First, we attempted to determine the prevalence of suicidal ideation in Japanese workers because of the lack of data at present on the prevalence of suicidal ideation in working population. Second, we examined the symptoms of major depressive disorder (MDD), hypothesizing that some of these symptoms would be strongly related to suicidal ideation, and thus serve as possible predictors.

Methods

Participants and ethical considerations

A cross-sectional design was used. Data were obtained from 1,314 full-time office workers attending health examinations in an enterprise in Tokyo, Japan. Due to missing health

examination data, we excluded 48 participants, and thus, we analyzed the data from 1,266 Japanese workers (96% of the total number of employees, 1100 men and 166 women aged 20–69 years). All participants provided written informed consent after receiving a complete explanation regarding the purpose, nature, and risks of the procedures used. This study was performed in accordance with the World Medical Association's Declaration of Helsinki, and its protocol was approved by the Ethics Committee of the Teikyo University School of Medicine and the company's labor safety committee.

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Assessment of lifestyle factors

A structured questionnaire administered by the physician was used to assess lifestyle factors, including smoking status, alcohol consumption, and exercise[15]. Based on their smoking history, the subjects were classified into three categories: current smokers, past smokers, and non-smokers (no history of smoking). Alcohol consumption was classified into three categories based on the weekly frequency of consumption: 6–7 times/week, 1–5 times/week, and occasional drinking. Exercise was classified into two categories: regular or irregular. These questions were asked as additional questions during the DSM-IV interview.

Sample size

Based on our previous study[7,8], we expected to find a difference of 30% in the rate of each symptom between both groups with and without suicidal ideation. To achieve a power of 0.90 given a two-sided α of 0.05, and a ratio of our exposed sample to our control sample of 1:25, we needed at least 32 participants in the group with suicidal ideation and 800 participants without suicidal ideation. Finally, through the actual data collection we collected 34 participants with suicidal ideation and 1232 participants without suicidal ideation.

Statistical analysis

After the characteristics of the study population were descriptively evaluated according to the presence of suicidal ideation, multiple logistic regression analyses were used to evaluate the association between suicidal ideation and **each MDD symptom**, by calculating crude and adjusted odds ratios (ORs). The ratios were adjusted for potential confounding factors to depression and suicide, such as sex, age, and three lifestyle factors (smoking status, alcohol consumption, and exercise). Finally, receiver operating curve (ROC) analyses were performed to examine the predictive potentials of MDD symptoms for suicidal ideation. Statistical significance was inferred at $p < 0.05$ (two-tailed) for both the crude and adjusted ORs of the logistic analyses and the test equality of the area under the curve (AUC). All analyses were performed using STATA version 11.

Results

A total of 34 (2.7%, 95% confidence interval [1.8, 3.8]) and 70 (5.5%, 95% CI [4.3, 6.8])

people were diagnosed with having suicidal ideation and MDD, respectively. Those with suicidal ideation were more likely to be aged between 40 and 49 years, drinkers, and not exercising regularly (Table 1). Only the age factor (i.e., being in one's 40s) significantly differed between participants with and without suicidal ideation. Six out of the eight symptoms of MDD (depressive mood, loss of interest, weight loss, psychomotor agitation, worthlessness, and concentration loss) were related to suicidal ideation in both the crude and adjusted analyses (Table 2).

Depressive mood had the strongest relationship to suicidal ideation (OR 11.2, 95% CI [5.4, 23.0]), followed by worthlessness (OR 8.5, 95% CI [4.1, 17.4]) and then concentration loss (OR 6.1, 95% CI [4.1, 17.4]).

Worthlessness had the highest AUC (0.73, 95% CI [0.71, 0.76]) in predicting suicidal ideation, followed by concentration loss (0.71, 95% CI [0.62, 0.79]) and then depressive mood (0.69, 95% CI [0.66, 0.71]).

Discussion

Our study revealed that the prevalence of suicidal ideation was 2.7% in Japanese workers. In addition, we found that six symptoms of depression, particularly depressive mood, worthlessness, and concentration loss, were related to suicidal ideation. These are potential predictors that can be used in identifying suicidal ideation among Japanese workers. As we expected, suicidal ideation was less prevalent in Japanese workers than in Western populations[16]. We may have to consider that this low prevalence of suicidal ideation is not reflective of a low prevalence in the general population, because some Japanese people are reluctant to speak about their mental condition. While we will need to reconsider this prevalence rate in the near future, this rate is useful as one of the first evaluations of suicidal ideation among workers in Japan,

which has one of the highest rates of completed suicide worldwide.

Although there is no way to predict who will eventually die by suicide, treating the clear warning signs for suicide can reduce patients' suffering. This study revealed a significantly positive association between some symptoms of depression and suicidal ideation. In countries like Japan, where people are reluctant to express their feelings, these symptoms might be useful in estimating an individual's risk of suicidal ideation and eventual suicide[4,16].

Some of the above symptoms (depressive mood, worthlessness, and concentration loss) are similar to symptoms found to be predictors of suicidal ideation in previous studies[16,17]. Only concentration loss was a new predictor, which might be due to the characteristics of our study sample. For workers, concentration loss would be a particularly salient symptom due to its interruption of their daily work.

Our results also showed that while participants who were between 40 and 49 years old, drinkers, and not exercising regularly had a higher tendency for suicidal ideation, only being in one's 40s was statistically significant in this study. This finding would be reasonable because the greatest increase in the number of deaths by suicide in the last decade in Japan occurred among 40–49-year-old workers[3]. Although not statistically significant, heavy drinking has been shown to be associated with a higher risk of alcohol abuse, and not exercising regularly is associated with a greater risk of poor mental health[1]. We believe that **completed suicides have a background of suicidal ideation.** Thus, our recommended strategy to reduce suicide based on this research is to identify its potential risk by asking indirect questions related to suicidal ideation, including questions related to depressive mood, worthlessness, and concentration loss, because these symptoms appear to be related to the presence of suicidal ideation, which in turn increases the likelihood of completed suicide.

Several limitations of this study warrant consideration. First, because of its cross-sectional nature, our results do not directly imply that symptoms of MDD and suicidal ideation are part of a clinical continuum, but rather that a simple statistical association exists after adjusting for important confounding factors. **To confirm the results, a more robust study such as prospective cohort study would be needed.** Second, because of the small sample size, the results do not directly represent the general population of Japanese workers. **The study is only applicable to a working population in an urban area in Japan.** However, this is one of the first studies to report the prevalence of suicidal ideation in Japanese workers. Thus, this report could be of paramount importance in Japan, where many people are reluctant to discuss their mental condition.

Acknowledgements

This research was supported in part by Grant-in-Aid for Scientific Research (2009-2012) (C) from the Ministry of Education, Science, Sports and Culture, Japan; and Research Grant (2011-2014) for Health and Welfare from Ministry of Health, Labour and Welfare, Japan (No. 24590761).

Data sharing statements

There is no additional data available.

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Table 1

Prevalence of suicide ideation and sociodemographic characteristics of individuals with and without suicide ideation (N = 1266)

Variable	Suicidal ideation + (*n* = 34)		Suicidal ideation - (*n* = 1232)			
	%	95% CI	%	95% CI	OR	95% CI
Sex						
Male	79.4	[62.1, 91.3]	87.1	[85.1, 88.9]	0.6	[0.2, 1.3]
Female	21.6	[8.7, 37.9]	12.9	[11.1, 14.9]	1.0	[1.0, 1.0]
Age						
20–29	14.7	[2.6, 26.8]	9.3	[7.6, 10.9]	1.6	[1.0, 2.5]
30–39	26.5	[11.4, 41.5]	29.9	[27.3, 32.4]	1.5	[0.8, 2.8]
40–49	47.1	[30.0, 64.1]	29.9	[27.3, 32.4]	4.2	[1.4, 12.5]
50+	11.7	[0.4, 23.2]	30.9	[28.4, 33.6]	1.0	[1.0, 1.0]
Smoking status						
Current	38.2	[21.6, 54.8]	36.4	[33.6, 39.1]	1.0	[0.7, 1.5]
Past	26.5	[11.4, 41.5]	31.0	[28.4, 33.6]	0.8	[0.3, 1.9]
Never	35.3	[19.0, 51.6]	32.6	[30.0, 35.3]	1.0	[1.0, 1.0]
Alcohol consumption						
Every day (6–7 times/week)	29.4	[13.9, 45.0]	18.8	[16.6, 20.9]	0.7	[0.4, 1.1]
Often (1–5 times/week)	47.1	[30.0, 64.1]	46.5	[43.7, 49.3]	0.6	[0.3, 1.4]
No regular drinking	23.5	[9.0, 38.0]	34.7	[32.1, 37.4]	1.0	[1.0, 1.0]
Exercise						
Irregular	70.6	[52.5, 84.9]	62.1	[59.3, 64.8]	1.5	[0.7, 3.1]
Regular	29.4	[15.1, 47.5]	37.9	[35.2, 40.7]	1.0	[1.0, 1.0]

Table 2. Association of MDD symptoms with suicidal ideation (N = 1266)

MDD symptoms	n (%)	Suicidal ideation (n = 34)								
		Model 1* (Non-adjusted)		Model 2† (Adjusted)		Model 3‡ (Adjusted)				
		OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value	Sensitivity %	Specificity %	AUC (95% CI)
Depressive mood	92 (7.3)	**11.8 [5.8, 24.2]**	**<0.01**	**11.5 [5.6, 23.6]**	**<0.01**	**11.2 [5.4, 23.0]**	**<0.01**	44.1	93.8	0.69 [0.66, 0.71]
Loss of interest	117 (9.2)	**3.2 [1.4, 7.2]**	**<0.01**	**3.5 [1.5, 7.9]**	**<0.01**	**3.5 [1.5, 8.0]**	**<0.01**	23.5	91.2	0.57 [0.55, 0.60]
Weight loss	48 (3.8)	**4.8 [1.8, 12.9]**	**<0.01**	**4.9 [1.8, 13.5]**	**<0.01**	**5.0 [1.8, 13.8]**	**<0.01**	14.7	96.5	0.56 [0.53, 0.58]
Insomnia	455 (35.9)	**2.0 [1.0, 4.1]**	**0.04**	1.9 [1.0, 3.8]	0.07	1.8 [0.9, 3.7]	0.09	52.9	64.5	0.59 [0.56, 0.61]
Psychomotor agitation	741 (58.5)	**2.4 [1.1, 5.2]**	**0.04**	2.2 [1.0, 5.0]	0.05	2.2 [1.0, 4.9]	0.06	76.5	42.0	0.59 [0.56, 0.62]
Fatigue	920 (72.7)	2.9 [1.0, 8.2]	0.05	2.6 [0.9, 7.6]	0.07	2.6 [0.9, 7.5]	0.08	61.8	84.7	0.58 [0.55, 0.61]
Worthlessness	210 (16.6)	**8.9 [4.4, 18.1]**	**<0.01**	**8.6 [4.2, 17.5]**	**<0.01**	**8.5 [4.1, 17.4]**	**<0.01**	61.8	84.7	0.73 [0.71, 0.76]
Concentration loss	274 (21.6)	**6.3 [3.1, 12.7]**	**<0.01**	**6.3 [3.1, 12.8]**	**<0.01**	**6.1 [3.0, 12.5]**	**<0.01**	61.8	79.5	0.71 [0.62, 0.79]

*Model 1 was the crude analysis. †Model 2 was adjusted for sex and age (used as categorical variables). ‡Model 3 was adjusted for sex, age (used as categorical variables), and lifestyle factors (smoking status, alcohol consumption, and exercise).

Revised Report

October 8, 2013

Manuscript ID bmjopen-2013-003643
Title: The Relationship Between Suicidal Ideation and Symptoms of Depression in Japan

Dear Mr. Richard Sands and the reviewers (Mr. Arup Dhar and Ms. Toffol Elena),

Thank you for reviewing our manuscript. We are in receipt of your kind letter related to the publication of our manuscript, "The Relationship Between Suicidal Ideation and Symptoms of Depression in Japan" in *BMJ Open.* We revised our manuscript following the reviews. *Italic* parts are the reviewers' comments and following **bold** parts are revised points in detail, and the altered parts are also **bolded** in the revised manuscript.

Managing editor's comment: please include the study design type in the study title.
General response to the managing editor: We really appreciate you being engaged in our paper's revising process.
Response: Thank you for your comment. We have changed the title to **"The Relationship between Suicidal Ideation and Symptoms of Depression in Japanese Workers: A Cross sectional Study."**

Reviewer: Arup Dhar

(Qu1) Suggest title of paper includes the term 'Japanese workers' as opposed to simply 'Japan', as the title in its current format is misleading.

General response to Mr. Arup Dhar: We really appreciate you being engaged in our paper's revising process.

Response: Thank you for your comment. We have changed the title to **"The Relationship between Suicidal Ideation and Symptoms of Depression in Japanese Workers: A Cross sectional Study"** in order not to be misleading.

(Qu2) Address limitations further eg why standardised interviews were not used eg Mini International Neuropsychiatry Interview. Was there was any inter rater reliability training sessions carried out?

Response: Thanks for your valuable comment. As we mentioned in the introduction section, the question of suicide in Japanese workers is a kind of taboo, so it was difficult to use MINI for asking about suicide (six questions). Instead, we limited our question to suicidal ideation.

Interviewers' diagnoses were sufficiently consistent. Two physicians, who specialize in both psychiatry and psychosomatic medicine, checked the consistency of their diagnoses for 20 cases according to the axis I classification of disorders, including MDD (the 20 cases were presented by a professor not related to this study). Out of the 20 cases, 14 were diagnosed similarly by the two physicians (the kappa statistics was 0.94).

Reviewer: Toffol, Elena

This paper reports the prevalence of MDD and suicidal ideation in a sample of 1266 Japanese workers; additionally, it describes the association between suicidal ideation and specific depressive symptoms in the above-mentioned population. Even though the work is overall well-built, I think some limitations need to be addressed.

General response to Ms. Toffol Elena: We really appreciate you being engaged in our paper's revising process.

My major comment concerns the overall aim of the study. I understand the authors' position that suicidal ideation is a taboo in many cultures, and that it may be difficult to assess on a general screening level. However, I would not spread the message that investigating depressive symptoms may be an alternative to assessing suicidal ideation. I would rather claim that assessing specific depressive symptoms, known to be related to suicidal ideation, is an important addition, possibly a preliminary step in the more specific and direct evaluation of suicidal ideation. Also, the authors found significant associations between suicidal ideation and some specific depressive symptoms (depressive mood, worthlessness and concentration loss): is this really a novel finding? In other words, how much these associations are rather expression of all being part of the same diagnostic group?

Response: Thanks for your kind and concrete comments. We would like to say that assessing specific depressive symptoms in occupational fields is an important addition. Our research was based on the occupational field, not the clinical field. That is the main novelty of our paper. Clinically, the relationship between suicide and depression has been researched by many previous studies. However, studies which have mentioned this relationship in the occupational field has been few. Our investigation therefore is important as an occupational field study. To clarify our study's originality, we have changed the title to **"The Relationship between Suicidal Ideation and Symptoms of Depression in Japanese Workers: A Cross sectional Study"** in order not to be misleading.

The idea of detecting possible predictors and indirect signs of suicidal ideation is interesting, but I think a more robust design (e.g. a longitudinal one) would be needed. I would at least address these points in the limitations.

Response: Following the reviewers comments, we added the following sentence in the limitation section, **"To confirm the results, a more robust study such as prospective cohort study would be needed"**(Page 10, lines 4-5).

Also, the authors state that Japanese workers may be reluctant to report suicidal ideation: thus, is it possible that those who are classified as non-ideators in this study, in fact have themselves suicidal ideation? Could this have biased the results?
Response: There is a possibility that reluctance in Japanese respondents may cause bias, this however tends to produce estimates of the effect that are diluted, or closer to the null or no-effect value than the actual effect. Therefore, the result itself is plausible.

Other minor considerations are reported below:
1. in general: a language revision is needed. Some sentences were not very clear to me. E.g.: introduction, page 4, line 15 "however, outcome has yet been observed clearly"; discussion, page 9, line 48 "completed suicides are likely to have a background of suicidal ideation".
Response: To make the meaning more clearly, we change the sentence to "however the suicide rate in Japan has not decreased (page 4, lines 5-6)" and "completed suicides have a background of suicidal ideation (page 9, line 18-19)."

2. abstract: what does "the prevalence and potential for suicidal ideation ...." mean? In the abstract the authors mention a previous study of theirs: the readers may not be familiar with this study, I would add some more information here (psychiatric patients? any patients?; also, I would suggest reporting the prevalence rate: e.g. "...although a previous study reported a XXX prevalence rate of suicide in XXX").
Response: Following the reviewer's comments, we changed the sentence in abstract to "The prevalence of **suicidal ideation** and **predictors** for suicidal ideation among Japanese workers is unknown, **although a previous study reported a 30 % prevalence rate of suicide in a psychosomatic clinical setting.**"

3. introduction, page 4, line 18: what are the "collaborative care models"? I would briefly mention what a collaborative care model consists of.
Response: We added the following words, "collaborative care, **that is, structured care involving a greater role of nonmedical specialists** for treating depression……"(page 4, Lines7-8)

4. introduction, page 4, beginning of paragraph 3: I would reformulate this first sentence. Again I would be careful in claiming that instead of investigating depression, we could simply investigate suicidal ideation (besides, this is somehow contradictory with the general aim of study). I would rather say that "in addition to…". Similarly, I would reformulate the sentence at page 5, lines 20-22: "Therefore, instead of identifying suicidal ideation…." This should also be pointed out in the discussion.

Response: Following the reviewer's comments, we changed the sentence "**In addition to investigating……**(page 4 line 14)**","we try to identify both suicidal ideation and the symptoms closely related to suicidal ideation in determining an individual's risk of suicide**"(page 5 lines 8-9).

5. Introduction, page 49-51: the authors refer to a previous study of theirs. I would suggest reporting here the prevalence rate of suicidal ideation found in the study; also, in which kind of clinics was the study conduct? Psychiatric clinics? Any clinics?

Response: Same as the abstract part, we added the following sentence in the introduction, "Our previous study reported the prevalence of suicidal ideation **(30%) in a psychosomatic clinical setting**[7]" (page 4, line 21).

6. Introduction, page 5, line 25: the authors state that "more than 30000 people have committed suicide each year for the past 10 years". Suicidal rates would be more informative.

Response: We have added "**25 per 100,000 people**" after the 30000 people (page 5 Line 10)

7. Methods: one concern is about the representativeness of the study population. Participants were over 1000 office-worker in an enterprise in Tokyo. I would say that this is a quite selected population. How about workers in other sectors (e.g. physically demanding jobs) or in other areas (e.g. rural areas)? Also, though a big number, I would assume that 1000 people is a rather small proportion of the Japanese population. I would acknowledge this more in detail in the limitations. Also, I am wondering about the gender disproportion in the sample (13% women): could this have influenced the results? Women are known to be more likely to suffer from depression, and suicidal ideation is one of the diagnostic criteria for MDD.

Response: Thank you for your comments. As we mentioned in the limitation, our data can only apply to the working population in urban working places. We have mentioned

this in the discussion section as follows. "**The study is only applicable to a working population in an urban area in Japan.**" (page 10, lines 6–7).

As the reviewer has mentioned, our sample size was relatively small. However, a small sample size does not mean that the correlation is unsure. If we observe a statistically significant difference in a small sample, it actually implies that the result is robust, because it would be easier to achieve statistical significance with a large number of subjects. However, there is definitely a possibility that our sample does not represent the general population. We have thus added the before mentioned sentence in the limitation section.

The fact that low number of women reflects Japanese women's low participation in the workplace. Now, a national project to enhance the entrance of women into the workforce is undergoing. Statistically no significant differences were observed in the results of the analysis before and after the adjustment by sex in table 2, therefore sex difference does not have a significant influence on the results.

8. Methods, Assessment of major depressive disorder including suicidal ideation: which clinical interview was used to assess MDD? And how was suicidal ideation evaluated? Is suicidal ideation a "diagnosis"?

Response: We evaluated MDD and suicidal ideation independently. To diagnose MDD, the semi-structured clinical interview (Structured Clinical Interview for DSM-IV for axis I disorders: SCID-CV) was used. To diagnose suicidal ideation, Y/N questions about suicidal ideation were used in the following interview of SCID. Suicidal ideation was a kind of diagnosis on Y/N questions. No discrepancy was observed between suicide question of MDD and Y/N suicidal questions.

9. Methods, Assessment of lifestyle factors: how were sleep disturbances evaluated?

Response: Three types of insomnia symptoms from the previous month were assessed using the following questions: "Do you have difficulty falling asleep at night?" (difficulty in initiating sleep), "Do you wake up during the night after you have gone to sleep?" (difficulty in maintaining sleep), and "Do you wake up too early in the morning and have difficulty getting back to sleep?" (early morning awakening). These questions were adopted from our previous studies (Nomura K, Yamaoka K, Nakao M, Yano E. 2005. Sleep. Nomura K, Nakao M, Takeuchi T, Yano E. 2009. Sleep Med), and the answers were confirmed by 2 male physicians specializing in psychiatry according to the DSM-IV-TR definition of insomnia. However these results had not included the results. We deleted these parts totally in the method section. Thanks again.

10. Methods, Statistical analyses: the authors state that "logistic regression analyses were used to evaluate the association between suicidal ideation and MDD": is this correct? Or did they study the associations with each MDD symptom?

Response: Thank you for finding our mistake. That was a typo. We changed the phrase to "suicidal ideation and **each MDD symptom**"(page 7, line 11).

11. Results: the results reported in the first paragraph are not completely clear: the authors say that "those with suicidal ideation were more likely to be women", but in fact 21.6% only are women. I assume the authors refer to the comparison with individuals without suicidal ideation (women 21.6% vs. 12.9%), but as it is reported now, is somehow confusing.

Response: Yes. That was confusing. We deleted the sex difference sentences in both results and discussion.

12. Results and Table 1: the authors report that, compared with non ideators, those with suicidal ideation were more likely to be in the age group 40-49 years. Also those in the age group 20-29 were more likely to report suicidal ideation.

Response: That might be true. However 95%CI of age 20 to 29 included 1.0, it means it was not statistically significant. Therefore, we did not include that age group.

13. Table 1: in the methods the authors mention the assessment of sleep disturbances and anxiety, but then they do not report any results about sleep disturbances and anxiety. These results should be reported at least in the table (otherwise, please remove the description from the methods section).

Response: Thanks for your check. We totally deleted assessment of sleep disturbance and anxiety in the method.

14. Table 2 would be clearer if the significant items and ORs were somehow highlighted; I would also like to see the p-values in the Table.

Response: We highlighted (**bolded**) significant items and ORs with p-values in table2.

We checked and confirmed that the following items are included in our manuscript.

Takeaki Takeuchi Takeaki Takeuchi Oct 9

Mutsuhiro Nakao Mutsuhiro Nakao Oct 9

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed

	Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy
	(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

The Relationship between Suicidal Ideation and Symptoms of Depression in Japanese Workers: A Cross sectional Study

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Abstract

Objectives: The prevalence of **suicidal ideation** and **predictors** for suicidal ideation among Japanese workers is unknown, **although a previous study reported a 30 % prevalence rate of suicide in a psychosomatic clinical setting.** Hence, we evaluated the prevalence of suicidal ideation and its relationship with depressive symptoms among Japanese workers.

Methods: For this purpose, a cross-sectional design was used. Major depressive disorder (MDD) and suicidal ideation in 1,266 workers (1100 men and 166 women, aged 20–69 years) were assessed through clinical interviews conducted in accordance with the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders.

Results: A total of 34 and 70 participants were diagnosed with suicidal ideation and MDD, respectively. Suicidal ideation was especially prevalent in 40–49-year-olds. Six out of the eight symptoms of MDD (depressive mood, loss of interest, weight loss, psychomotor agitation, worthlessness, and concentration loss) were related to suicidal ideation. Depressive mood had the strongest relationship with suicidal ideation, followed by worthlessness and concentration loss. Worthlessness had the highest area under the curve in predicting suicidal ideation, followed by concentration loss and depressive mood.

Conclusions: We conclude that MDD symptoms—particularly depressive mood, worthlessness, and concentration loss—are potential predictors of suicidal ideation in Japanese workers.

Article focus

- To determine the prevalence of suicidal ideation in Japanese workers because of the lack of data in the working population.
- To examine the symptoms of major depressive disorder (MDD) that relate to suicidal ideation hypothesizing that these serve as possible predictors of suicide.

Key messages

- The prevalence of suicidal ideation was 2.7% in Japanese workers.
- Six symptoms of MDD, particularly depressive mood, worthlessness and concentration loss were related to suicidal ideation.
- These seem to be potential predictors that can be used in identifying suicidal ideation among Japanese workers, treating these symptoms as clear warning signs for dealing with suicidal risk

Strengths and limitations of this study

- This is the first evaluation of suicidal ideation among workers in Japan, which has one of the highest rates of suicide worldwide.
- Assessment of MDD including suicidal ideation were made by clinical interviews based on the Diagnostic Statistical Manual of Mental Disorders Fourth Edition, Text Revision.
- Results do not directly imply that symptoms of MDD and suicidal ideation are part of a clinical continuum because of its cross-sectional nature.
- Results do not directly represent the general population of Japanese workers because of the small sample size.

Although Japan has the highest global ranking for longevity, it also has one of the highest suicide rates, being ranked 9th for men and 3rd for women in the world[1]. From 1995 to 1998, the incidence of reported suicide rose dramatically from 17 to 25 per 100,000 people, and that high rate continued even in 2010[2,3]. Since 2005, the Japanese Cabinet Office and the Ministry of Health, Labour and Welfare have been attempting to reduce the suicide rate; **however the suicide rate in Japan has not decreased.**

To reduce the number of suicides, **collaborative care, that is, structured care involving a greater role of nonmedical specialists for treating depression** have shown potential in both improving depression outcomes and decreasing suicide risk[4]. However, with the exception of psychiatrists or psychological specialists, most doctors find it difficult to diagnose depression because of the complexities involved in administering clinical interviews. In addition, doctors must pay attention to those who do not perfectly match the diagnostic criteria[5]. If depression is not diagnosed appropriately, it might be difficult to find the pathway that leads to suicide.

In addition to investigating the potential for depression, it would be much simpler and more useful to determine the presence of suicidal ideation in individuals to assess their suicide risk. Suicidal ideation, which refers to wishing that one's life would end or thoughts of harming or killing oneself, represents an important phase in the suicidal process and often precedes suicidal attempts or death by suicide. In clinical settings, it is relatively straightforward to ask patients whether they have suicidal ideation, because this is one of the most important routine questions in mental health[6]. Our previous study reported the prevalence of suicidal ideation **(30%) in a psychosomatic clinical setting**[7]. Naturally, attempted suicide is one of the strongest risk factors for death by suicide[8-11], and 60% of planned first attempts occur within the first year of ideation onset[9]. Therefore, identifying those people with suicidal ideation would be logically

the first step in reducing the incidence of suicide.

One problem is that, in screening process such as workplaces, it might be difficult to identify people with suicidal ideation because asking workers whether they had suicidal ideation could lead to conflicts in their relationships. In addition, people from Asian countries are sometimes reluctant to speak about their mental condition, including suicidal ideation, even to their physicians, because it is considered taboo[2]. The Japanese in particular are less willing to express emotional distress or feelings such as suicidal ideation compared with Westerners[12,13]. Therefore, **we try to identify both suicidal ideation and the symptoms closely related to suicidal ideation in determining an individual's risk of suicide.**

In Japan, more than 30,000 people**, 25 per 100,000 people,** have committed suicide each year for the past 10 years, and 27% of them were working people[3]. Thus, we thought that it was highly important to identify the prevalence of suicidal ideation and the symptoms that are closely related to suicidal ideation in the working population in Japan.

The aims of this study were twofold. First, we attempted to determine the prevalence of suicidal ideation in Japanese workers because of the lack of data at present on the prevalence of suicidal ideation in working population. Second, we examined the symptoms of major depressive disorder (MDD), hypothesizing that some of these symptoms would be strongly related to suicidal ideation, and thus serve as possible predictors.

Methods

Participants and ethical considerations

A cross-sectional design was used. Data were obtained from 1,314 full-time office workers attending health examinations in an enterprise in Tokyo, Japan. Due to missing health

examination data, we excluded 48 participants, and thus, we analyzed the data from 1,266 Japanese workers (96% of the total number of employees, 1100 men and 166 women aged 20–69 years). All participants provided written informed consent after receiving a complete explanation regarding the purpose, nature, and risks of the procedures used. This study was performed in accordance with the World Medical Association's Declaration of Helsinki, and its protocol was approved by the Ethics Committee of the Teikyo University School of Medicine and the company's labor safety committee.

Assessment of major depressive disorder including suicidal ideation

To ascertain whether each participant met the Diagnostic Statistical Manual of Mental Disorders Fourth Edition, Text Revision (DSM-IV) [14]criteria for MDD, clinical interviews for DSM-IV axis I disorders were conducted by two study physicians specializing in both psychiatry and psychosomatic medicine, assisted by a researcher trained in psychology. Suicidal ideation was also evaluated during the interviews. To confirm the diagnosis of suicidal ideation, interviewees underwent additional independent interviews that specifically focused on suicidal ideation.

Assessment of lifestyle factors

A structured questionnaire administered by the physician was used to assess lifestyle factors, including smoking status, alcohol consumption, and exercise[15]. Based on their smoking history, the subjects were classified into three categories: current smokers, past smokers, and non-smokers (no history of smoking). Alcohol consumption was classified into three categories based on the weekly frequency of consumption: 6–7 times/week, 1–5 times/week, and occasional drinking. Exercise was classified into two categories: regular or irregular. These questions were asked as additional questions during the DSM-IV interview.

Sample size

Based on our previous study[7,8], we expected to find a difference of 30% in the rate of each symptom between both groups with and without suicidal ideation. To achieve a power of 0.90 given a two-sided α of 0.05, and a ratio of our exposed sample to our control sample of 1:25, we needed at least 32 participants in the group with suicidal ideation and 800 participants without suicidal ideation. Finally, through the actual data collection we collected 34 participants with suicidal ideation and 1232 participants without suicidal ideation.

Statistical analysis

After the characteristics of the study population were descriptively evaluated according to the presence of suicidal ideation, multiple logistic regression analyses were used to evaluate the association between suicidal ideation and **each MDD symptom**, by calculating crude and adjusted odds ratios (ORs). The ratios were adjusted for potential confounding factors to depression and suicide, such as sex, age, and three lifestyle factors (smoking status, alcohol consumption, and exercise). Finally, receiver operating curve (ROC) analyses were performed to examine the predictive potentials of MDD symptoms for suicidal ideation. Statistical significance was inferred at $p < 0.05$ (two-tailed) for both the crude and adjusted ORs of the logistic analyses and the test equality of the area under the curve (AUC). All analyses were performed using STATA version 11.

Results

A total of 34 (2.7%, 95% confidence interval [1.8, 3.8]) and 70 (5.5%, 95% CI [4.3, 6.8])

people were diagnosed with having suicidal ideation and MDD, respectively. Those with suicidal ideation were more likely to be aged between 40 and 49 years, drinkers, and not exercising regularly (Table 1). Only the age factor (i.e., being in one's 40s) significantly differed between participants with and without suicidal ideation. Six out of the eight symptoms of MDD (depressive mood, loss of interest, weight loss, psychomotor agitation, worthlessness, and concentration loss) were related to suicidal ideation in both the crude and adjusted analyses (Table 2).

Depressive mood had the strongest relationship to suicidal ideation (OR 11.2, 95% CI [5.4, 23.0]), followed by worthlessness (OR 8.5, 95% CI [4.1, 17.4]) and then concentration loss (OR 6.1, 95% CI [4.1, 17.4]).

Worthlessness had the highest AUC (0.73, 95% CI [0.71, 0.76]) in predicting suicidal ideation, followed by concentration loss (0.71, 95% CI [0.62, 0.79]) and then depressive mood (0.69, 95% CI [0.66, 0.71]).

Discussion

Our study revealed that the prevalence of suicidal ideation was 2.7% in Japanese workers. In addition, we found that six symptoms of depression, particularly depressive mood, worthlessness, and concentration loss, were related to suicidal ideation. These are potential predictors that can be used in identifying suicidal ideation among Japanese workers. As we expected, suicidal ideation was less prevalent in Japanese workers than in Western populations[16]. We may have to consider that this low prevalence of suicidal ideation is not reflective of a low prevalence in the general population, because some Japanese people are reluctant to speak about their mental condition. While we will need to reconsider this prevalence rate in the near future, this rate is useful as one of the first evaluations of suicidal ideation among workers in Japan,

which has one of the highest rates of completed suicide worldwide.

Although there is no way to predict who will eventually die by suicide, treating the clear warning signs for suicide can reduce patients' suffering. This study revealed a significantly positive association between some symptoms of depression and suicidal ideation. In countries like Japan, where people are reluctant to express their feelings, these symptoms might be useful in estimating an individual's risk of suicidal ideation and eventual suicide[4,16].

Some of the above symptoms (depressive mood, worthlessness, and concentration loss) are similar to symptoms found to be predictors of suicidal ideation in previous studies[16,17]. Only concentration loss was a new predictor, which might be due to the characteristics of our study sample. For workers, concentration loss would be a particularly salient symptom due to its interruption of their daily work.

Our results also showed that while participants who were between 40 and 49 years old, drinkers, and not exercising regularly had a higher tendency for suicidal ideation, only being in one's 40s was statistically significant in this study. This finding would be reasonable because the greatest increase in the number of deaths by suicide in the last decade in Japan occurred among 40–49-year-old workers[3]. Although not statistically significant, heavy drinking has been shown to be associated with a higher risk of alcohol abuse, and not exercising regularly is associated with a greater risk of poor mental health[1]. We believe that **completed suicides have a background of suicidal ideation.** Thus, our recommended strategy to reduce suicide based on this research is to identify its potential risk by asking indirect questions related to suicidal ideation, including questions related to depressive mood, worthlessness, and concentration loss, because these symptoms appear to be related to the presence of suicidal ideation, which in turn increases the likelihood of completed suicide.

Several limitations of this study warrant consideration. First, because of its cross-sectional nature, our results do not directly imply that symptoms of MDD and suicidal ideation are part of a clinical continuum, but rather that a simple statistical association exists after adjusting for important confounding factors. **To confirm the results, a more robust study such as prospective cohort study would be needed.** Second, because of the small sample size, the results do not directly represent the general population of Japanese workers. **The study is only applicable to a working population in an urban area in Japan.** However, this is one of the first studies to report the prevalence of suicidal ideation in Japanese workers. Thus, this report could be of paramount importance in Japan, where many people are reluctant to discuss their mental condition.

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Author Contribution

Takeaki Takeuchi and Mutsuhiro Nakao collected and analyzed the data; Takeaki Takeuchi wrote the manuscript; Mutsuhiro Nakao reviewed and edited the manuscript and helped in its analysis. All authors contributed to the discussion. No author has any conflicts of interest to declare.

Data sharing statements

There is no additional data available.

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Table 1

Prevalence of suicide ideation and sociodemographic characteristics of individuals with and without suicide ideation (N = 1266)

Variable	Suicidal ideation + (*n* = 34)		Suicidal ideation - (*n* = 1232)			
	%	95% CI	%	95% CI	OR	95% CI
Sex						
Male	79.4	[62.1, 91.3]	87.1	[85.1, 88.9]	0.6	[0.2, 1.3]
Female	21.6	[8.7, 37.9]	12.9	[11.1, 14.9]	1.0	[1.0, 1.0]
Age						
20–29	14.7	[2.6, 26.8]	9.3	[7.6, 10.9]	1.6	[1.0, 2.5]
30–39	26.5	[11.4, 41.5]	29.9	[27.3, 32.4]	1.5	[0.8, 2.8]
40–49	47.1	[30.0, 64.1]	29.9	[27.3, 32.4]	4.2	[1.4, 12.5]
50+	11.7	[0.4, 23.2]	30.9	[28.4, 33.6]	1.0	[1.0, 1.0]
Smoking status						
Current	38.2	[21.6, 54.8]	36.4	[33.6, 39.1]	1.0	[0.7, 1.5]
Past	26.5	[11.4, 41.5]	31.0	[28.4, 33.6]	0.8	[0.3, 1.9]
Never	35.3	[19.0, 51.6]	32.6	[30.0, 35.3]	1.0	[1.0, 1.0]
Alcohol consumption						
Every day (6–7 times/week)	29.4	[13.9, 45.0]	18.8	[16.6, 20.9]	0.7	[0.4, 1.1]
Often (1–5 times/week)	47.1	[30.0, 64.1]	46.5	[43.7, 49.3]	0.6	[0.3, 1.4]
No regular drinking	23.5	[9.0, 38.0]	34.7	[32.1, 37.4]	1.0	[1.0, 1.0]
Exercise						
Irregular	70.6	[52.5, 84.9]	62.1	[59.3, 64.8]	1.5	[0.7, 3.1]
Regular	29.4	[15.1, 47.5]	37.9	[35.2, 40.7]	1.0	[1.0, 1.0]

Table 2. Association of MDD symptoms with suicidal ideation (N = 1266)

MDD symptoms	n (%)	Suicidal ideation (n = 34)								
		Model 1* (Non-adjusted)		Model 2† (Adjusted)		Model 3‡ (Adjusted)		Sensitivity %	Specificity %	AUC (95% CI)
		OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value			
Depressive mood	92 (7.3)	**11.8 [5.8, 24.2]**	**<0.01**	**11.5 [5.6, 23.6]**	**<0.01**	**11.2 [5.4, 23.0]**	**<0.01**	44.1	93.8	0.69 [0.66, 0.71]
Loss of interest	117 (9.2)	**3.2 [1.4, 7.2]**	**<0.01**	**3.5 [1.5, 7.9]**	**<0.01**	**3.5 [1.5, 8.0]**	**<0.01**	23.5	91.2	0.57 [0.55, 0.60]
Weight loss	48 (3.8)	**4.8 [1.8, 12.9]**	**<0.01**	**4.9 [1.8, 13.5]**	**<0.01**	**5.0 [1.8, 13.8]**	**<0.01**	14.7	96.5	0.56 [0.53, 0.58]
Insomnia	455 (35.9)	**2.0 [1.0, 4.1]**	**0.04**	1.9 [1.0, 3.8]	0.07	1.8 [0.9, 3.7]	0.09	52.9	64.5	0.59 [0.56, 0.61]
Psychomotor agitation	741 (58.5)	**2.4 [1.1, 5.2]**	**0.04**	2.2 [1.0, 5.0]	0.05	2.2 [1.0, 4.9]	0.06	76.5	42.0	0.59 [0.56, 0.62]
Fatigue	920 (72.7)	2.9 [1.0, 8.2]	0.05	2.6 [0.9, 7.6]	0.07	2.6 [0.9, 7.5]	0.08	61.8	84.7	0.58 [0.55, 0.61]
Worthlessness	210 (16.6)	**8.9 [4.4, 18.1]**	**<0.01**	**8.6 [4.2, 17.5]**	**<0.01**	**8.5 [4.1, 17.4]**	**<0.01**	61.8	84.7	0.73 [0.71, 0.76]
Concentration loss	274 (21.6)	**6.3 [3.1, 12.7]**	**<0.01**	**6.3 [3.1, 12.8]**	**<0.01**	**6.1 [3.0, 12.5]**	**<0.01**	61.8	79.5	0.71 [0.62, 0.79]

*Model 1 was the crude analysis. †Model 2 was adjusted for sex and age (used as categorical variables). ‡Model 3 was adjusted for sex, age (used as categorical variables), and lifestyle factors (smoking status, alcohol consumption, and exercise).

The Relationship between Suicidal Ideation and Symptoms of Depression in Japanese Workers: A Cross sectional Study

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Author Contribution

Takeaki Takeuchi and Mutsuhiro Nakao collected and analyzed the data; Takeaki Takeuchi wrote the manuscript; Mutsuhiro Nakao reviewed and edited the manuscript and helped in its analysis. All authors contributed to the discussion. No author has any conflicts of interest to declare.

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Based on our previous study[7,8], we expected to find a difference of 30% in the rate of each symptom between both groups with and without suicidal ideation. To achieve a power of 0.90 given a two-sided α of 0.05, and a ratio of our exposed sample to our control sample of 1:25, we needed at least 32 participants in the group with suicidal ideation and 800 participants without suicidal ideation. Finally, through the actual data collection we collected 34 participants with suicidal ideation and 1232 participants without suicidal ideation.

Statistical analysis

After the characteristics of the study population were descriptively evaluated according to the presence of suicidal ideation, multiple logistic regression analyses were used to evaluate the association between suicidal ideation and each MDD symptom, by calculating crude and adjusted odds ratios (ORs). The ratios were adjusted for potential confounding factors to depression and suicide, such as sex, age, and three lifestyle factors (smoking status, alcohol consumption, and exercise). Finally, receiver operating curve (ROC) analyses were performed to examine the predictive potentials of MDD symptoms for suicidal ideation. Statistical significance was inferred at $p < 0.05$ (two-tailed) for both the crude and adjusted ORs of the logistic analyses and the test equality of the area under the curve (AUC). All analyses were performed using STATA version 11.

Results

A total of 34 (2.7%, 95% confidence interval [1.8, 3.8]) and 70 (5.5%, 95% CI [4.3, 6.8])

people were diagnosed with having suicidal ideation and MDD, respectively. Those with suicidal ideation were more likely to be aged between 40 and 49 years, drinkers, and not exercising regularly (Table 1). Only the age factor (i.e., being in one's 40s) significantly differed between participants with and without suicidal ideation. Six out of the eight symptoms of MDD (depressive mood, loss of interest, weight loss, psychomotor agitation, worthlessness, and concentration loss) were related to suicidal ideation in both the crude and adjusted analyses (Table 2).

Depressive mood had the strongest relationship to suicidal ideation (OR 11.2, 95% CI [5.4, 23.0]), followed by worthlessness (OR 8.5, 95% CI [4.1, 17.4]) and then concentration loss (OR 6.1, 95% CI [4.1, 17.4]).

Worthlessness had the highest AUC (0.73, 95% CI [0.71, 0.76]) in predicting suicidal ideation, followed by concentration loss (0.71, 95% CI [0.62, 0.79]) and then depressive mood (0.69, 95% CI [0.66, 0.71]).

Discussion

Our study revealed that the prevalence of suicidal ideation was 2.7% in Japanese workers. In addition, we found that six symptoms of depression, particularly depressive mood, worthlessness, and concentration loss, were related to suicidal ideation. These are potential predictors that can be used in identifying suicidal ideation among Japanese workers. As we expected, suicidal ideation was less prevalent in Japanese workers than in Western populations[16]. We may have to consider that this low prevalence of suicidal ideation is not reflective of a low prevalence in the general population, because some Japanese people are reluctant to speak about their mental condition. While we will need to reconsider this prevalence rate in the near future, this rate is useful as one of the first evaluations of suicidal ideation among workers in Japan,

which has one of the highest rates of completed suicide worldwide.

Although there is no way to predict who will eventually die by suicide, treating the clear warning signs for suicide can reduce patients' suffering. This study revealed a significantly positive association between some symptoms of depression and suicidal ideation. In countries like Japan, where people are reluctant to express their feelings, these symptoms might be useful in estimating an individual's risk of suicidal ideation and eventual suicide[4,16].

Some of the above symptoms (depressive mood and worthlessness) are similar to symptoms found to be predictors of suicidal ideation in previous studies[16,17]. Because the findings of previous studies applied to clinical patients, our study generalized those symptoms as a predictor of suicidal ideation to the working population. Only concentration loss was a new predictor, which might be due to the characteristics of our study sample. For workers, concentration loss would be a particularly salient symptom due to its interruption of their daily work.

Our results also showed that while participants who were between 40 and 49 years old, drinkers, and not exercising regularly had a higher tendency for suicidal ideation, only being in one's 40s was statistically significant in this study. This finding would be reasonable because the greatest increase in the number of deaths by suicide in the last decade in Japan occurred among 40–49-year-old workers[3]. Although not statistically significant, heavy drinking has been shown to be associated with a higher risk of alcohol abuse, and not exercising regularly is associated with a greater risk of poor mental health[1]. We believe that completed suicides have a background of suicidal ideation. Thus, our recommended strategy to reduce suicide based on this research is to identify its potential risk by asking indirect questions related to suicidal ideation, including questions related to depressive mood, worthlessness, and concentration loss, because these

symptoms appear to be related to the presence of suicidal ideation, which in turn increases the likelihood of completed suicide.

Several limitations of this study warrant consideration. First, because of its cross-sectional nature, our results do not directly imply that symptoms of MDD and suicidal ideation are part of a clinical continuum, but rather that a simple statistical association exists after adjusting for important confounding factors. To confirm the results, a more robust study such as prospective cohort study would be needed. Second, because of the small sample size, the results do not directly represent the general population of Japanese workers. The study is only applicable to a working population in an urban area in Japan. However, this is one of the first studies to report the prevalence of suicidal ideation in Japanese workers. Thus, this report could be of paramount importance in Japan, where many people are reluctant to discuss their mental condition.

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Data sharing statements

No additional data available.

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Contributorship

Takeaki Takeuchi and Mutsuhiro Nakao collected and analyzed the data; Takeaki Takeuchi wrote the manuscript; Mutsuhiro Nakao reviewed and edited the manuscript and helped in its analysis. All authors contributed to the discussion.

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Table 1

Prevalence of suicide ideation and sociodemographic characteristics of individuals with and without suicide ideation (N = 1266)

Variable	Suicidal ideation + (*n* = 34)		Suicidal ideation - (*n* = 1232)			
	%	95% CI	%	95% CI	OR	95% CI
Sex						
Male	79.4	[62.1, 91.3]	87.1	[85.1, 88.9]	0.6	[0.2, 1.3]
Female	21.6	[8.7, 37.9]	12.9	[11.1, 14.9]	1.0	[1.0, 1.0]
Age						
20–29	14.7	[2.6, 26.8]	9.3	[7.6, 10.9]	1.6	[1.0, 2.5]
30–39	26.5	[11.4, 41.5]	29.9	[27.3, 32.4]	1.5	[0.8, 2.8]
40–49	47.1	[30.0, 64.1]	29.9	[27.3, 32.4]	4.2	[1.4, 12.5]
50+	11.7	[0.4, 23.2]	30.9	[28.4, 33.6]	1.0	[1.0, 1.0]
Smoking status						
Current	38.2	[21.6, 54.8]	36.4	[33.6, 39.1]	1.0	[0.7, 1.5]
Past	26.5	[11.4, 41.5]	31.0	[28.4, 33.6]	0.8	[0.3, 1.9]
Never	35.3	[19.0, 51.6]	32.6	[30.0, 35.3]	1.0	[1.0, 1.0]
Alcohol consumption						
Every day (6–7 times/week)	29.4	[13.9, 45.0]	18.8	[16.6, 20.9]	0.7	[0.4, 1.1]
Often (1–5 times/week)	47.1	[30.0, 64.1]	46.5	[43.7, 49.3]	0.6	[0.3, 1.4]
No regular drinking	23.5	[9.0, 38.0]	34.7	[32.1, 37.4]	1.0	[1.0, 1.0]
Exercise						
Irregular	70.6	[52.5, 84.9]	62.1	[59.3, 64.8]	1.5	[0.7, 3.1]
Regular	29.4	[15.1, 47.5]	37.9	[35.2, 40.7]	1.0	[1.0, 1.0]

Table 2. Association of MDD symptoms with suicidal ideation (N = 1266)

MDD symptoms	n (%)	Suicidal ideation (n = 34)								
		Model 1* (Non-adjusted)		Model 2† (Adjusted)		Model 3‡ (Adjusted)		Sensitivity %	Specificity %	AUC (95% CI)
		OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value			
Depressive mood	92 (7.3)	**11.8 [5.8, 24.2]**	**<0.01**	**11.5 [5.6, 23.6]**	**<0.01**	**11.2 [5.4, 23.0]**	**<0.01**	44.1	93.8	0.69 [0.66, 0.71]
Loss of interest	117 (9.2)	**3.2 [1.4, 7.2]**	**<0.01**	**3.5 [1.5, 7.9]**	**<0.01**	**3.5 [1.5, 8.0]**	**<0.01**	23.5	91.2	0.57 [0.55, 0.60]
Weight loss	48 (3.8)	**4.8 [1.8, 12.9]**	**<0.01**	**4.9 [1.8, 13.5]**	**<0.01**	**5.0 [1.8, 13.8]**	**<0.01**	14.7	96.5	0.56 [0.53, 0.58]
Insomnia	455 (35.9)	**2.0 [1.0, 4.1]**	**0.04**	1.9 [0.9, 3.8]	0.07	1.8 [0.9, 3.7]	0.09	52.9	64.5	0.59 [0.56, 0.61]
Psychomotor agitation	741 (58.5)	**2.4 [1.1, 5.2]**	**0.04**	2.2 [0.9, 5.0]	0.06	2.2 [0.9, 4.9]	0.06	76.5	42.0	0.59 [0.56, 0.62]
Fatigue	920 (72.7)	2.9 [0.9, 8.2]	0.06	2.6 [0.9, 7.6]	0.07	2.6 [0.9, 7.5]	0.08	61.8	84.7	0.58 [0.55, 0.61]
Worthlessness	210 (16.6)	**8.9 [4.4, 18.1]**	**<0.01**	**8.6 [4.2, 17.5]**	**<0.01**	**8.5 [4.1, 17.4]**	**<0.01**	61.8	84.7	0.73 [0.71, 0.76]
Concentration loss	274 (21.6)	**6.3 [3.1, 12.7]**	**<0.01**	**6.3 [3.1, 12.8]**	**<0.01**	**6.1 [3.0, 12.5]**	**<0.01**	61.8	79.5	0.71 [0.62, 0.79]

*Model 1 was the crude analysis. †Model 2 was adjusted for sex and age (used as categorical variables). ‡Model 3 was adjusted for sex, age (used as categorical variables), and lifestyle factors (smoking status, alcohol consumption, and exercise).