いるのと同時に、耐糖能異常（糖尿病）をもつことが、うつ病のリスクを高めている、と報告されている。

我が国において、大規模震災という甚大なストレス状況下における精神健康状態の変化を記述し、また災害後の精神健康度と震災前の身体的指標との関連を検討した研究はほとんどない。

そこで、平成16年に発生した中越地震後の地域住民の精神健康の震災後3年間の推移を記述する。また、災害後の精神健康の状態と、被災規模や震災前の身体健康指標との関連を検討する。

B．研究方法

1）調査対象者

本健康診査は中越地震発生以前の平成16年4月19日から同年10月2日、震災発生1年後として、平成17年4月18日から同年11月1日、震災発生2年後として平成18年4月17日から同年11月11日、震災発生3年後として平成19年4月16日から同年11月14日に実施された。本健康診査の受診者は、A市の20歳以上の全成人（33,269人、小千谷市全人口41,641人　平成12年国勢調査）のうち、任意で受診を希望したものであり、平成16年が6,851名、平成17年が7,097名、平成18年は6,586名、平成19年は6,696名であった。このうち、震災前の平成16年および震災後3年間すべての健診を受診し、データの照合がとれ欠損値のないもの3,538名を分析の対象とした。2）健康診査の概要

本健康診査は老人保健事業の一つとして、問診、理学的検査、血圧測定、検尿、循環器検査、貧血検査、肝機能検査、腎機能検査、血糖検査及びヘモグロビンA1c検査を行っている。精神健康度を測定するために、A市はこころの健康スクリーニング尺度、K10/6の10項目を震災以降に健診項目として追加した。

3）測定項目

i) 震災後の精神健康度：K10/6

K6は、米国の精神保健に関する地域疫学調査で開発された、精神保健に関するスクリーニング尺度であり、欧米ではその信頼性・妥当性が検証されている。わが国においても、古川らによって日本語版が開発されており、気分障害、不安障害のスクリーニング特性について検討されている（Furukawa, 2008）。

ii) 説明変数

本健康診査の検査項目は広範にわたるが、本研究では、特に以下の領域の変数について検討した。1）地震の影響として、震災規模（被災強、それ以外）、2）社会経済的変数として、性別、年齢、居住地、職業、3）検査データとして身長、体重、Body Mass Index(BMI)、血圧（収縮期、拡張期）、脂質検査、耐糖能検査の検査所見に基づいて検討した。

4）分析方法

分析の主要評価項目は、震災後の精神健康度であり、先行研究に従ってK6の種々のカットオフ値を用いて、震災後3年間にわたる軽度ストレス状態、中程度ストレス状態、重度ストレス状態のものの割合を算出した。これらの精神健康度を指標として、震災規模、および身体健康指標について、その変数の特性に応じてχ^2検定、Fisherの直接確率、t検定を行った。特に被災前の身体健康指標の影響

を検討するために、年齢、震災規模を調整して多変量ロジスティック解析を行った。すべての分析には、STATA Ver10(Collage Station, Tx)を用いた。

なお、本研究は、A市の保健活動を目的に収集した情報の二次解析であり、連結不可能匿名化データを扱った。本研究は国立精神・神経センターの倫理委員会の承認をうけて行った。

C．結果

図表の通り。なお、詳細は別添を参照されたい。

D．考察

K6で中程度ストレス状態とされる10点以上のものは5.4%、5.7%、3.4%と変化した。これら震災1年後のK6による区分の頻度は、Kawakami, et al（2006）による平時の地域住民における頻度よりも低値であった。

災害1年後の精神健康を予測する要因を検討したところ、K6が5点以上、10点以上のいずれにおいても震災規模が大きかったこと、女性であることがそのリスクを高めていた。

K6が10点以上、つまり中程度ストレス相当では、震災前のHbA1cの上昇がリスクとなっていた。

先行研究でも耐糖能異常とうつ病は双方向の関係が指摘されており、特に震災という極度のストレス状況下ではその関係が顕著に表れた可能性がある。

E．結論

中越地震前の健康診査における身体健康指標として、HbA1cは震災1年後の中程度ストレス状態を、BMIが重度ストレス状態は予測していた。

【参考文献】

1) Furukawa TA, Kawakami N, Saitoh M et al: The performance of the Japanese version of the K6 and K10 in the World Mental Health Survey Japan. Int J Methods Psychiatr Res 17: 152-158, 2008.

2) Kawakami N. [Distribution and associated factor of mental health status by K6 in a national survey in Japan]. In: Hashimoto H (ed.), Report on research on statistics and information by the Health and Labour Sciences Research Grants. Tokyo, 2006.

F．研究発表

1．論文発表

2．学会発表

G．知的所有権の取得状況

1．特許取得

2．実用新案登録

3．その他

いずれもなし

表１．中越大震災後の精神健康K6における種々のカットオフポイントの記述統計(n=3,538)

	平成17年		平成18年		平成19年	
	n	%	n	%	n	%
5点以上	827	23.4	712	20.1	639	18.1
10点以上	192	5.4	201	5.7	120	3.4
13点以上	86	2.4	126	3.6	64	1.8
平均（95%CI）	2.8	(2.7-2.9)	2.2	(2.1-2.3)	2.1	(2.0-2.2)

図. 被災規模ごとの中越大震災 1 年後の精神健康得点（K6)の分布 (n=3,538)

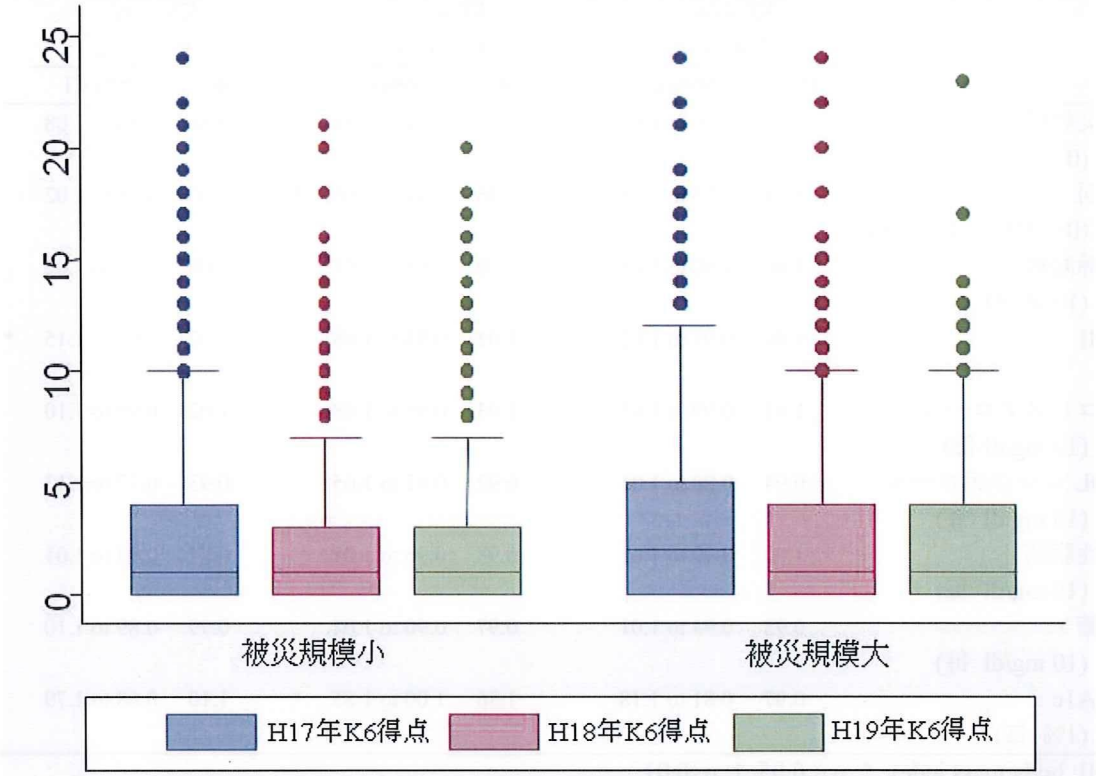

表２．災害１年後の精神健康不良に関するメタボリック関連要因のロジスティック回帰分析の結果（n=3,532)

	K6 score: 5 or above			K6 score: 10 or above			K6 score: 13 or above		
	OR	95% CI		OR	95% CI		OR	95% CI	
震災規模 (0=小、 1=大)	1.36	1.16 to 1.60	†	1.36	1.01 to 1.84	*	0.86	0.86 to 2.08	
性別 (0=男性、 1=女性)	1.38	1.15 to 1.65	†	1.46	1.04 to 2.06	*	1.00	0.98 to 1.02	
年齢階級 (10 歳毎)	1.00	1.00 to 1.01		1.00	0.98 to 1.01		1.00	0.98 to 1.02	
BMI	1.00	0.97 to 1.02		1.03	0.98 to 1.08		1.07	1.01 to 1.15	*
総コレステロール (10 mg/dl 毎)	1.02	0.99 to 1.05		1.03	0.98 to 1.08		1.02	0.95 to 1.10	
HDL コレステロール (10 mg/dl 毎)	0.94	0.88 to 1.01		0.92	0.92 to 1.05		0.93	0.77 to 1.13	
中性脂肪 (10 mg/dl 毎)	1.00	0.99 to 1.01		0.98	0.96 to 1.01		0.97	0.93 to 1.01	
血糖 (10 mg/dl 毎)	0.98	0.94 to 1.01		0.97	0.90 to 1.04		0.99	0.89 to 1.10	
HbA1c (1% 毎)	0.97	0.81 to 1.18		1.36	1.00 to 1.85	*	1.10	0.68 to 1.79	

BMI: body mass index, *: $p < 0.05$, †: $p<0.01$

別添. 震災前の身体健康指標を用いた中越地震後の心理的ストレスの予測因子の検討

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Abstract

This study examined how pre-event physical health indicators predicted psychological distress through the experience of the Niigata-Chuetsu earthquake in Japan, given the fact of known interaction between physical and mental health. Among the participants of community health check-ups before and for three consecutive years after the earthquake, various physical indicators were analyzed to predict later psychological distress assessed by the Kessler 6 (K6) scale. Among participants with complete dataset (n = 3,538), the proportion of mild psychological distress defined as score on the K6 of >/= 5 decreased from 23.4%, to 20.1% and then to 18.1% consecutively in the subsequent years. At a moderate level of psychological distress defined as a K6 score of >/= 10, the proportion showed no consistent decreases, at 5.4%, 5.7%, and 3.4%, over the same period. The significant predictors of those with moderate psychological distress one year post disaster were severity of disaster damage (OR: 1.36; 95%CI: 1.01 to 1.84), being female (OR: 1.46; 95%CI: 1.04 to 2.06), and level of HbA1c (OR: 1.36; 95%CI: 1.00 to 1.85). Among the pre-event physical indicators, the level of HbA1c, prior to the disaster predicted moderate, but not mild or severe psychological distress after the earthquake.

Key words: Disasters, Mental health, Prevalence, Risk factors, Hyperglycemia,

I. Introduction

Extensive research has explored a range of possible risk factors in attempts to identify those with increased likelihood of significant psychological distress after major disasters [24]. Additionally, much work has been done to explore the impacts of broader socioeconomic [27], and psychosocial factors [4], as well as event exposure [30]. However, surprisingly limited attention has been paid to physical indicators [31], even though empirical evidence shows the close interplay between physical and mental health even at the time of non-disaster as described below. In Japan, physical health indicators, which are available at community or employment health check-up program, can be a valuable source of reference to identify those at risk of poor mental health after disaster exposure. The use of such existing information should be examined as it may advantageous in determining appropriate health support during and after disaster events.

A coherent body of research has been amassed on the relationship between mental health and physical diseases, such as cardiovascular disease (CVD) and diabetes [19, 26, 29]. Among these studies, depression, or negative emotion is consistently reported to predict incidence of CVD independently of other identified biological and behavioral risk factors [13, 23]. Another perspective on the link between physical and mental health is illustrated by research showing that diabetes may increase risk of the development of depression [21], although the inverse association is also reported [5]. Thus far, the relationship between physical illness and mental health has been examined with specific mental disorder diagnoses as an outcome, with other individual risk factors, such as blood pressure, glucose tolerance being controlled as covariates. There remains a knowledge gap concerning the direct relationship between individual disease-related risk factors and poor mental health, which requires further exploration.

Some research suggests that individual risk factors of physical disease, such as fasting blood glucose, or blood pressure are better predictors of mortality than clusters of risk factors [22]. One may speculate whether this relationship may also extend to predict psychological distress, given the fact that there is a body of research suggesting the interaction of physical and mental disorders. Previous studies have examined physical risk factors for depressive symptoms, specifically C-

reactive protein, blood cell counts, fibrinogen, to explore the role of inflammatory markers [6, 18], and obesity [28]. However, systematic investigations of traditional cardiovascular and diabetic risk factors and their predictive influence over psychological distress are relatively scarce [20] and still remains to be examined.

Natural disasters, especially major earthquakes, can happen unexpectedly, causing serious material, physical and psychological damage to people in the affected area and the resources that they would usually have access to. On October 23, 2004, the central Niigata region in Japan experienced a major earthquake, the *Niigata-Chuetsu earthquake*, of a magnitude of 6.8 on the Richter scale. The earthquake resulted in 68 deaths, more than 4,700 injuries, and over 120,000 reports of house damage. This event represented an opportunity to examine the impact of pre-disaster physical health indicator on mental health outcome following the disaster, utilizing the readily available health check-up data already collected in the community.

The present study examines the physical health indicators prior to the event in an exploration as to whether or not they may predict post-disaster psychological distress. The study utilises data collected during the physical check-up program in the community which was implemented before, and for three consecutive years after the earthquake. The primary interest was: 1) to describe long-term course of psychological distress after an earthquake at population level, and 2) to examine whether risk factors for CVD and diabetes have impacts on psychological distress under different degrees of disaster-related stress. Specifically, this study aims to test a hypothesis that low glucose tolerance and/or hypertension predicts increased risk for significantly higher levels of reported psychological distress under the extremely stressful condition of experiencing a severe earthquake.

II. Methods

1. Study participants

The annual health check-up program had been organized by a local health authority of Ojiya City, Niigata prefecture, Japan, where a major earthquake struck in 2004. The program had

been implemented between April and October each year. In the years following the earthquake, the health check-up was conducted in the same period between 2005 and 2007. Among 33,269 adults in the city (Japanese Census, 2000; http://www.e-stat.go.jp), the number of participants for the check-up was 6,851 in 2004, 7,097 in 2005, 6,586 in 2006, and 6,696 in 2007. Of 32,743 eligible for the program, the coverage rate of the health check-up was 20.1%. The dataset used for our analysis included participants who attended all check-ups for four consecutive years without missing data. This afforded 3,538 observations (or 10.6%) of the eligible adult population for the year 2007. This over-represents older people (65 years and older, n=1711, 48.4%), which reflects the nature of community check-up program in Japan. The participants were followed over the period with anonymous identifiers.

2. Mental health indicators

Assessment of psychological distress by K6 was added to the check-up program after the disaster. The participants' level of non-specific psychological distress during the past 30 days was assessed with Kessler's K6 scale [15], which was found to show superior screening capacity and greater robustness against subsample variations [7]. The response option is 0 to 4, with higher score values indicating poorer mental health status. Due to its brevity, the K6 is now being used in community surveys in non-disaster settings as well as disaster settings, such as in the aftermath of the Hurricane Katrina [9]. The psychometric properties as a screener of mental disorders of the Japanese version of K6 have been empirically confirmed [8]. Despite the continuing argument that the accuracy of the predictive value of a screener depends on multiple factors, (chiefly the prevalence of the case in the sample [11], based on the reason that we had no prevalence data for a Japanese community post disaster, we chose to use the K6 with the following cutoff points; participants who scored 5 and above, 10 and above, and 13 and above on the K6 were categorised as having "mild", "moderate" and "severe" psychological distress, respectively according to the previous analysis of Japanese national data [14].

3. Physical health indicators

The participant information used in this study was primarily derived from laboratory data collected during the health check-ups before and after the earthquake. Measurements for physical health taken in 2004 of body mass index (BMI), blood pressure, systolic blood pressure (SBP), diastolic blood pressure (DBP), and other laboratory data for total cholesterol, HDL-cholesterol, triglyceride, glucose, and HbA1c, which indicates blood glucose level during the previous 2 to 3 month, were used for the analysis. In considering the predictive use of such indicators at a time of disaster, data for the pre-disaster period in 2004 were incorporated into the analysis.

4. Disaster-related damage indicators

The severity of disaster damage was categorised according to the Japanese disaster damage registration guidelines conventionally used in compensation for building damage. The local municipal authority registers building damage in five categories (1 = none; 5 = total collapse). In this study, the level of disaster damage was dichotomously re-coded, i.e., an area where the number of buildings with half-collapse or greater damage (coded as 3 or higher) exceeded its average proportion in the city was coded as a "severely damaged area," and other areas as a "less severely damaged area." Other basic demographic characteristics including age, sex, employment status, as well as health-related behaviors (such as daily alcohol intake and smoking habits) were also examined.

This study is a secondary analysis of anonymous administrative data. All procedures of the present study were approved by the Ethics Committee of the National Center of Neurology and Psychiatry, Japan.

5. Statistical Analysis

In order to examine the change of diffident psychological distress level over three years, and to identify physical indicator which is possibly indicative of psychological distress level, first, we described changes in mental health status using different cutoffs of K6 over the three years. In the following analysis, the relative influence of age, sex, employment status, daily alcohol intake, smoking habits, and severity of disaster damage were compared for those with moderate psychological distress on the K6 in 2005. Second, inter-group comparisons of pre-disaster physical

health indicators were made between those with low and moderate level of psychological distress. Finally, a logistic regression analysis was performed to examine the ability of pre-disaster physical health variables to predict level of psychological distress one year after the earthquake. From previous studies, being female and experiencing severe disaster damage are consistently reported as strong predicators for poor mental health [1, 25]. These factors were thus added to our model. All statistical analyses were conducted with STATA Ver10.0 (College Station, TX), and statistical significance was determined at $p < 0.05$.

III. Results

Of the 3,538 subjects with complete follow-up data over the four consecutive years, the proportion of psychological distress in those scoring 5 or above on the K6 decreased over time, from 23.4% in 2005 (one year after the earthquake) to 20.1% in 2006 and 18.1% in 2007. At moderate and severe level of psychological distress, the proportion in those scoring 10 and above, and 13 and above on K6 showed no consistent decreases over the period. The corresponding proportions are 5.4%, 5.7%, and 3.4% for scores of 10 and above, and 2.4%, 3.6%, and 1.8% for scores of 13 and above.

In the first analysis, we focused on clarifying the link between mental health outcome one year after the event and pre-disaster variables. We found that those with moderate psychological distress were more likely to be female. In terms of health-related behaviors, those with moderate levels of psychological distress were less likely to drink alcohol daily compared with their counterparts with better mental health ($p=0.04$). However, no trend was found for smoking habits (Table 1).

In Table 2, physical health indicators before the earthquake were compared between those with moderate level of psychological distress post-disaster and the other groups. Among participants who reported moderate level of psychological distress, total pre-disaster cholesterol level was marginally higher ($p=0.07$), and HbA1c level was significantly higher ($p=0.05$) than that in those with better mental health. There were no notable differences in other physical indicators

examined during the health check-up. Similar analyses were conducted using mild and severe psychological groups respectively; however, no difference was found for examined physical health indicators. In multivariate analysis, the predictors for mild psychological distress (a score of 5 and above on the K6) more than one year after the disaster were severity of disaster damage (OR: 1.36; 95%CI: 1.16 to 1.60; $p < 0.001$), and being female (OR: 1.38; 95%CI: 1.15 to 1.65; $p < 0.001$). However, the predictors for moderate psychological distress (a score of 10 and above on the K6) were severity of disaster damage (OR: 1.36, 95%CI: 1.01 to 1.84, p=0.043), being female (OR: 1.46, 95%CI: 1.04 to 2.06, p=0.031), and the additional significant predictor of HbA1c level (OR: 1.36, 95%CI: 1.00 to 1.85, p=0.048), as shown in Table 3. The analysis to identify risk factor for severe psychological distress found that only BMI was found to increase the risk at statistically significant level.

IV. Discussion

This study sought to characterise changes in mental health status after a severe earthquake with a sample of participants of municipal health- check-ups, and to examine the possible relationships between mental and pre-event physical health indicators. The study revealed an improving trend of the study population as the group of those reporting mild symptoms grew smaller over time. The decrease in reports of mild levels of psychological distress over time was different from patterns found at the moderate and severe level, where the proportions of psychological distress in those with K6 scores exceeding the cutoff of 10 and above or 13 and above remained relatively stable.

Comparison with other studies

In this study, the reported proportions of psychological distress for those who were above the three different cutoff values were even lower than that in a study conducted in a non-disaster setting in Japan, where the proportions of psychological distress in those above the cutoff values were 27.5% for a score of 5 or above, 8.7% for a score of 10 or above, and 3.0% for a score of 13 or above on the K6 [14]. Considering the self-selected nature of the sample of the present study, presumably, the participants are more likely to be health-conscious and healthy individuals.

Therefore, the proportion of reported psychological distress would not be expected to be particularly high, although there were no data prior to the event available to confirm this interpretation. Because of the voluntary nature of the health check-up program, those who had pre-disaster mental health problems, which is reported as a significant risk factor for poor mental health after a disaster [2, 16], may have not participated in the program. Taking these possible interpretations into account, it is possible that the number of those with significant levels of psychological distress in the present study may have been underestimated.

The finding that being female predicted poor mental health more than one year after the severe earthquake is consistent with previously reported correlates of poor post-disaster mental health. It is noteworthy that low glucose tolerance, determined by higher HbA1c levels, was found to predict higher levels of psychological distress, which is consistent with a body of research reporting that lower glucose tolerance has a negative effect on mental health [12, 21]. It is possible that a disaster and the subsequent stressful living situation may aggravate the effects of low glucose tolerance. However, due to a lack of mental health status indicators prior to the earthquake, further research on the flow of this causal relationship is warranted. Interestingly, increase of BMI was the only indicator to predict severe level of psychological distress, and a similar finding was reported in prospective cohort study of Norway [3]. The detailed mechanism is unclear and the mechanism should be scrutinized by a possibility that increased weight has effects on physical activity and mood. Unlike the finding in mild and moderate level, the severity of disaster damage and being female did not increased the risk for this specific category, suggesting that the nature of severe level of psychological distress may differ from that of mild and moderate level of distress in light of disaster effects. It is also noteworthy that the effect of HbA1c on severe level of psychological distress was not found in the analysis. It is likely that the role of glucose tolerance requires careful interpretation and further examination concerning its link with differing levels of psychological distress.

Strengths and weaknesses

Long-term follow-up performed annually at population level after a natural disaster is

infrequent in disaster mental health research. Our results contribute to the existing literature in which physical health has been examined in relation to past history and current illness [32], and specific genotype such as the 5-HTTLPR gene [17]. In addition, to our knowledge, the investigation of an association between mental health and physical health status using laboratory data has been very limited. We took advantage of the fact that Japanese adults undergo annual health check-ups as part of their community or employment health program, and that glucose tolerability, as measured by levels of HbA1c, is one of the essential health indicators tested. Therefore, our data on physical health, which included HbA1c, were readily available and afforded valuable insights into the possible range of links between mental health and physical health for community residents.

In interpreting the results, caution is needed based on the following limitations in addition to the biased sample described earlier. The information on pre-disaster mental health was not available, and as such it was not possible to fully evaluate the extent of the earthquake's impact on mental health status. These limitations are inherent to disaster mental health research up to the present date [10]. Nevertheless, the results obtained without such prior information suggest that participants with a higher HbA1c level were at increased risk for moderate psychological distress. Such a finding has practical implications for general and mental health management at the time of a disaster.

Finally, for practical reasons, this study used the K6 as a key assessment instrument, which can be considered a screening scale that is less precise than the use of clinical interviews. Nonetheless, from a public health perspective where trade-offs have to be made between precision and time taken to gather data, it is more practical to gauge mental health status through a screening measures such as the K6, rather than by specific diagnosis of mental disorders through clinical interview.

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References

1) Başoğlu M, Salcioğlu E, Livanou M: Traumatic stress responses in earthquake survivors in Turkey. J Trauma Stress 15: 269-276, 2002.
2) Başoğlu M, Kiliç C, Salcioğlu E et al: Prevalence of posttraumatic stress disorder and comorbid depression in earthquake survivors in Turkey: an epidemiological study. J Trauma Stress17: 133-141, 2004.
3) Bjerkeset O, Romundstad P, Evans J et al: Association of adult body mass index and height with anxiety, depression, and suicide in the general population: the HUNT study. Am J Epidemiol 167: 193-202, 2008.
4) Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. J Consult Clin Psychol 68: 748-766, 2000.
5) Das-Munshi J, Stewart R, Ismail K et al: Diabetes, common mental disorders, and disability: findings from the UK National Psychiatric Morbidity Survey. Psychosom Med 69: 543-550, 2007.
6) Doulalas AD, Rallidis LS, Gialernios T et al: Association of depressive symptoms with coagulation factors in young healthy individuals. Atherosclerosis 186: 121-125, 2006.
7) Furukawa TA, Kessler RC, Slade T et al: The performance of the K6 and K10 screening scales for psychological distress in the Australian National Survey of Mental Health and Well-Being. Psychol Med 33: 357-362, 2003.
8) Furukawa TA, Kawakami N, Saitoh M et al: The performance of the Japanese version of the K6 and K10 in the World Mental Health Survey Japan. Int J Methods Psychiatr Res 17: 152-158, 2008.
9) Galea S, Brewin CR, Gruber M et al: Exposure to hurricane-related stressors and mental illness after Hurricane Katrina. Arch Gen Psychiatry 64: 1427-1434, 2007.
10) Galea S, Maxwell AR, Norris F. Sampling and design challenges in studying the mental health consequences of disasters. Int J Methods Psychiatr Res 17 Suppl 2: S21-28, 2008.
11) Goldberg DP, Oldehinkel T, Ormel J. Why GHQ threshold varies from one place to another. Psychol Med 28: 915-921, 1998.
12) Golden SH, Williams JE, Ford DE et al: Depressive symptoms and the risk of type 2 diabetes: the Atherosclerosis Risk in Communities study. Diabetes Care 27: 429-435, 2004.
13) Hamer M, Molloy GJ, Stamatakis E. Psychological distress as a risk factor for cardiovascular events: pathophysiological and behavioral mechanisms. J Am Coll Cardiol 52: 2156-2162, 2008.
14) Kawakami N. [Distribution and associated factor of mental health status by K6 in a national survey in Japan]. In: Hashimoto H (ed.), Report on research on statistics and information by the Health and Labour Sciences Research Grants. Tokyo, 2006.
15) Kessler RC, Andrews G, Colpe LJ et al: Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med 32: 959-976, 2002.
16) Kilic C, Ulusoy M: Psychological effects of the November 1999 earthquake in Turkey: an epidemiological study. Acta Psychiatr Scand 108: 232-238, 2003.
17) Kilpatrick DG, Koenen KC, Ruggiero KJ et al: The serotonin transporter genotype and social support and moderation of posttraumatic stress disorder and depression in hurricane-exposed adults. Am J Psychiatry 164: 1693-1699, 2007.
18) Kop WJ, Gottdiener JS, Tangen CM et al: Inflammation and coagulation factors in persons > 65 years of age with symptoms of depression but without evidence of myocardial ischemia. Am J Cardiol 89: 419-424, 2002.
19) Kubzansky LD, Koenen KC, Spiro A 3rd et al: Prospective study of posttraumatic stress disorder symptoms and coronary heart disease in the Normative Aging Study. Arch Gen Psychiatry 64: 109-116, 2007.
20) Luijendijk HJ, Stricker BH, Hofman A et al: Cerebrovascular risk factors and incident depression in community-dwelling elderly. Acta Psychiatr Scand 118: 139-148, 2008.
21) Mezuk B, Eaton WW, Albrecht S et al: Depression and type 2 diabetes over the lifespan: a

meta-analysis. Diabetes Care 31: 2383-2390, 2008.
22) Mozaffarian D, Kamineni A, Prineas RJ et al: Metabolic syndrome and mortality in older adults: the Cardiovascular Health Study. Arch Intern Med 168: 969-978, 2008.
23) Nabi H, Kivimaki M, De Vogli R et al: Positive and negative affect and risk of coronary heart disease: Whitehall II prospective cohort study. BMJ 337: a118, 2008.
24) Norris FH, Friedman MJ, Watson PJ et al: 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981-2001. Psychiatry 65: 207-239, 2002.
25) Parslow RA, Jorm AF, Christensen H. Associations of pre-trauma attributes and trauma exposure with screening positive for PTSD: analysis of a community-based study of 2,085 young adults. Psychol Med 36: 387-395, 2006.
26) Prince M, Patel V, Saxena S et al: No health without mental health. Lancet 370: 859-877, 2007.
27) Seplaki CL, Goldman N, Weinstein M et al: Before and after the 1999 Chi-Chi earthquake: traumatic events and depressive symptoms in an older population. Soc Sci Med 62: 3121-3132, 2006.
28) Simon GE, Von Korff M, Saunders K et al: Association between obesity and psychiatric disorders in the US adult population. Arch Gen Psychiatry 63: 824-830, 2006.
29) Stansfeld SA, Fuhrer R, Shipley MJ et al: Psychological distress as a risk factor for coronary heart disease in the Whitehall II Study. Int J Epidemiol 31: 248-255, 2002.
30) Sumer N, Karanci AN, Berument SK et al: Personal resources, coping self-efficacy, and quake exposure as predictors of psychological distress following the 1999 earthquake in Turkey. J Trauma Stress 18: 331-342, 2005.
31) Trevisan M, O'Leary E, Farinaro E et al: Short- and long-term association between uric acid and a natural disaster. Psychosom Med 59: 109-113, 1997.
32) Van Kamp I, van der Velden PG, Stellato RK et al: Physical and mental health shortly after a disaster: first results from the Enschede firework disaster study. Eur J Public Health 16: 253-259, 2006.

Table 1. Comparison of basic characteristics, disaster damage, and health-related behaviors between those with good mental health status and those with moderate psychological distress in one year after the Niigata-Chuetsu earthquake (n = 3,538)

		K6 score: less than 10		K6 score: 10 or above			
		n	%	n	%	χ^2/t-test	
		3,346		192			
Sex							
	Female	2,186	65.3	143	74.5	6.8	*
Mean age	(95%CI)	57.2	56.7 to 57.7	56.7	54.8 to 58.6	0.5	
Employment status							
	Employed	1,463	43.7	75	39.1	3.1	
	Housewives	1,442	43.1	95	51		
	Unemployed	395	11.8	20	10.4		
	Unclassified	46	1.4	2	1		
Disaster damage							
	Severe	1,119	33.4	77	40.1	3.6	
Daily alcohol intake							
	Yes	882	26.5	37	19.6	4.5	*
Smoking habit							
	Yes	464	14	20	10.6	1.7	

*: $p < 0.05$

Table 2. Comparison of pre-disaster physical health indicators between those with good mental health status and those with moderate psychological distress at one year after the earthquake (n = 3,538)

	K6 score: less than 10		K6 score: 10 or above		
	Mean	95% CI	Mean	95% CI	t-test
BMI (kg/m^2)	23.0	22.9 to 22.9	23.0	22.9 to 23.9	-1.472
SBP (mmHg)	128.5	127.9 to 129.2	128.6	126.0 to 131.2	-0.062
DBP (mmHg)	72.5	72.2 to 72.9	72.4	70.9 to 74.0	0.115
T cholesterol (mg/dl)	202.8	201.7 to 203.9	206.5	201.8 to 211.1	-1.486
HDL cholesterol (mg/dl)	62.0	61.5 to 61.5	61.3	59.0 to 63.2	0.681
Triglyceride (mg/dl)	124.1	121.5 to 126.7	122.0	112.2 to 131.7	0.385
Glucose (mg/dl)	105.7	104.9 to 106.6	104.8	100.9 to 108.6	0.535
HbA1c (%)	5.1	5.1 to 5.1	5.2	5.1 to 5.3	-2.004*

BMI: body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure
*: $p < 0.05$

Table3. Results of logistic regression model for predicting mild, moderate and severe psychological distress one year after the earthquake in relation to physical health indicators prior to the earthquake (n = 3,532)

	K6 score: 5 or above		K6 score: 10 or above		K6 score: 13 or above	
	OR	95% CI	OR	95% CI	OR	95% CI
Severity of disaster damage (0 = non-severe, 1 = severe)	1.36	1.16 to 1.60 †	1.36	1.01 to 1.84 *	0.86	0.86 to 2.08
Sex (0 = male, 1 = female)	1.38	1.15 to 1.65 †	1.46	1.04 to 2.06 *	1.00	0.98 to 1.02
Age group (in 10-year age groups)	1.00	1.00 to 1.01	1.00	0.98 to 1.01	1.00	0.98 to 1.02
BMI (in 1unit groups)	1.00	0.97 to 1.02	1.03	0.98 to 1.08	1.07	1.01 to 1.15 *
Total cholesterol (in 10-mg/dl groups)	1.02	0.99 to 1.05	1.03	0.98 to 1.08	1.02	0.95 to 1.10
HDL cholesterol (in 10-mg/dl groups)	0.94	0.88 to 1.01	0.92	0.92 to 1.05	0.93	0.77 to 1.13
Triglyceride (in 10-mg/dl groups)	1.00	0.99 to 1.01	0.98	0.96 to 1.01	0.97	0.93 to 1.01
Glucose (in 10-mg/dl groups)	0.98	0.94 to 1.01	0.97	0.90 to 1.04	0.99	0.89 to 1.10
HbA1c (in 1% increments)	0.97	0.81 to 1.18	1.36	1.00 to 1.85 *	1.10	0.68 to 1.79

BMI: body mass index

*: $p < 0.05$, †: $p<0.01$