

Table 1 Characteristics of participants in each Delphi round

	Round 1		Round 2		Round 3	
	n=95	%	n=94	%	n=90	%
Age (years)						
Mean (standard deviation)	48.6	(8.1)	48.7	(8.1)	48.5	(8.2)
Range	28–69		28–69		28–68	
Gender						
Male	48	50.5	46	48.9	44	48.9
Female	47	49.5	48	51.1	46	51.1
Professional background						
Psychiatrist	28	29.5	29	30.9	29	32.2
Other physician	13	13.7	12	12.8	11	12.2
Public health nurse	21	22.1	21	22.3	19	21.1
Nurse	4	4.2	4	4.3	4	4.4
Psychologist	12	12.6	12	12.8	10	11.1
Psychiatric social worker	11	11.6	11	11.7	10	11.1
Administrator	2	2.1	2	2.1	2	2.2
Other	4	4.2	3	3.2	5	5.6

Round 2

In Round 2, 19 items achieved positive agreement and 12 achieved negative agreement (overall agreement rate, 62.0%). Three statements with which participants agreed most strongly were: 1) A protocol for emergency work structure and information flow should be prepared in normal times; 2) A mental health team should attend regular meetings on health and medicine to exchange information; and 3) Generally, it is recommended not to ask disaster survivors about psychological problems at the initial response but ask about their present worries and physical condition. Three statements with which participants disagreed most strongly in this round were: 1) Individuals should be encouraged to provide detailed accounts of their experiences; 2) Individuals should be provided with education if they are interested in

receiving it; and 3) Bad news should be withheld from distressed individuals for fear of causing more upset.

Round 3

In Round 3, excluding 12 items for which there was negative agreement in Round 2, 19 items were asked, but none achieved agreement. The changes in mean score of the items that did not achieve consensus in Rounds 1–3 are shown in Figure 2.

Discussion

Items that reached consensus

Most of the items that reached consensus in Round 1 were statements which are present in other guidelines or publications, or statements regarding the basic attitudes of human service providers. As experts, our participants answered based on knowledge they had acquired through their own disaster experiences or from workshops, lectures, and publications. Therefore, we consider the statements that reached consensus to be ones that are shared by the wide range of professionals working in disaster mental healthcare. In accordance with the nature of the Delphi process in which consensus is achieved by the majority of participants on specific issues, novel statements did not emerge as agreed-on principles (Appendix 1).

Items that did not reach consensus

During the survey, more comments were made than initially expected. Such comments included the need to clarify certain statements and specify the assumptions and settings, as well as included practical proposals for specifically defined situations. These comments were made based on the participants' own experiences, local health structure, and human resource situation, and were therefore extremely valuable. Thus, we decided to include these comments in the final version of disaster mental health guidelines in the form of special articles

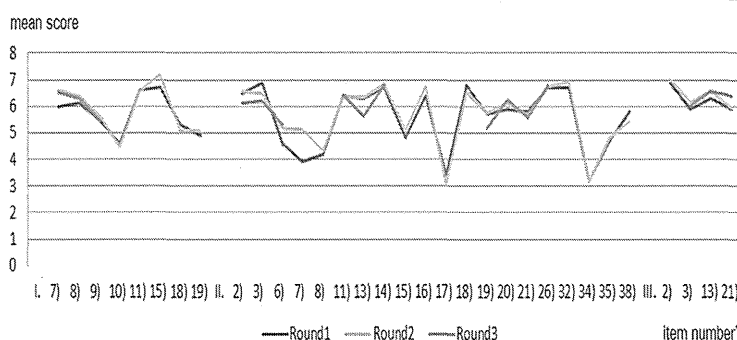


Figure 2 Mean score of the items that did not reach consensus in Rounds 1–3 of the Delphi process. *: Statements corresponding to each number are given in Appendix 2.

on controversial items, so that readers of the guidelines could make their own decision on controversial issues.

I. Mental health system during a disaster

First, agreement was not achieved for those items concerning the collection of information needed to set up a disaster mental health system. Specifically, consensus was not achieved for either the item stating that information should be collected first on-site in the disaster area at the expense of a more rapid response or for the item stating that mental health professionals should be deployed to the affected area as soon as possible, even without prior information on the area, to assess local mental health needs. To scout information effectively, a highly experienced team of professionals should be deployed in advance of the entire team to the affected area, and this advance team should become familiarized with the local health resources and services available so they can make best use of them. Alternatively, scouting should be done immediately and jointly involving personnel from both the health and civil sectors.

In Japan's community healthcare system, in addition to providing primary health care, public health nurses play a major role in providing mental health and psychosocial care [8,9]. In light of this, we asked about several patterns of shared working style for providing mental health services. None of the items reached consensus, and many participants answered that the working pattern used would depend on the circumstances and human resources available, especially in relation to their professional skills and experience of working during a disaster. Some practical suggestions were made in the comments provided: whenever possible, a local and a dispatched public health nurse should work together, although in times of a disaster there is usually a shortage of health staff, which would leave the dispatched nurse to provide outreach to the affected population alone. For effective outreach, it is essential to map cases and resources as well as gather information on the affected area; however, some experts expressed concern about the costs of these necessary preparatory activities for dispatched staff.

Second, the majority of participants expressed reservations about cooperating with the media. The items on the media were adopted from the TENTS guidelines [7] and we found during the Delphi process that some ambiguity remained after the statements were translated into Japanese. Based on comments described, the participants seemed to expect the media to broadcast general information

on the disaster and safety issues, broadcast psychoeducational information on people's reactions (mostly common reactions to an abnormal event) and coping techniques, and some exemplary community recovery efforts. In reality, however, it was noted that the media tends to cover stories that present a biased image of the affected area, journalists tend to be less sensitive to the privacy of the people affected, and mental health personnel feel overburdened by media interviews (usually because they are not well prepared to respond to the media). Practical suggestions for working with the media included establishing an understanding of mental health issues prior to a disaster; for example, special attention should be paid not to cause secondary victimization when interviewing people affected by the disaster, and a representative from the mental health team should be designated to deal with media interviews and other media contact. Thus, it is advised that direct service providers refrain from responding to approaches by the media and instead communicate via a designated team member.

II. Mental health care in times of disaster

In terms of the basic approach to be adopted with disaster survivors, basically the principles of psychological first aid (IASC) were accepted. However, emphasis on promoting sense of efficacy and connectedness was not agreed on. Based on the participants' comments, the initial response should be focused more on medical needs, with the concepts of efficacy and connectedness in mind. Those who had experience in managing mental health responses to man-made disasters voiced that it was not easy to promote connectedness in a community where there is a perpetrator and victims. It is noteworthy that none of the items stating the role of mental health professionals were agreed on. All of the items were adopted from the TENTS survey [7] and the statements suggest mental health professionals should play a supporting role for professionals at the frontline. Most of the Japanese professionals had firsthand experience in disaster management, thus it is reasonable that they did not agree with a supporting role only. Most of items on initial response did not reach consensus, and 5 of 7 such items were from TENTS guideline. The ambiguous wording of sentences was the main reason for this divergence and a detailed examination of these differences in Japanese and international experts' opinions will to be described elsewhere.

Statements on screening proved to be another controversial area. Although the importance of

screening was endorsed, participants did not reach consensus on how to assess people (e.g., by questionnaire, interview, or formal assessment). Participants suggested that it would depend on the aim of the assessment and the resources and manpower available. Other practical comments recommended that mental health professionals should coordinate a health survey with other actors so that multiple surveys would not be conducted with the affected population. In terms of information provision, the statement that individuals should be provided with education if they were interested in receiving it was not accepted. It was stated that it is not feasible to select affected people with interest in such information and that such selection would carry the risk of stigmatizing person with mental health needs in the community. The idea that volunteers should be recruited and screened for their suitability was not accepted in the survey. Participants expressed concern that there is no valid tool to screen for suitability and that it would be more beneficial to provide orientation on mental health issues for interested volunteers before they begin their activities.

III. Dispatched mental health team

Under the items concerning a dispatched mental health team, discussion centered around who would assume the coordinating role (i.e., at what level, municipal, prefectural, or national). Institutionalization of a coordination mechanism in normal times was seen as key to providing effective services following the Great East Japan Earthquake in 2011. Regarding outreach by the dispatched mental health team, more than 70% of participants agreed that outreach was suitable, but it did not reach the mean score needed to achieve consensus. The reason for not achieving consensus was that many participants agreed with this statement with a rating of ≥ 7 , but a relatively large proportion rated it 5, a neutral position (28.3% for Round 1, 21.7% for Round 2, and 12.4% for Round 3). Agreeing that outreach is an effective approach in the affected area, some participants stated that the dispatched team can only offer temporary help, so local professionals should directly provide outreach to the affected population with support from the dispatched team. Another controversial issue concerned the involvement of mental health professional as volunteers. As professionals who assume clinical responsibility for the care they provide, it is recommended that they work in the affected area within the remit of an organization so that communications involving personal sensitive

information can be shared effectively and safely.

Other frequent comments were that whether mental health professionals should volunteer depends on the situation, mainly in relation to the availability of such professionals, and on their own clinical skills and discernment.

Limitations

In accordance with the purpose of the Delphi process, which is transparent consensus generation among experts, generalizability of the sample is not required. However, if participants are selected from an inappropriate sampling frame, biased agreement or lead agreements (i.e., influenced by the surveyor) will likely result. Therefore, careful consideration should be given to the participants recruited and to retain a good participation rate. In this study, we invited experienced professionals from the Japanese Society of Traumatic Stress, the Crisis Response Team, and local and deployed health professionals who had experienced massive earthquakes in Kobe and Niigata, Japan. In terms of their professional backgrounds, the majority worked in medicine, public health, social welfare, or psychology. The quality and quantity of the participants' disaster response experiences were not strictly controlled for and some of the proposed items were ambiguous and required clarification, and this may reflect the fact that participants understood the item from their own context. In spite of this, these professionals have firsthand experience of responding to disasters and are key members of the disaster mental health team in Japan, and therefore we believe the results obtained in this study represent the realistic views of active team members. However, we acknowledge that involving only service providers can be a weakness. Although some local health professionals voiced their views also as persons affected by disasters themselves, service recipients were not included in our survey. Thus, further exploration on what is needed and what is beneficial should be made from the perspective of service users.

In each Delphi round, a large number of comments was provided and the research team summarized the comments into a 200-word statement for reference in the next round. As there is a risk that the summaries could wrongly lead to and create collective views among the participants [10], the research team members tried to avoid this by creating the summary statements individually and discussing the comments before finalizing the summaries within the team. We included not only the views of the majority of the participants, but also practical suggestions and diverse recommendations received from a few participants in the summaries so that these statements would offer participants the opportunity to rethink the issues in a balanced way, both supportively and critically.

Conclusion

The response rates were above 90% during the survey and many comments were made in each round, suggesting the participants had good awareness of and were highly motivated to solve the problems the survey addressed. As the participants were deemed to be experts in disaster mental health, this study seems to have successfully gathered their views and prompted some discussion of innovative approaches to disaster mental health. The product of this Delphi process was a new set of guidelines that contains more practical guidance to help mental health workers assigned to work in affected areas problem solve. Guidance is offered in the four domains of 1) the disaster mental health system, 2) initial response, 3) dispatch of a mental health team, and 4) staff care. The newly developed guidelines cover practical issues that were based on the firsthand experiences of Japanese mental health professionals with experience providing mental health care after disasters. Therefore, the new guidelines make a major departure from the previously published ones in that they do not simply conceptualize disaster mental health services, but provide a comprehensive description on what to do and say in times of disaster. We believe that with dissemination and use of the developed guidelines nationally, local mental health systems can be improved and will be better prepared ahead of future disasters.

Appendix 1 Items that reached consensus

*: Statements asked in the TENTS survey [7].

I. Mental health system during a disaster

1. Developing a disaster mental health plan

- 1) Mental health professionals should be represented on the psychosocial care planning group.*
- 2) Mental health and community health professionals should have an understanding of the role of and legal rationale for their professional activities as described in related laws and administrative guidelines.
- 3) Local administration and health and medical facilities should have a business continuity plan and an emergency plan prepared.

2. Setting up a disaster mental health system

- 4) At the outset of a disaster, local governments should set up a "disaster mental health

taskforce", with local mental health agencies and practitioners implementing the mental health strategy.

- 5) On setting up a disaster mental health taskforce, it is necessary to have advice from disaster mental health experts or experienced mental health professional to develop a disaster mental health system and action plan.
- 6) The information system should be centralized at prefectural level to collect disaster-related information and distribute it to affected municipalities.

3. Role of public health nurses.
No items achieved agreement.

4. Challenges faced by public health nurses

- 12) Public health nurses should identify their roles and responsibilities to ensure better liaison with other actors in their routine work in usual times before a disaster occurs (utilization of suicide prevention coordination taskforce, etc.)

5. Documentation of activities and services

- 14) For a smooth handover among service providers, the disaster mental health activities and services provided should be documented.
- 16) The psychosocial response provided should be monitored and evaluated by the planning group.*

6. Working with the media

- 17) To provide appropriate information for media reports, the prefecture should set up an information focal point to manage centralized information output which is tasked with responding to the media.
- 20) Survivors should not be exposed to or be interviewed excessively by the media. Practical arrangements for this include posting a note asking the media to refrain from accessing survivors without permission.

II. Mental health care in times of disaster

7. Basic approach for disaster survivors

- 1) The initial response should promote a sense of safety.*
- 4) The initial response should promote calming.*

- 5) The initial response requires practical, pragmatic support provided in an empathic manner.*
 8. Role of mental health professionals
No items achieved agreement.
 9. Initial response
 - 9) Information regarding the situation and concerns of individuals should be obtained and provided in an honest and open manner.
 - 10) Information should be confirmed before responding to queries from the people affected by the disaster, in order not to give them inaccurate or misleading information.
 - 12) Generally, it is recommended not to ask disaster survivors about psychological problems at the initial response but ask about their present worries and physical condition.*
 10. Screening
 - 22) Individuals with ongoing mental health difficulties should be offered a formal assessment by a trained practitioner.*
 - 23) Screening for mental health problems should be provided for the assessment of high-risk groups, not for only research purposes.
 11. Treatment for high-risk groups
 - 24) Groups at high risk of mental health problems at times of disaster include elderly persons, children, mothers with infants, disabled persons, patients with psychiatric and physical disease, and foreigners.
 - 25) Specialist care is required for specific populations, for example, the elderly and children.*
 - 26) Separate plans are required for specific populations, for example, the elderly and children.*
 - 27) It is desirable to cooperate with the multiple organizations that are providing a response to address the mental health of school-age children, such as schools and school counselors, child consultation offices, and local offices of the Japan Society of Certified Clinical Psychologists.
 - 28) For the mental health care of infants, it is important to respond to parents' anxiety to enable them to bring up children with a stable mind.
 - 29) For the mental health care of infants, it is necessary to provide information about children's traumatic reactions and care, and provide advice to their parents at evacuation centers, kindergartens, and nursery schools.
 12. Information provision
 - 30) A telephone helpline that provides emotional support should be launched.
 - 31) Written leaflets containing education about normal responses to traumatic events and where to seek help if necessary should be provided.*
 - 32) Psychological reactions should be normalised during the initial response.*
 13. Staff training
 - 37) All responders should have undergone formal training.*
 - 39) Ongoing supervision of all involved should be provided.*
 - 40) Ongoing training of all involved should be provided.*
 - 41) Different levels of training are required for individuals who are more involved in the psychosocial response.
- ### III. Dispatched mental health team
14. Decision on accepting a mental health team from non-affected areas
 - 1) Immediately after a disaster, a mental health team that knows the affected area should be dispatched to severely affected locations for rapid needs analysis.
 15. Commencement of the mental health team's activities
 - 4) The mental health team should attend regular meetings on health and medicine to exchange information.
 - 5) The mental health team should strive to obtain consensus about its policy of care with other actors in health and medicine.
 - 6) A mental health team dispatched from non-affected areas should first obtain information on the disaster and damage before entering the affected area.
 16. Activities of dispatched mental health teams
 - 7) A mental health team from non-affected areas should flexibly offer services depending on local

needs. (The team should be aware that the members' own past experiences of disaster response may not be suited to the affected area.)

- 8) The mental health team should provide services with permission from the local health authority and in collaboration with local mental health resources.
 - 9) A mental health team from non-affected areas should arrange members' own accommodation, food, and equipment to avoid placing additional burden on the affected area.
 - 10) The mental health team should each comprise a psychiatrist, nurse, public health nurse, psychiatric social workers, and an administrator who takes care of logistics.
 - 11) The mental health team should not readily prescribe medication to the affected population. They should be prescribed by other agencies.
 - 12) A mental health team from non-affected areas should enter the affected area assuming there is no need for mental health care among the affected population.
 - 14) The mental health team should strive to liaise on individual cases with local resources, bearing in mind that it can only offer temporary intervention.
 - 15) The mental health team should offer additional support to affected areas that local mental health professionals cannot fully cover (e.g., providing psychoeducation on traumatic stress).
 - 16) A mental health team from non-affected areas should be attentive to the mental well-being of local health professionals.
18. Mental health professionals wishing to work as volunteers
- 20) Professionals such as physicians, nurses, and psychologists should be dispatched through an organization so that they can share personal clinical information and work as a team.

IV. Staff's stress management

19. Institutionalization of staff care in the affected area
- 1) A protocol for an emergency work structure and information flow should be prepared in normal times.
 - 2) A service policy concerning staff offers of help to the affected people on the way to work should be predetermined.
 - 3) Regarding staff's work management, especially for taking rests, a manual or training program

should be developed and implemented at organizational level.

- 4) Regarding staff's safety, an information center or procedure to be implemented in a disaster should be predetermined in normal times.
20. Rest and relaxation
- 5) Staff should work by rotation to ensure there is time for rest.
 - 6) A welfare program and time off for recognition of staff's hard work should be institutionalized.
 - 7) A space for rest and privacy should be secured for staff at offices or shelters.
21. Support for dispatched staff
- 8) Review meetings or health check-ups involving screenings and interviews should be arranged for dispatched staff.
 - 9) Time for rest and recuperation should be ensured for dispatched staff.
 - 10) The work of dispatched staff as well as staff who remained to cover the work of the dispatched staff should be recognized and acknowledged by the organization as a whole (e.g., making time to produce a mission report to share experiences within the organization).
22. Self-help for staff
- 11) Awareness and education of staff about self-care should be fully covered in normal times.

Appendix 2 Items that did not reach consensus in Round 2

*: Statements asked in the TENTS survey [7]

- I. Mental health system during a disaster
2. Setting up a disaster mental health system
- 7) To develop a disaster mental health plan, mental health professionals should be deployed to the affected area as soon as possible, even without prior information on the area, to assess local mental health needs.
- 8) To develop a disaster mental health plan, mental health professionals should be deployed to the affected area after first collecting information on damage in the disaster area, even at the expense of a more rapid response.

3. Role of public health nurses

- 9) Public health nurses from the affected area should stay at their health centers to assume a command role, such as information gathering, responding to inquiries, and giving instructions to other staff, instead of providing outreach services themselves.
- 10) Deployed public health nurses should stay at local health centers to gather information and respond to inquiries, so that public health nurses from the affected areas can directly provide outreach services.
- 11) Deployed public health nurses should assertively provide outreach services in the affected area, gather information on the area and security of residents, and report their activities to their commander at the local health center.

4. Challenges faced by public health nurses

- 15) Clinical activities in times of disaster should be documented so that the response provided in the early recovery phase can be reflected in subsequent regular clinical contact.

6. Working with the media

- 18) Those providing an initial response should work closely with the media.*
- 19) Those providing an initial response should avoid contact with the media.*

II. Mental health care in times of disaster

7. Basic approach to working with disaster survivors

- 2) The initial response should promote a sense of self and community efficacy.*
- 3) The initial response should promote connectedness.*

8. Role of mental health professionals

- 6) Initial support should be provided by non mental health professionals.*
- 7) Mental health professionals have no role in the initial response.*
- 8) Mental health professionals should provide an advisory and supervisory role but rarely get directly involved in the initial response.*

9. Initial response

- 11) It had better to ask the open questions such as "How are you feeling?" when support staff talk to survivors.
- 13) For the disaster survivor who is overwhelmed by fear and anxiety and stunned, it is more preferred to treat in the empathetic way which provide safety such as snuggling up than to verbalize their feelings.*
- 14) It is recommended to explain for the survivors and their families who express stress reaction about the common psychological reaction among disaster survivors.*
- 15) Individuals with high levels of distress should be contacted proactively to maintain contact.*
- 16) Individuals involved should be contacted proactively, irrespective of their symptoms.*
- 17) Individuals should be encouraged to provide detailed accounts of their experiences.*
- 18) Individuals should be neither encouraged nor discouraged from giving detailed accounts.*

10. Screening

- 19) All individuals should be screened for mental health difficulties using a structured questionnaire or interview.*
- 20) Formal screening should not occur, but helpers should be aware of the importance of identifying individuals with significant difficulties.*
- 21) Individuals with difficulties should be formally assessed with consideration for their physical, psychological, and social needs before receiving any specific intervention.*

11. Information provision

- 32) Psychological reactions should be normalised during the initial response.
- 34) Individuals should be provided with education if they are interested in receiving it.*
- 35) Bad news should be withheld from distressed individuals for fear of causing more upset.*

12. Staff training

- 38) Volunteers should be recruited and screened for suitability before being accepted.*

III. Dispatched mental health team

13. Decision on accepting a mental health team from non-affected areas

- 2) Once local needs are known, a mechanism to dispatch a mental health team should be institutionalized.
- 3) The mechanism to dispatch a mental health team should be established at prefectural and national levels.

14. Activities of dispatched mental health team

- 13) A mental health team from non-affected areas should provide outreach to the affected population by visiting homes and shelters.

15. Duration of the mental health team's activities

- 18) To maximize its performance, the dispatched mental health team should operate for at least five days, to include handover sessions from and to successive teams.

16. Mental health professionals wishing to work as volunteers

- 21) Professionals such as physicians, nurses, and psychologists should not offer services individually.

Authors' contributions

YS and MF had access to all data from the study and complete freedom to direct its analysis and reporting without influence, editorial direction, or censorship from the sponsors. SN and TN made significant contributions to the conception and monitoring of the survey; YK to survey supervision. All authors reviewed and revised the manuscript for intellectual content and have approved the final version of the manuscript.

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Combination use of Beck Depression Inventory and two-question case-finding instrument as a screening tool for depression in the workplace

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ABSTRACT

Objectives: The present study aimed to validate screening tools that could be used to identify depression among workers.

Design: Diagnostic test study.

Settings: Workers from three Japanese companies agreed to participate.

Participants: Recruitment for the group 1 occurred between January 2001 and February 2004, and 89 participants (81 men and 8 women with a mean age of 38.4±6.6 years) (98.8%) took part in the study. Recruitment for the group 2 occurred between July 2000 and February 2004, and 1500 participants (1408 men and 92 women with a mean age of 40.9±7.2 years) (94.2%) took part in the study. Demographic data are shown in supplementary table 1.

Interventions: Primary and secondary outcome measures: the Beck Depression Inventory (BDI) and a two-question case-finding instrument (TQI) were administered to 89 workers and Mini-International Neuropsychiatric Interview was conducted to verify the diagnosis of depression. A second group of 1500 workers completed the BDI and TQI to detect possible sample bias for the distribution of depression. Specificity, sensitivity and positive predictive value were calculated in order to obtain the optimal cut-off scores for BDI and TQI and receiver operating characteristic curves, and Youden Index were applied to further refine the optimal cut-off scores.

Results: When paired together, BDI score ≥10 and TQI score of 2 adequately identified workers who had major depressive disorder and those who had other psychiatric disorders that are frequently comorbid with major depressive disorder.

Conclusions: The combination of BDI score ≥10 and TQI score of 2 can adequately screen for current and potential cases of depression among workers. Furthermore, BDI and TQI offer the advantage of being relatively easy to administer to a large number of workers. Early detection of depression could improve treatment outcomes and decrease economic burden.

Trail registration:

ARTICLE SUMMARY

Article focus

- Depression is associated with enormous economic burden and the social cost of depression is attributed to the functional impairment of employees.
- Even though the magnitude of productivity loss from depression is substantial, a large number of depressed workers are untreated or inadequately treated.
- An efficient screening tool for depression among workers is needed because it is difficult to interview and evaluate all employees.

Key messages

- The combination use of the BDI and a two-question case-finding instrument adequately identified workers who had MDD.
- Furthermore, it adequately identified workers who had other psychiatric disorders that are frequently comorbid with MDD.

Strength and limitations of this study

- This study presents an effective way to screen for current and potential cases of depression in the workplace, which is easy to administer to a large number of workers.
- The limitations of the study are as follows: the sample size was relatively small, the Japanese version of two-question case-finding instrument has not been validated, not all participants were diagnosed using the diagnostic interview and effect of socio-economical factors and clinical factors were not included in the analysis.

INTRODUCTION

Depression is a highly prevalent disorder, that is, associated with enormous economic costs. Major depressive disorder (MDD) was estimated to affect 18.1 million people living in the USA in 2000 and to have lifetime prevalence of 16.2% and an annual prevalence of 6.6%.^{1 2} The total economic burden (both direct and indirect costs) of depression

Combination use of two questionnaires for depression screening in the workplace

was estimated to be more than US\$ 83 billion and €118 billion in the USA and Europe, respectively.^{1 3} 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 criteria for major depressive episode and score more than 40 points (depressive range) on the self-rating depression scale.^{4 5} The annual societal cost of depression and suicide was estimated at 2.7 trillion yen.⁶ Based on the epidemiological trends, depression will become the second leading cause of global disease burden by 2020⁷ and is expected to rank first in disease burden in high-income countries by the 2030.⁸

The economic burden of depression is attributed to functional impairment of employees due to physical and cognitive symptoms. Moreover, the prevalence of depression is highest in the age group of 15–64, which corresponds to the typical working age.⁹ Indeed, it was reported that depressed workers in the USA have 1.5–3.2 times more short-term work-disability days per month than people who were not depressed.¹⁰ Furthermore, the European ESEMeD study revealed that depressed workers had 3–4 times more work-loss days per month compared with workers without depression.¹¹ In addition to the cost of depression-related absenteeism, presenteeism, the state in which depressed workers stay at work but have reduced productivity as a result of their condition, needs to be considered.

Even though the magnitude of productivity loss from depression is substantial, a large number of depressed workers are untreated or inadequately treated.^{2 12 13} The increasing duration of untreated illness (DUI) may be associated with worse treatment outcomes of depression.¹⁴ Many studies have reported that DUI is a predictive factor for treatment outcome.^{15–17} In addition, early treatment of the first depressive episode is important because our previous study showed that a shorter DUI implied better remission outcomes in patients with the first MDD.¹⁸ Therefore, early identification of depressed workers is crucial in order to improve treatment outcomes and reduce cost.^{2 12} Moreover, since it is difficult to interview and evaluate all employees, an efficient screening tool for depression among workers is needed.

The aim of the present study was to establish an efficient way to identify workers who were diagnosed as having MDD (= workers with depression) and those who were not diagnosed as having MDD but had other psychiatric disorders that are frequently comorbid with MDD (= workers with comorbid disorders). We identified workers with depression using Mini-International Neuropsychiatric Interview (M.I.N.I.) and investigated an optimal pair of cut-off scores using a combination of Beck Depression Inventory (BDI) and a two-question case-finding instrument (TQI) for depression screening. Afterwards, we examined the specificity and sensitivity of the screening procedure for identification of both

workers with depression and those with comorbid disorders. The current study is a continuation of the preliminary research conducted in 2003.¹⁹ In addition to the larger sample size used in the current study, we evaluated the receiver operating characteristic (ROC) curves and Youden Indices in order to calculate the optimal cut-off point for depression in the workplace.

MATERIALS AND METHODS

Participants

We selected two groups of participants. Group 1 was established in order to investigate the optimal pair of cut-off scores of BDI and TQI for screening of depression. Participants in group 1 answered both BDI and TQI, and their diagnosis was confirmed using the M.I.N.I.²⁰ The M.I.N.I. Japanese version was used as a diagnostic standard for identifying cases. Recruitment occurred between January 2001 and February 2004, and it included 90 workers in a company who agreed to participate. One (1.1%) participant did not complete the questionnaires; 89 (98.8%) took part in the study. The mean age of them was 38.4 (SD, 6.6) and 81 (91.0%) were men.

Group 2 was established in order to investigate the sampling bias in the distribution of depression severity among group 1, which was a relatively small sample size. In group 2, a large number of subjects were necessary; therefore, only BDI and TQI were performed and the M.I.N.I. assessment was omitted. Recruitment occurred between July 2000 and February 2004, and 1591 workers from three companies agreed to participate. All the employees in the companies were invited to participate in the study. Ninety-one (5.7%) participants did not complete the questionnaire; 1500 (94.2%) took part in the study. The mean age of them was 40.9 (SD, 7.2) and 1408 (93.9%) were men. Demographic data of participants in each group are shown in supplementary table 1.

Measurements

Beck Depression Inventory

The BDI, developed by Beck *et al.*,²¹ is one of the most widely used self-rating questionnaires for measuring the severity of depression. The BDI-I is a 21-item scale (range 0–60). We used the Japanese version of BDI-I, which has been validated and is widely used in Japan.²²

Two-question case-finding instrument

A two-question depression-screening tool developed by Whooley *et al* was extracted from the Primary Care Evaluation of Mental Disorders questionnaire.^{23 24} It includes two questions about depressed mood and anhedonia: (1) 'During the past month, have you often been bothered by feeling down, depressed, or hopeless?' and (2) 'During the past month, have you often been bothered by little interest or pleasure in doing things?' The TQI operates in the range of many other validated depression-screening tools, and it eases the burden of administration by being succinct. For the two-question

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instrument, a 'yes' answer to either of the two questions was considered to indicate a positive result.

After obtaining consent from the author of the original work, the original TQI was carefully translated into Japanese. The semantic fidelity of the Japanese version of TQI was ascertained by means of back translation, whereby the first Japanese version was translated back into English by an independent researcher blind to the original English version, and any discrepancies between the original and the retranslations were corrected until the two were semantically equivalent.

Criterion standard

The M.I.N.I. is a short structured diagnostic interview, developed jointly by psychiatrists and clinicians in the USA and Europe, for Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition and International Classification of Diseases, Tenth Edition psychiatric disorders.²⁰ With an administration time of approximately 15 min, M.I.N.I. was designed to meet the need for a short but accurate structured psychiatric interview for multicenter clinical trials and epidemiology studies and to be used as a first step in outcome tracking in non-research clinical settings. Trained psychiatrists and clinical psychologists performed the Japanese version of M.I.N.I. structured interview, and the results were used to validate the optimal pair of cut-off scores of BDI and TQI.

Study design and procedure

In group 1, participants were assessed by BDI and TQI and then they were additionally diagnosed using the M.I.N.I. In group 2, only BDI and TQI assessments were performed. Subsequently, we investigated the frequency distributions of BDI and TQI in two groups and compared them to confirm that there were no significant differences between the two experimental groups. After confirming that group 1 was not a biased sample, we explored the optimal pair of cut-off scores of BDI and TQI for identifying workers with depression.

The frequency distributions of BDI and TQI were compared using Mann-Whitney U test ($p < 0.05$) to examine whether there were statistically significant differences between the two groups. The sensitivity (Se), specificity (Sp) and positive predictive value (PPV) were calculated for all possible cut-off scores for BDI, TQI and all possible pairs of cut-off scores of BDI and TQI to identify workers with depression in group 1. Sensitivity refers to the proportion of correctly identified cases and specificity to the proportion of correctly identified non-cases. PPV is the probability that depressed workers identified using the optimal cut-off score are cases according to the M.I.N.I.

To determine the optimal cut-off point, the ROC curve was created for all possible cut-off scores of BDI, TQI and all possible pairs of cut-off scores of BDI and TQI. The Youden Indices were calculated, concurrently. The ROC curve is a popular graphical method of displaying the discriminatory accuracy of a diagnostic test for

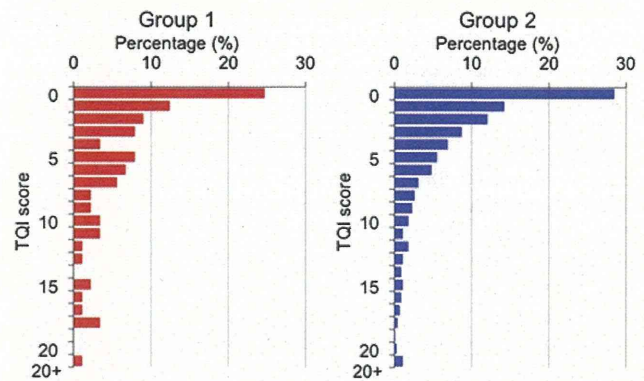


Figure 1 Frequency distribution.

distinguishing between two populations. The ROC curve is a plot of Se and $1 - Sp$ for all possible cut-off scores of the test. To evaluate the discriminatory ability of a diagnostic test, it is common to summarise the information of the ROC curve into a single global value or index.²⁵ The Youden Index is the easiest to apply and frequently used in practice. This index can be defined as $\{Se + Sp - 1\}$ and provides a criterion for the 'optimal' threshold value; the threshold value for which $Se + Sp - 1$ is maximised.²⁶

Furthermore, we applied the screening thresholds to identify workers with comorbid disorders in addition to those with depression. The Se, Sp and PPV were calculated for all possible cut-off scores for BDI, TQI and all possible pairs of cut-off scores of BDI and TQI to identify both workers with depression and those with comorbid disorders. Subsequently, the ROC curve was created and the Youden Indices were calculated.

RESULTS

The frequency distributions of BDI and TQI in each group are presented in figure 1 and table 1, respectively. Mann-Whitney U test revealed that there was no significant difference in the frequency distribution of BDI between the two groups. However, significant difference was found in the frequency distributions of TQI between two groups ($p = 0.003$). The diagnoses of the participants in group 1 based on M.I.N.I. are listed in table 2.

The sensitivity, specificity and PPV for all possible cut-off scores of BDI, TQI and all possible pairs of cut-off scores of BDI and TQI to identify workers with

Table 1 Frequency distributions of two-question case-finding instrument

Number of 'yes' answers	Group 1 N (%)	Group 2 N (%)
0	51 (57.3)	1097 (73.1)
1	25 (28.1)	229 (15.3)
2	13 (14.6)	174 (11.6)

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Table 2 The diagnoses of participants in group 1 according to mini-international neuropsychiatric interview

Diagnosis	N (%)
No diagnosis	60 (67.4)
Substance use disorder	16 (17.9)
Anxiety disorder	6 (6.7)
Major depressive disorder	3 (3.3)
Bipolar disorder	1 (1.1)
Dysthymia	1 (1.1)
Bipolar disorder + substance use disorder	1 (1.1)
Major depressive disorder + substance use disorder + anxiety disorder	1 (1.1)

depression are listed in table 3. The ROC curves are showed in supplementary figure 1, and the Youden Indices are listed in table 3. The maximum value of the Youden Index was derived from neither BDI nor TQI alone but the combination of the BDI and TQI: 0.776 at the point of BDI score ≥ 10 and TQI score =2. The pair of scores of BDI ≥ 10 and TQI =2 was considered to be optimal to identify workers with depression; both those whose BDI score was ≥ 10 and those whose TQI score was =2 were defined as 'cases'.

The sensitivity, specificity and PPV at all possible cut-off scores for BDI, TQI and all possible pairs of cut-off scores of BDI and TQI to identify both workers with depression and those with comorbid disorders are listed in table 4. The ROC curves are showed in supplementary figure 2, and the Youden Indices are listed in table 4. The maximum value of the Youden Index was derived from neither BDI nor TQI alone but from the combination of BDI and TQI: 0.316 at the point of BDI score ≥ 9 and TQI =2. The combination of BDI ≥ 10 and TQI =2, which was considered to be optimal to identify workers with depression, showed the Youden Index of 0.281 to identify both workers with depression and those with comorbid disorders. There was little difference in the Youden Index between the two points, and the primary purpose of this screening was to identify workers with depression; therefore, the pair of scores of BDI ≥ 10 and TQI =2 would be adequate to identify both workers with depression and those with comorbid disorders.

DISCUSSION

The present study revealed that combined implementation of BDI and TQI is useful to screen for depressed workers, and the optimal pair of cut-off scores is a BDI score ≥ 10 and a TQI score =2. Furthermore, all diagnosed workers in our sample were considered to be depressed because substance use disorder and anxiety disorder are frequently comorbid with depression and patients with bipolar disorder and dysthymia often experience depression. Our results also suggest that it is also possible to identify workers who are likely to be depressed using two instruments with the cut-off scores;

therefore, the combination use is considered to be effective as a screening tool in the workplace.

Several studies have investigated the cut-off point of BDI in general populations and failed to get consistent results.^{13–21} Furthermore, there has been no study that investigated optimal cut-off scores of BDI and TQI in the workplace. Beck suggested that a total score of < 10 is not associated with depressive disorders; scores between 10 and 18 indicate mild to moderate depression; scores between 19 and 29 correlate with moderate and severe depression and scores of more than 30 indicate severe depression. Indeed, a BDI score ≥ 10 has been selected as a cut-off in many studies.^{27–29} However, Lasa *et al*²⁹ reported that a BDI score ≥ 13 had high sensitivity and specificity for detecting depression and was an optimal cut-off in a general population. We speculate that the difference between the cut-off detected in our study and that reported in the previous study is related to differences between the two study populations. Specifically, almost half of the participants in the Lasa study were women (50.16%) and a high BDI score (≥ 13) was more common among women than men. However, as the majority of participants in the current study were men, difference in terms of gender composition might have contributed to the low cut-off score of BDI in this study as compared with that in the Lasa study. In our study, better sensitivity and specificity was achieved by an additional use of TQI. TQI is less time consuming; therefore, the combination use of BDI and TQI as a screening tool in the workplace is considered to be reasonable, especially for companies with large numbers of employees.

Several important limitations of our study design should be considered when interpreting the results. In particular, the facts that our sample size was relatively small and the vast majority of the participants were men may affect the precision of calculated estimates based on the data presented in our study. We conducted additional analyses in the men-only sample and presented the results in the supplementary materials (supplementary tables 2, 3, 4 and 5 and supplementary figures 3, 4 and 5). Other methodological problems are as follows: the Japanese version of TQI has not been validated and the MINI interview was not performed in the larger group. Validation of the Japanese version of TQI would have contributed to improve accuracy of the present results. Performing the diagnostic interview even in shorter versions of MINI in the larger group would have contributed to increase the number of subjects for analysis. Moreover, a statistically significant difference was found in the frequency distribution of TQI between groups 1 and 2, although there was no significant difference in BDI between the two groups. The score range of BDI is wide (0–60), and it has been proved that BDI can be used as a measure of depression symptom severity. On the other hand, the score range of TQI is 0–2, and TQI is considered to be a tool that can help to make the

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Table 3 The sensitivity, specificity, PPV and Youden Indices for all possible cut-off scores for BDI, TQI and all possible pairs of cut-off scores of BDI and TQI to identify workers who were diagnosed with major depressive disorder

	Sensitivity	Specificity	PPV	Youden Index	
BDI cut-off score					
4	100	56.4	9.7	0.564	
5	100	60.0	10.5	0.600	
6	75.0	67.0	9.6	0.420	
7	75.0	74.1	12.0	0.491	
8	75.0	80.0	15.0	0.550	
9	75.0	82.3	16.6	0.573	
10	75.0	84.7	18.7	0.597	
11	50.0	87.0	15.3	0.370	
12	50.0	90.5	20.0	0.405	
13	50.0	91.7	22.2	0.417	
14	50.0	92.9	25.0	0.429	
15	50.0	92.9	25.0	0.429	
16	25.0	94.1	16.6	0.191	
17	25.0	95.2	20.0	0.202	
18	0	98.8	25.0	0.214	
TQI cut-off score					
1	100	60.0	10.5	0.600	
2	75.0	88.2	23.0	0.632	
BDI	TQI	Sensitivity	Specificity	PPV	Youden Index
Pairs of cut-off scores					
4	2	100	56.4	9.7	0.564
5	2	100	60.0	10.5	0.600
6	2	100	65.8	12.1	0.658
7	2	100	72.9	14.8	0.729
8	2	100	75.2	16.0	0.752
9	2	100	76.4	16.6	0.764
10	2	100	77.6	17.3	0.776
11	2	75.0	80.0	15.0	0.550
12	2	75.0	82.3	16.6	0.573
13	2	75.0	82.3	16.6	0.573
14	2	75.0	83.5	17.6	0.585
15	2	75.0	83.5	17.6	0.585
16	2	75.0	84.7	18.7	0.597
17	2	75.0	85.8	20.0	0.608
18	2	75.0	87.0	21.4	0.620
4	1	100	47.0	8.1	0.470
5	1	100	49.4	8.5	0.491
6	1	100	52.9	9.0	0.529
7	1	100	55.2	9.5	0.552
8	1	100	56.4	9.7	0.564
9	1	100	56.4	9.7	0.564
10	1	100	56.4	10.0	0.576
11	1	100	57.6	10.0	0.576
12	1	100	57.6	10.5	0.600
13	1	100	60.0	10.5	0.600
14	1	100	60.0	10.5	0.600
15	1	100	60.0	10.5	0.600
16	1	100	60.0	10.5	0.600
17	1	100	60.0	10.5	0.600
18	1	100	60.0	10.5	0.600

BDI, Beck Depression Inventory; PPV, positive predictive value; TQI, two-question case-finding instrument.

diagnosis of depression, but not to evaluate symptom severity. Therefore, BDI is thought to be suitable to compare the distributions of severity of depression, whereas the difference in the frequency distributions

of TQI would be negligible. Finally, no data of the socio-economical status were collected in this study; therefore, effect of socio-economical factors was not included in the analyses.

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Table 4 The sensitivity, specificity, PPV and Youden Indices for all possible cut-off scores for BDI, TQI, and all possible pairs of cut-off scores BDI and TQI to identify both workers who were diagnosed as having MDD and those who were not diagnosed as having MDD but had other psychiatric disorders frequently comorbid with MDD

	Sensitivity	Specificity	PPV	Youden Index	
BDI cut-off score					
4	62.0	61.6	43.9	0.237	
5	58.6	65.0	44.7	0.236	
6	51.7	73.3	48.3	0.250	
7	44.8	80.0	52.0	0.248	
8	41.3	86.6	60.0	0.280	
9	41.3	90.0	66.6	0.313	
10	37.9	91.6	68.7	0.295	
11	31.0	93.3	69.2	0.243	
12	27.5	96.6	80.0	0.242	
13	27.5	98.3	88.8	0.259	
14	24.1	98.3	87.5	0.224	
15	24.1	98.3	87.5	0.224	
16	17.2	98.3	83.3	0.155	
17	13.7	98.3	80.0	0.121	
18	10.3	98.3	75.0	0.086	
TQI cut-off score					
1	48.2	60.0	36.8	0.082	
2	20.2	88.3	46.1	0.090	
BDI	TQI	Sensitivity	Specificity	PPV	Youden Index
Pairs of cut-off scores					
4	2	62.0	61.6	43.9	0.237
5	2	58.6	65.0	44.7	0.236
6	2	55.1	71.6	48.4	0.268
7	2	48.2	78.3	51.8	0.266
8	2	48.2	81.6	56.0	0.299
9	2	48.2	83.3	58.3	0.316
10	2	44.8	83.3	56.5	0.281
11	2	37.9	85.0	55.0	0.229
12	2	34.4	86.6	55.5	0.211
13	2	34.4	86.6	55.5	0.211
14	2	31.0	86.6	52.9	0.177
15	2	31.0	86.6	52.9	0.177
16	2	27.5	86.6	50.0	0.142
17	2	24.1	86.6	46.6	0.108
18	2	20.6	86.6	42.8	0.073
4	1	62.0	48.3	36.7	0.104
5	1	58.6	50.0	36.1	0.086
6	1	58.6	55.0	38.6	0.136
7	1	55.1	56.6	38.0	0.118
8	1	55.1	58.3	39.0	0.135
9	1	55.1	58.3	39.0	0.135
10	1	51.7	58.3	37.5	0.100
11	1	48.2	58.3	37.5	0.100
12	1	48.2	60.0	36.8	0.082
13	1	48.2	60.0	36.8	0.082
14	1	48.2	60.0	36.8	0.082
15	1	48.2	60.0	36.8	0.082
16	1	48.2	60.0	36.8	0.082
17	1	48.2	60.0	36.8	0.082
18	1	48.2	60.0	36.8	0.082

BDI, Beck Depression Inventory; MDD, major depressive disorder; PPV, positive predictive value; TQI, two-question case-finding instrument.

We conclude that combined application of BDI and TQI is an efficient way to identify not only workers who are depressed but also those who are likely

to be depressed in the workplace. Although further investigations using larger samples are needed, the BDI and TQI combination is a useful screening

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tool, especially for big companies that have many employees.

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Competing interests None.

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Combination use of Beck Depression Inventory and two-question case-finding instrument as a screening tool for depression in the workplace

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Relationships Between Mental Health Distress and Work-Related Factors Among Prefectural Public Servants Two Months After the Great East Japan Earthquake

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Abstract

Background In times of disaster, public servants face multiple burdens as they engage in a demanding and stressful disaster-response work while managing their own needs caused by the disaster.

Purpose We investigated the effects of work-related factors on the mental health of prefectural public servants working in the area devastated by the Great East Japan Earthquake to identify some ideas for organizational work modifications to protect their mental health.

Methods Two months after the earthquake, Miyagi prefecture conducted a self-administered health survey of prefectural public servants and obtained 4,331 (82.8 %) valid responses. We investigated relationships between mental health distress (defined as $K6 \geq 13$) and work-related variables (i.e., job type, overwork, and working environment) stratified by level of earthquake damage experienced.

Results The proportion of participants with mental health distress was 3.0 % in the group that experienced less damage and 5.9 % in the group that experienced severe damage. In the group that experienced less damage, working >100 h of overtime per month (adjusted odds ratio [OR], 2.06; 95 % confidence interval [CI], 1.11–3.82) and poor workplace

communication (adjusted OR, 10.96; 95 % CI, 6.63–18.09) increased the risk of mental health distress. In the group that experienced severe damage, handling residents' complaints (adjusted OR, 4.79; 95 % CI, 1.55–14.82) and poor workplace communication (adjusted OR, 9.14; 95 % CI, 3.34–24.97) increased the risk, whereas involvement in disaster-related work (adjusted OR, 0.39; 95 % CI, 0.18–0.86) decreased the risk.

Conclusions Workers who have experienced less disaster-related damage might benefit from working fewer overtime hours, and those who have experienced severe damage might benefit from avoiding contact with residents and engaging in disaster-related work. Facilitating workplace communication appeared important for both groups of workers.

Keywords Mental health · Public servants · Disaster-related work · Overwork · Great East Japan Earthquake

Introduction

On March 11, 2011, the Great East Japan Earthquake and tsunami hit the northeastern coast of Japan leaving 18,550 dead or missing [1]. Another 2,688 people died owing to the effects of this disaster [2]. Professionals dispatched to support those affected in the devastated area were highly concerned about the level of exhaustion of local public servants [3, 4]. Disaster exposure, such as bereavement and property damage, is known to adversely affect mental health [5]. In times of disaster, public servants face multiple burdens as they engage in demanding and stressful disaster-response work while managing their own needs caused by the disaster.

Although many studies have investigated the effects of post-disaster work on mental health, these have focused mainly on first responders trained to handle traumatic events, such

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as rescue workers, firefighters, and police [6–8]. The few studies focusing on public servants or company employees other than first responders were conducted among recovery workers such as construction workers, cleanup workers, and municipal workers [9–13], transit workers responding to the 2001 World Trade Center attack [14], or recovery workers involved in later phases of the response to the 2005 Pakistani earthquake [15]. These studies indicated that the mental health of the workers involved was affected by exposure to traumatic events in the course of their work [9, 12–14] or the duration of the work engagement [10, 11, 13], as well as by disaster-related damage experienced, such as losing family members or friends or household goods and property damage [11, 14, 15]. However, most of these studies were conducted several years after the disaster, and they did not consider the synergistic effect of work-related stressors and disaster-related damage on mental health.

In this study, we compiled data from a health survey of prefectural public servants conducted 2 months after the Great East Japan Earthquake, compared the perceived health condition and mental health status of these public servants by level of earthquake damage they experienced, and investigated relationships between work-related variables and mental health stratified by level of earthquake damage experienced. We hypothesized that post-disaster job type, overwork, or working environment might affect the mental health of public servants differently depending on the level of earthquake damage they experienced. We aimed to find some clues about organizational work modifications in the more acute phase of the disaster to assist public servants who experienced severe damage by the earthquake.

Method

Survey

A web-based self-administered health survey was conducted by the Labor Welfare Division of Miyagi prefecture, for all its public servants 2 months after the Great East Japan Earthquake (May 2011). Miyagi prefecture has a population of approximately 2,327,110 [16] and is located on the Pacific side of the northeastern region of mainland Japan. The prefecture was heavily damaged by the earthquake, and more than 10,000 were reported dead or missing [1].

Study Population

The May 2011 survey (the first survey) involved 4,334 (82.8 %) participants among all public servants in the prefecture as of May 2011 ($N=5,233$). From this survey, we included 4,331 (82.8 %) participants in our analysis who had no missing data on mental health distress as measured by the K6

and no missing data for the questions concerning the damage they experienced from the earthquake (i.e., degree of property damage, existence or non-existence of dead or missing family members, and experience of living someplace other than their own house). This study did not include police, firefighters, or teachers because they belonged to a different personnel system.

Study Variables

Damage Caused by the Great East Japan Earthquake

The survey asked about degree of property damage as listed in the official report (i.e., none or minimal, partial collapse, half collapse, or total collapse of the home). As for information on the degree of property damage, we also used data from the October 2011 survey (the second survey), which we conducted in the same manner for the same population as the first survey. Among the 4,334 participants in the first survey, 3,743 (86.4 %) were involved in the second survey, which represented 71.5 % of all public servants in the prefecture as of May 2011. We compared responses on property damage between the first and second surveys among workers who participated in both surveys ($n=3,743$) and found that 1,069 (28.6 %) participants had reported different degrees of property damage. Thus, at the time of the first survey, degree of property damage possibly was not yet certified, or it might have changed by the time of the second survey. Therefore, to enhance data accuracy, we used data from the second survey for participants who responded to both surveys and data from the first survey for participants who did not respond to the second survey.

We also asked for information on dead or missing family members (yes or no) and whether participants were living someplace other than their own house such as a shelter (no; previously, yes; or currently, yes).

Work-Related Variables

Variables representing job type included involvement in disaster-related work (yes or no) and job description (work at a morgue, handling residents' complaints, or other). Variables representing overwork included working more than 100 hours overtime per month (yes or no) and taking 1 day off per week (yes or no). Variables representing working environment included work site (inland area or coastal area) and level of workplace communication (i.e., communication with bosses, colleagues, and subordinates [poor, reasonable, or good]).

Health-Related Variables

We asked for information on subjective physical condition (bad, not so good, as usual, or good), sleep (sleepless, not so

good, good, or excellent), appetite (unchanged, decreased, or increased), and change in alcohol intake (unchanged, decreased, increased, or nondrinker).

Mental health distress was assessed by the K6, a six-item standardized screening instrument of non-specific psychological distress over the past 30 days [17, 18]. Items are rated on a five-point Likert scale from 0 (none) to 4 (all the time), with a summary score ranging from 0 to 24. In this study, mental health distress was defined as a K6 score of ≥ 13 [19].

Demographic Characteristics

We obtained information on gender and age, with age used as a categorical variable divided into four age groups (18–29, 30–39, 40–49, and 50–64 years).

Statistical Analysis

We divided participants into two groups by level of earthquake-related damage experienced: the less damaged group and the severely damaged group. The severe damaged group comprised participants whose homes had half collapsed or totally collapsed, who had a family member(s) who had died or was missing, or who were living someplace other than their own home at the time of the first survey. The less damaged group comprised all other participants.

First, we compared demographic characteristics, work-related variables, and health-related variables between these two groups (chi-square tests). Second, we examined the relationships between mental health distress (K6 ≥ 13) and work-related variables within each group (chi-square tests). Then, for each group, we calculated the adjusted odds ratio (OR) and 95 % confidence interval (CI) for job type, overwork, and level of workplace communication on mental health distress, controlling for gender, age group, and work site using logistic regression analysis.

All statistical analysis was performed using Stata 12.0 for Windows (StataCorp LP, College Station, TX). Statistical significance was set at 0.05, and all tests were two-tailed.

Results

Table 1 shows the level of earthquake-related damage by group, with 667 participants categorized in the severely damaged group and 3,664 participants in the less damaged group. Table 2 shows the demographic characteristics and work-related variables of the study groups. More than three-quarters of all participants were men. No statistical differences in these variables were found between the two groups except for work site. As would be expected, the severely damaged group included more participants who worked in a coastal area.

Table 3 shows the comparison of health condition between the study groups. Severely damaged participants were more likely to perceive their physical condition as not so good or bad, be dissatisfied with their sleep, and have decreased or increased appetite and alcohol intake. Regarding mental health distress, the proportion of participants whose score exceeded the K6 cutoff point of ≥ 13 was larger in the severely damaged group ($n=39$, 5.9 %) than in the less damaged group ($n=111$, 3.0 %).

In the less damaged group, bivariate analysis (chi-square tests) of relationships between demographic characteristics and work-related variables and mental health distress showed that those who were female, in their thirties or forties, worked >100 h overtime per month or did not have good workplace communication were more likely to score ≥ 13 on the K6. As for job type, we found no significant correlations with mental health distress (Table 4). In the severely damaged group, those who were female, not involved in disaster-related work, or who did not have good workplace communication were more likely to have mental health distress. As for overwork, we found no significant correlation with mental health distress (Table 5).

Table 6 shows the results of the logistic regression analysis of the relationship between work-related variables and mental health distress, controlling for gender, age group, and work site in each group. In the less damaged group, working >100 h overtime per month (adjusted OR, 2.06; 95 % CI, 1.11–3.82) and poor workplace communication (adjusted OR, 10.96; 95 % CI, 6.63–18.09) increased the risk of mental health distress. In the severely damaged group, handling residents' complaints (adjusted OR, 4.79; 95 % CI, 1.55–14.82) and poor workplace communication (adjusted OR, 9.14; 95 % CI, 3.34–24.97) increased the risk of mental health distress, and involvement in disaster-related work reduced the risk (adjusted OR, 0.39; 95 % CI, 0.18–0.86).

Discussion

The main findings of this study can be summarized as follows. In the severely damaged group, handling residents' complaints increased the risk of mental health distress, although engagement in disaster-related work decreased the risk. In the less damaged group, working >100 h overtime per month increased the risk. In both groups, poor workplace communication increased the risk.

In the severely damaged group, although job type was related to mental health distress, overwork was not. When responding to a major disaster as part of an organization, disaster-related work might produce a sense of belonging to an organization or society, or a sense of contributing to the disaster response, factors which might be more protective to mental health than reducing overwork, particularly for those