



Web Based Screening for Depression in the Workplace

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Authors' contributions

This work was carried out in collaboration between all authors. Author HI designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors KA, KM and ES designed the study questions and revised the article for important intellectual content. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The aim of this study was to examine an effective screening method of depressive disorders in the workplace.

Methodology: Employees with a managerial career track of a large size company completed a web-based psychological assessment using the Patient Health Questionnaire depression scale (PHQ-9) and the Generalized Anxiety Disorder Scale (GAD-7) at the first screening. After three months, employees who had a PHQ-9 score of 10 or greater were further re-assessed using the PHQ-9 and GAD-7 at the second screening. They were then interviewed using the Mini International Neuropsychiatric Interview (MINI) to determine a clinical diagnosis of depressive disorders. Moreover, analysis of the validity of the PHQ-9 categorical algorithm and the cut-off score of PHQ-9 ≥ 10 were conducted.

Results: Of the 402 participants, 350 employees completed the depression and anxiety scales. Though 20 subjects had a score of 10 points or more on the PHQ-9 score at the first screening,

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and nine of them maintained a score of 10 points or more at the second screening. While nine subjects were diagnosed with a major depressive syndrome by the PHQ-9 categorical algorithm at the first screening, only three of them remained with a major depressive syndrome at the second screening.

Conclusion: Considering the spontaneous remission rate of depression, it seems reasonable to conduct double web-based screening for major depressive disorders in the workplace.

Keywords: Depression; PHQ-9; screening; workplace.

1. INTRODUCTION

Major depressive disorder (MDD) is one of the most prevalent and treatable mental disorders and is regularly treated by various health care providers, including mental health specialists, medical subspecialists, and primary care clinicians [1].

MDD was estimated to affect 18.1 million people living in the USA in 2000 and have a lifetime prevalence of 16.2% and an annual prevalence of 6.6%. In Japan, MDD was estimated to have an annual prevalence of 2.2% and 7.0% of white collar workers were reported to meet the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria for major depressive episode [2-5].

In the USA, the total economic burden of this illness was \$83.1 billion in 2000. Of this total, \$26.1 billion (31%) were direct treatment costs, \$5.4 billion (7%) were suicide-related costs, and \$51.5 billion (62%) were workplace costs [2].

Presenteeism is the loss of workplace productivity resulting from employee health problems and/or personal issues. Even though the employee is physically present at work, they experience problems (e.g., arthritis, allergies, family illness, stress), which prevent them from fully performing their work duties, making them more likely to make mistakes at work. Because presenteeism is a workplace issue, efficiency of work is not maintained and might be related to absenteeism [6].

According to the "2011 estimates of the social cost of mental illness", presenteeism and absenteeism are the largest indirect costs associated with depressive disorders, mortality costs followed. To reduce the cost of such disorders, it is necessary to increase the participation rate of patients, and to develop a system that can provide effective interventions [7].

Early treatment of the first depressive episode is important because previous studies have indicated that a shorter duration of untreated illness (DUI) is related to better remission outcomes in patients with the first MDD [8]. Therefore, early identification of depressed workers is crucial in order to improve treatment outcomes and reduce cost [3,9].

Most studies reported depression screening in the medical setting [10-12]. However, there were few screening studies of depression in the workplace [13].

The aim of this pilot study was to develop an effective web-based screening method for depressive disorders in the workplace.

2. MATERIALS AND METHODS

2.1 Procedures

Employees on the managerial career track of a large size company were encouraged to complete a web-based psychological assessment as periodic health examination using the Patient Health Questionnaire depression scale (PHQ-9) and the Generalized Anxiety Disorder 7-item anxiety scale (GAD-7) at the first screening. The subjects who completed the scales on the Internet had the opportunity to provide the computerized feedback about their results. The employees were told that participation was voluntary and refusing would not result in any disadvantage.

After three months, employees who had PHQ-9 scores of 10 or more at the first screening were further re-assessed using the PHQ-9, the GAD-7 and the Beck Depression Inventory (BDI-II) at the second screening. Next, they were interviewed for clinical diagnoses of depressive disorders using the Mini International Neuropsychiatric Interview (MINI) and the Hamilton Rating Score for Depression (HAM-D). These tools are commonly used for the diagnosis of depression and for assessing the severity of symptoms. A

psychiatrist and a public health nurse conducted all interviews after written informed consent (Fig. 1). All procedures were approved by the Ethics Committee of Chiba University Graduate School of Medicine.

2.2 Measurements

2.2.1 Patient health questionnaire (PHQ-9)

We used the Japanese version of the Patient Health Questionnaire (PHQ) to assess depressive disorders. The Japanese PHQ was

developed and its validity was assessed using the Mini-International Neuropsychiatric Interview-Plus [14]. The PHQ-9 is the 9 item depression module from the full PHQ. The PHQ-9 is a 9-item self-reported questionnaire designed to evaluate the presence of depressive symptoms during the prior 2 weeks [1]. As a severity measure, scores can range from 0 (absence of depressive symptoms) to 27 (severe depressive symptoms). Each of the 9 items, asking for each of the Diagnostic and Statistical Manual Fourth Edition (DSM-IV) diagnostic criteria, can be scored from 0 (not at all) to 3 (nearly every day).

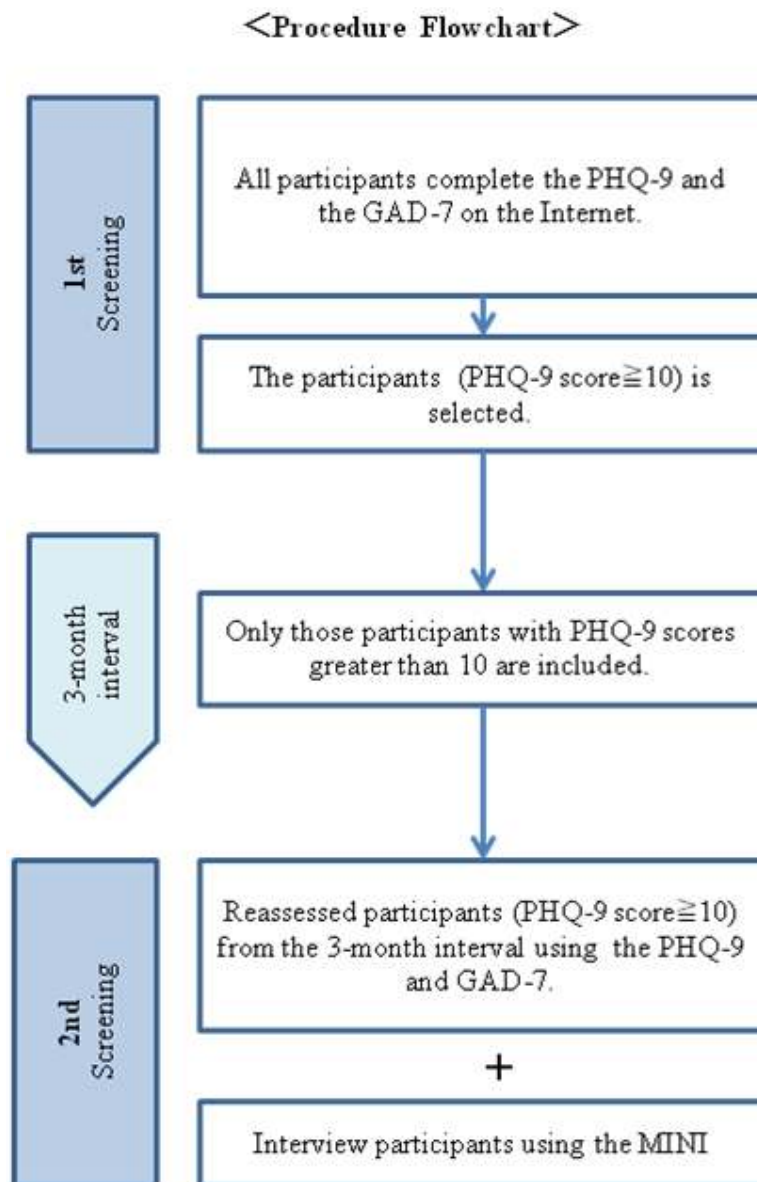


Fig. 1. Procedure flowchart

An item was also added to the end of the diagnostic portion of the PHQ-9 asking patients who checked off any problems on the questionnaire: "How difficult have these problems made it for you to do your work, take care of things at home, or get along with other people? ".

According to PHQ-9 categorical algorithm [1], major depressive syndrome is diagnosed if 5 or more of the 9 depressive symptom criteria have been present at least "more than half the days" in the past 2 weeks, and 1 of the symptoms is depressed mood or anhedonia. Other depressive syndrome is diagnosed if 2, 3, or 4 depressive symptoms have been present at least "more than half the days" in the past 2 weeks, and 1 of the symptoms is depressed mood or anhedonia. Suicidal ideation is counted whenever it is present (at least "several days" in the past 2 weeks). As with the original PRIME-MD, before making a final diagnosis, the clinician is expected to rule out physical cause of depression, normal bereavement, and history of a manic episode.

2.2.2 Generalized anxiety disorder 7-item anxiety scale (GAD-7)

We used the Japanese version of the 7-item generalized anxiety disorder scale (GAD-7) to assess anxiety considering for comorbidity. Similar to the PHQ, the Japanese version GAD-7 has been developed by reverse translation [15]. GAD-7 questionnaire is a one-dimensional self-administered scale designed to assess the presence of the symptoms of Generalized Anxiety Disorder (GAD), as listed in the DSM-IV. The total GAD-7 score is calculated by simple addition of the answers to each item. Scores for all 7 items range from 0 (Not at all) and 3 (Nearly every day). Therefore, the total score ranges from 0 and 21 [16].

2.2.3 Mini-international neuropsychiatric interview (MINI)

We used the Japanese version of the Mini International Neuropsychiatric Interview (MINI) to verify the diagnosis of depression [17]. The MINI was designed as a brief structured interview for the major Axis-I psychiatric disorders in DSM-IV. Validation and reliability studies have been done for MINI [18].

2.2.4 Beck depression inventory II (BDI-II)

We used the Japanese version of the Beck Depression Inventory II (BDI-II) to assess depressive symptoms. Japanese version of the BDI-II is psychometrically robust and can be

used to assess depressive symptoms in Japanese population [19]. The Beck Depression Inventory Second Edition (BDI-II) is a self-report measure of depression. Twenty-one symptoms of depression are rated on a 4-point scale, within the time frame of the past 2 weeks [20,21].

2.2.5 Hamilton rating scale for depression (HAM-D)

We used the Japanese version of the Hamilton Rating Scale for Depression (HAM-D) to assess depressive disorders more accurately [22]. The HAMD is conducted as a semi-structured clinician-rated interview. The Hamilton Rating Scale for Depression (HAM-D; Hamilton, 1960) is a clinician-rated measure that has been used extensively in clinical research and in ordinary clinical practice for assessment of the severity of depression, changes in its severity over time, and efficacy of treatment [23-25].

2.3 Data Analysis

Subjects were classified by PHQ-9 cutoff score and PHQ-9 categorical algorithm at the first screening and at the second screening, respectively.

Criterion validity was evaluated by determining the sensitivity and specificity of PHQ-9 ≥ 10 cut-off score and of the PHQ-9 categorical algorithm. The data obtained in the study were analyzed by the Statistical Environment R. We compared the participants with those who were diagnosed twice with major depressive syndrome and those who were diagnosed with major depressive syndrome only on the first time on the BDI-II, HAM-D, and GAD-7 using a Mann-Whitney U test.

3. RESULTS

At the first screening, the response rate of web based depression and anxiety scales was 87% (N = 350 / 402). The mean age of respondents was 38.4 years (SD=9.5). There were 11 females (3.1%) and 339 males (96.9%).

The median PHQ-9 score of the 350 participants was 3 (range 0 -27). The median lower quartile was 1, and the upper quartile was 6. There were 20 participants (5.7%) with a PHQ-9 score of 10 more.

At the first screening by the Internet, 9 participants were diagnosed with major

depressive syndrome (MDS) on the PHQ-9 categorical algorithm. 17 were diagnosed with other depressive syndrome on the PHQ-9 categorical algorithm. The rest of the participants (n=324) were diagnosed with no depressive syndrome by PHQ-9 categorical algorithm.

Table 1 shows the distribution of the PHQ-9 total scores and PHQ-9 categorical algorithm at the 1st screening.

At the second screening conducted three months later, we followed 20 participants who had PHQ-9 scores of at least 10 in the first screening. They were re-assessed using the PHQ-9 and GAD-7, and then interviewed for clinical diagnoses of depressive disorders using the MINI.

The mean age of the 20 participants was 35.2 years (SD=9.1). There were 2 females (10%) and 18 males (90%).

At the second screening of the 20 participants, five were diagnosed with major depressive syndrome using the PHQ-9 categorical algorithm, two with other depressive syndrome, and 13 with no depressive syndrome.

Table 2 shows the distribution of PHQ-9 scores and PHQ-9 categorical algorithm in the 20 participants at second screening.

From the first screening to the second screening, changes of depressive symptoms in 20 participants were found (Table 3). Though 20 participants had 10 or greater of the PHQ-9 score at the first screening, only nine participants remained at 10 or greater of the PHQ-9 score at the second screening. While nine participants had a major depressive syndrome diagnosed using the PHQ-9 categorical algorithm at the first screening, only three participants remained with a major depressive syndrome at the second screening (Fig. 2).

Among five participants who have been diagnosed with major depressive syndrome using the PHQ-9 categorical algorithm, three participants had the same diagnosis of major depressive episode, and two participants had different diagnoses using the MINI. Two were diagnosed with generalized anxiety disorder and personality disorder with medium degree of suicide risk, respectively.

Table 1. Distribution of the PHQ-9 scores and PHQ-9 categorical algorithm at the first screening

Level of depression severity, PHQ-9 score	Major depressive syndrome (n=9)	Other depressive syndrome (n=17)	No depressive syndrome (n=324)
	n (%)	n (%)	n (%)
Minimal 0-4	0 (0.0)	0 (0.0)	224 (69.1)
Mild 5-9	0 (0.0)	11 (64.7)	95 (29.3)
Moderate 10-14	2 (22.2)	6 (35.3)	5 (1.5)
Moderately severe 15-19	4 (44.4)	0 (0.0)	0 (0.0)
Severe 20-27	3 (33.3)	0 (0.0)	0 (0.0)

Table 2. Distribution of PHQ-9 total scores and PHQ-9 categorical algorithm at the second screening

Level of depression severity, PHQ-9 score	Major depressive syndrome (n = 5)	Other depressive syndrome (n = 2)	No depressive syndrome (n = 13)
	n (%)	n (%)	n (%)
Minimal 0-4	0 (0.0)	0 (0.0)	6 (46.2)
Mild 5-9	0 (0.0)	0 (0.0)	5 (38.5)
Moderate 10-14	1 (20.0)	2 (100.0)	1 (7.7)
Moderately severe 15-19	4 (80.0)	0 (0.0)	1 (7.7)
Severe 20-27	0 (0.0)	0 (0.0)	0 (0.0)

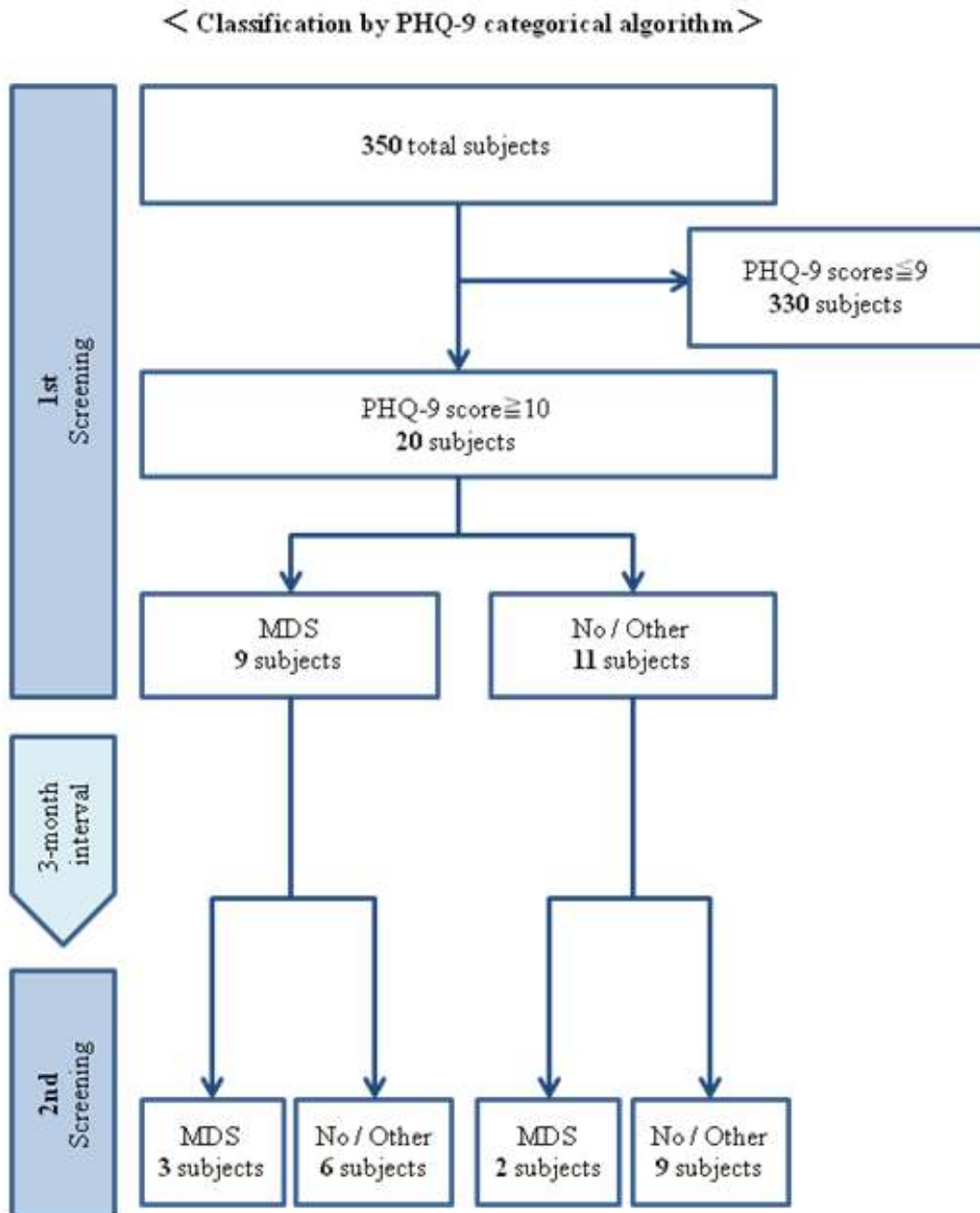


Fig. 2. Classification by PHQ-9 categorical algorithm

PHQ-9 categorical algorithm had 75% sensitivity and 86% specificity. On the other hand, PHQ-9 total score classification had 100% sensitivity and 68.8% specificity.

According to PHQ-9 categorical algorithm, we compared differences of depressive symptoms at the first screening between subjects who were twice diagnosed with major depressive syndrome

and those who were diagnosed with major depressive syndrome only once at the first screening (Table 4). Demographic information, BDI-II scores, HAM-D scores, and GAD-7 scores of the participants are presented in Table 4. The frequency distributions of the PHQ-9 categorical algorithm were compared using the Mann-Whitney U test ($p < .05$) to determine whether there were statistically significant differences

between the two groups. Results of the Mann-Whitney U test showed significant differences ($p < .05$) between the two groups on the BDI-II, and the HAM-D scores. Pearson correlation coefficients were calculated between measurements. The correlation coefficients are reported in Table 5.

Table 3. Changes of PHQ-9 total score and PHQ-9 categorical algorithm from 1st and 2nd screening

Sex	Age	1 st screening		2 nd screening	
		PHQ-9 total score	PHQ-9 categorical algorithm	PHQ-9 total score	PHQ-9 categorical algorithm
M	54	27	MDS	18	MDS
M	36	22	MDS	5	No
F	27	22	MDS	17	MDS
M	43	18	MDS	11	Other
M	47	16	MDS	10	No
M	36	16	MDS	17	MDS
M	27	15	MDS	12	Other
M	43	13	MDS	3	No
M	28	13	MDS	7	No
M	44	12	No	18	MDS
M	27	12	Other	5	No
F	23	12	Other	4	No
M	35	11	Other	3	No
M	34	11	No	5	No
M	26	11	Other	2	No
M	24	11	No	3	No
M	45	10	Other	18	No
M	45	10	No	4	No
M	32	10	No	14	MDS
M	27	10	Other	6	No

Table 4. Differences of depressive symptoms at the first screening between subjects who were diagnosed twice as major depressive syndrome and those who were diagnosed with major depressive syndrome only once at the first screening

Diagnosis	n	Gender ♀/♂	Age median	PHQ-9	BDI-II	HAM-D	GAD-7
Diagnosed twice with No/Other	9	1/8	27.0	4.0	4.0	9.0	5.0
Diagnosed twice with MDS*	3	1/2	36.0	17.0	33.0	16.0	14.0
Diagnosed once only the first time with MDS	6	0/6	39.5	8.5	11.5	6.5	5.0
p-values**					.047	.019	.123

Notes: *MDS= Major depressive syndrome

**Comparing diagnosed twice with MDS and Diagnosed once only the first time with MDS

Table 5. Pearson correlations between measurements

	PHQ-9	BDI-II	HAM-D	GAD-7
PHQ-9	1.00	0.64	0.62	0.66
BDI-II	0.64	1.00	0.72	0.33
HAM-D	0.62	0.72	1.00	0.43
GAD-7	0.66	0.33	0.43	1.00

4. DISCUSSION

Results of the present study identified changes in depressive symptoms over a period of three months. As the results of the current study about double web-based screening for 350 employees, we found 20 subjects who had 10 or greater of the PHQ-9 score at the first screening, but only 9 subjects remained at 10 or greater of the PHQ-9 score at the second screening after three months. While 9 subjects had a major depressive syndrome diagnosed by the PHQ-9 categorical algorithm at the first screening, only 3 subjects remained with a major depressive syndrome at the second screening. In the results of the PHQ-9 categorical algorithm, six of nine participants with major depressive syndrome (66.7%) were changed to no / other depressive syndrome after three months.

In previous study, the prevalence of major depression was 2.2% in Japan [4]. By contrast, the prevalence of this study was 0.9%. This might be caused by biased sampling. That is employees can be considered better in mental health than general population.

The present study revealed that some subjects who diagnosed with major depressive syndrome at the first screening did not diagnosed at the second screening. Previous studies have reported on the spontaneous remission rate of major depression. The episodic nature of major depression [26] necessitates understanding the extent to which recovery from depression occurs without treatment. A meta-analysis of clinical trials by Krogsboll et al. [27] attributed 35% of improvements in depression severity to spontaneous recovery, and a further 24% to placebo effects. Community-based epidemiological studies suggest that 90-98% of depression cases achieve remission within one year [28-30].

Whiteford et al. [31] found that the model estimated that 23% of prevalent cases of untreated depression will remit within 3 months, 32% within 6 months and 53% within 12 months, based on adult samples recruited from primary-care settings.

In comparison with the previous reports, the spontaneous remission rate in this study was 66.7% after 3 months using PHQ-9 categorical algorithm. Alterations of depressive symptoms may be influenced by environmental factors in the workplace, self-observation induced by

participation in screening, false detection of adjustment disorder and / or statistical phenomenon of regression to mean [32].

Thus, spontaneous remission rates may accurately assess the state of depression in the workplace. It is reasonable to perform double web-based depression screening using PHQ-9 in the workplace. Moreover, it may be more effective that the screening is performed at least four times a year.

5. CONCLUSION

In present study, we examined a screening method of depression in the workplace. Because subjective psychological assessments and feedbacks need participants to observe themselves and promote understanding about their mental health, mental health screening will contribute to earlier detection of and prevention from depression. Furthermore, using web-based method will promote employees to participate in screening, because it can be easily administered.

Additionally, six of nine participants who categorized into depression at first screening were not categorized at second in our study. This result suggested the spontaneous remission and usefulness of double web-based screening for major depressive disorders to provide adequate support in the workplace.

CONSENT

It is not applicable.

ETHICAL APPROVAL

All procedures were approved by the Ethics Committee of Chiba University Graduate School of Medicine.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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