

Table 3. Characteristics of psychiatric treatment during the year prior to death *n* = 38

	Whole <i>n</i> = 38	Men <i>n</i> = 22	Women <i>n</i> = 16
Period from the final consultation to suicide			
Within 5 days (hospitalized patients are included)	17 (44.7%)	11 (50.0%)	6 (37.5%)
Within 1 month	18 (47.4%)	8 (36.4%)	10 (62.5%)
Within 3 months	2 (5.3%)	2 (9.1%)	0
Unknown	1 (2.6%)	1 (4.5%)	0
Mean day of the period from the final consultation to suicide (days)	21.3 (SD = 53.7)	30.1 (SD = 70.6)	10.0 (SD = 10.5)
Duration of psychiatric treatment			
Initial consultation only	2 (5.3%)	1 (4.5%)	1 (6.3%)
Less than 1 year	5 (13.2%)	3 (13.6%)	2 (12.5%)
1–5 years	11 (28.9%)	4 (18.2%)	7 (43.8%)
More than 5 years	14 (36.8%)	11 (50.0%)	3 (18.8%)
Unknown	6 (15.8%)	3 (13.6%)	3 (18.8%)
Medication during the year prior to death	30 (78.9%)	18 (81.8%)	12 (75.0%)
Treatment interruptions and/or drug discontinuation during the year prior to death	8 (21.1%)	5 (22.7%)	3 (18.8%)
Therapeutic effect during the year prior to death			
Improved	10 (26.3%)	6 (27.3%)	4 (25.0%)
Stable	2 (5.3%)	0	2 (12.5%)
Unchanged	7 (18.4%)	5 (22.7%)	2 (12.5%)
Got worse	17 (44.7%)	10 (45.5%)	7 (43.8%)
Unknown	2 (5.3%)	1 (4.5%)	1 (6.3%)
Hospitalization to a psychiatric ward during the year prior to death	7 (18.4%)	2 (9.1%)	3 (18.8%)

We speculate that the present findings may reflect the particular characteristics of suicide completers in the populated area in Japan, as both samples of our study and the two previous studies were biased to those in the populated area, including Tokyo. In Japan, the number of psychiatric clinics in big cities has increased in recent years, almost doubling in the metropolitan area in the past decade or so.¹⁷ Our findings may indicate that accessibility to psychiatric treatment has improved in the populated area in Japan.

Incidentally, the distribution of mental disorder diagnosis in our sample was at least partially consistent with reports from other countries. However, the proportion of mood disorders and schizophrenia in our study was slightly higher than those in several Western studies, while the proportions of substance-related disorders and personality disorders were relatively low compared with the other countries.⁵ On the basis of the current data, we cannot draw firm conclusions about whether the subtle differences in diagnostic distribution were caused by differences in national characteristics or psychiatrists' diagnostic abilities.

2. Characteristics of suicides within 1 year of contact with mental health professionals

The results of the present study revealed that age at the time of death was significantly lower in the treatment group than the untreated group. This may be largely explained by reduced hesitation among younger people to consult psychiatrists, related to the recent implementation of education directed towards reducing stigma.¹⁸

The estimation of psychiatric diagnoses of suicide completers revealed that individuals in the treatment group were more frequently diagnosed with schizophrenia compared to the untreated group. In addition to disorders related to depression and alcohol use, schizophrenia is reported to be closely related to suicide,^{19,20} raising the suicide risk more than eight times.²¹

Nevertheless, predicting suicide among schizophrenic patients remains extremely difficult. Previous studies reported that approximately 90% of suicide completers with schizophrenia were receiving psychiatric treatment at the time of death.²² This suggests that routinely assessing suicide risk among schizo-

Table 4. Comparison between men and women in psychiatric treatment group $n = 38$

		Men $n = 22$	Women $n = 16$
Sociodemographic data	Mean age (years)**	41.7 (SD 13.1)	30.1 (SD 12.3)
	Age group*		
	Youth (≤ 39)	11 (50.0%)	14 (87.5%)
	Middle (40–59)	10 (45.5%)	1 (6.3%)
	Aged (≥ 60)	1 (4.5%)	1 (6.3%)
Medical data	Employed	15 (68.2%)	6 (37.5%)
	Drug overdose at the time of the death	14 (63.6%)	8 (50.0%)
	Prescription medicine: psychotropic drugs	12 (54.5%)	7 (43.8%)
	(The following choices were multiple answer)		
	Sleeping drug	9 (40.9%)	6 (37.5%)
	Antipsychotic drug	4 (18.2%)	3 (18.8%)
	Stabilizer	5 (22.7%)	1 (6.3%)
Psychosocial data	Antidepressive drug	4 (18.2%)	4 (25.0%)
	Experiences of self-harming behavior and non-fatal attempted suicide**	7 (31.8%)	13 (81.3%)
	Experience of marriage	13 (59.1%)	4 (25.0%)
	Job change during the year prior to death	4 (18.2%)	5 (31.1%)
	Administrative leave during the year prior to death	5 (22.7%)	1 (6.3%)
	Unmanageable debt during the year prior to death*	4 (18.2%)	0
Psychiatric diagnosis†	Substance-related disorders	5 (22.7%)	1 (6.7%)
	Schizophrenia	4 (18.2%)	3 (20.0%)
	Mood disorders	15 (68.2%)	12 (80.0%)
	Anxiety disorders	5 (22.7%)	2 (13.3%)
	Personality disorders	3 (13.6%)	2 (13.3%)

* $P < 0.05$, ** $P < 0.01$.

†A subject may have more than one mental disorder.

phrenic patients may be required for suicide prevention, even if the psychiatric symptoms appear stable and under control.

On the other hand, the present results revealed that untreated suicide completers were more frequently diagnosed with adjustment disorder than those that were treated. Suicide completers in the untreated group were found to more frequently suffer from social problems, such as unemployment or economic distress, compared to those in the treatment group, indicating that the mental health problems resulting in suicide in these cases might have been connected with social difficulties. Consequently, the mental health status of untreated suicide completers before suicide may be more frequently diagnosed as an adjustment disorder.

In the present study, over half of the suicide completers in the treatment group overdosed on psychotropic drugs that were prescribed by a psychiatrist as

part of their treatment at the time of death. Overdosing on psychotropic drugs is a less-lethal method of self-injury relative to hanging or jumping from a height.²³ However, the pharmacological effects of overdose with psychotropic drugs may cause disinhibition and an increase in impulsive behavior, promoting other fatal suicidal behavior.²⁴ Our findings suggest that psychiatrists should prescribe psychotropic drugs more carefully to young patients.

Additionally, a disproportionate number of women in the treatment group had histories of self-harm and attempted suicide. These self-destructive behaviors are well known as important risk factors for suicide. Establishing an assessment of suicide risk in young female patients engaging in non-lethal self-harming behavior, and developing treatment systems for young women may be important in psychiatric practice, although such patients are likely to elicit negative reactions from mental health professionals.^{25,26}

In our study, approximately 90% of suicide completers who received psychiatric treatment had consulted a psychiatrist in the month before suicide, and many cases in the treatment group were receiving regular psychiatric pharmacotherapy. These results suggest that an additional psychosocial intervention or support may be required as well as pharmacotherapy, to control the abuse of prescribed psychotropic drugs and prevent such patients from committing suicide.

3. Problems and suggestions for suicide prevention

The most important finding of the present study was that suicide completers receiving psychiatric treatment were typically aged in their 20s and 30s. In Japan, recent countermeasures for suicide prevention have included education focusing on reducing the stigma associated with mental health disorders, leading to an increase in the rate of psychiatric consultation. However, our findings suggest that necessary strategies are countermeasures for prescribed drug misuse on young adult patients as well as promotion of psychiatric consultation.

Suicide prevention among young adults with psychiatric treatment provides a future target of suicide countermeasures in Japan, as the number of suicides among people in their 20s and 30s has markedly increased within the current decade, whereas rates of suicide among middle- and older age groups have decreased since 2005.⁹ Based on the current findings, we propose three strategies to prevent young adults from committing suicide, as follows.

First, a strategy focusing on schizophrenia as well as depression is required. This proposal has already been specified in the partial revision of the 'Comprehensive Suicide Prevention Initiative' (October, 2008), stating a goal of 'promoting countermeasures for the high-risk person of suicide with mental disorders other than depression, including schizophrenia,' although concrete strategies have not been proposed.

Second, a strategy for preventing the abuse of prescribed psychotropic drugs is required. According to several recent studies, the number of patients transported to emergency medical units after attempting suicide by overdosing on psychotropic drugs has increased steadily in the last several years.²⁷ The long-term prescription of some psychotropic drugs was permitted by revisions to government policies in 2008 in Japan. We suspect that this change may have

influenced the increase in rates of abuse and overdose involving psychotropic drugs, as well as forged prescriptions and illegal acquisition of drugs via the Internet. The UK government has regulated access to some over-the-counter drugs (e.g. acetaminophen), resulting in a decrease in the rate of youth suicides.²⁸ This suggests that controlling access to drugs that have the potential to be abused with suicidal intent may be an effective countermeasure.

Finally, the development of appropriate treatment for self-harming behavior frequently exhibited by young female patients is required. According to the suicide statistics of the National Police Agency, the history of attempted suicide before death is most common in cases aged in their 20s, and the rate of suicide attempts in girls and women is high in all age groups. Some medical professionals may be inclined to negatively interpret 'low-lethality' self-harm behaviors, such as overdosing and self-cutting, as manipulative behaviors. Such attitudes among medical professionals may result in the underestimation of the suicide risk associated with these behaviors. Education focused on overcoming negative attitudes among medical professionals toward self-harming patients is required.

4. Limitations

Our study involved four main limitations. First, the sample size was relatively small. Although cooperating local government agencies publicized our study in the catchment community, it was difficult to recruit the bereaved participating in this study. One possible reason is that social prejudice against suicide may have reduced their motivation to participate. Second, the sample representation may have been biased, as subjects were limited to suicide completers whose bereaved consented to participate in our study, among those who accessed the survivor support provided by MHCW. We speculate that bereaved who disapproved of or distrusted psychiatric care for suicides may have been more likely to participate in our study. Thus, we cannot deny the possibility the sample constituted a high encounter rate group. Moreover, suicide completers who had lived alone were excluded from our sample, and the information source was limited to only one family member of the suicide completers. Third, an effect of recall bias among the bereaved informers cannot be entirely excluded because of the retrospective data collection method.

Finally, our study lacked a control group. However, the psychosocial characteristics of suicide completers with access to psychiatric treatment examined in the present study, who tended to be younger adults, women, and patients suffering from schizophrenia, are in accord with the characteristics of the individuals reported to be most inclined to undertake help-seeking behavior.²⁹ Accordingly, a comparative study using a control group consisting of alive individuals receiving psychiatric treatment is required.

Despite these limitations, the current study is valuable in providing the first research in Japan to use a psychological autopsy method to clarify the clinical characteristics of suicide completers receiving psychiatric treatment before death compared with those who received no psychiatric treatment. Our findings may thus be useful for developing suicide prevention strategies for psychiatric patients. In future, a comparative study using a control group matched for age, sex, and area of residence will be required to identify risk factors for suicide among individuals receiving psychiatric treatment.

Conclusion

The present study examined suicide completers receiving psychiatric treatment within the year prior to death using a psychological autopsy method. We found that a relatively high number of young adults were receiving psychiatric treatment before suicide. Our results revealed that many of the suicides among the treatment group involved overdose with psychotropic drugs at the time of death, and prior experience of self-harm. Additionally, treated cases were more frequently diagnosed with schizophrenia than untreated cases. Our findings thus indicate the necessity of revised strategies for suicide prevention in the future. Detailed investigation of actual suicide situations involving individuals with schizophrenia, controlling inappropriate access to prescribed drugs, and education for medical professionals regarding self-harming behavior may be valuable strategies for suicide prevention for individuals receiving psychiatric treatment.

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REFERENCES

1. Barraclough B, Bunch J, Nelson B, Sainsbury P. A hundred cases of suicide: Clinical aspects. *Br. J. Psychiatry* 1974; 125: 355–373.
2. Cheng AT. Mental illness and suicide. *Arch. Gen. Psychiatry* 1995; 52: 594–603.
3. Cheng AT, Chen TH, Chen CC, Jenkins R. Psychosocial and psychiatric risk factors for suicide: Case-control psychological autopsy study. *Br. J. Psychiatry* 2000; 177: 360–365.
4. De Leo D. Why are we not getting any closer to preventing suicide? *Br. J. Psychiatry* 2002; 181: 372–374.
5. Arseneault-Lapierre G, Kim C, Turecki G. Psychiatric diagnoses in 3275 suicides: A meta-analysis. *BMC Psychiatry* 2004; 4: 37.
6. Cavanagh JT, Carson AJ, Sharpe M, Lawrie SM. Psychological autopsy studies of suicide: A systematic review. *Psychol. Med.* 2003; 33: 395–405.
7. Roy A. Risk factors for suicide in psychiatric patients. *Arch. Gen. Psychiatry* 1982; 39: 1089–1095.
8. Ho T-P. Psychiatric care of suicides in Hong Kong. *J. Affect. Disord.* 2003; 76: 137–142.
9. Cabinet Office of Japan. *The White Paper for Countermeasures to Suicide*. Saeki Printing, Tokyo, 2009.
10. Phillips MR, Yang G, Zhang Y, Wang L, Ji H, Zhou M. Risk factors for suicide in China: A national case-control psychological autopsy study. *Lancet* 2002; 360: 1728–1736.
11. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*, 4th edn. American Psychiatric Association, Washington, DC, 1994.
12. Asukai N. Mental disorder as a risk factor of suicide; a clinical study of failed suicides. *Seishin Shinkeigaku Zasshi* 1994; 96: 415–443 (in Japanese).
13. Lönnqvist JK, Henriksson MM, Isometsä ET *et al.* Mental disorders and suicide prevention. *Psychiatry Clin. Neurosci.* 1995; 49: 111–116.
14. Foster T, Gillespie K, McClelland R. Mental disorders and suicide in Northern Ireland. *Br. J. Psychiatry* 1997; 170: 447–452.
15. Cho Y. Mounting incidence of depression – in relation to suicide prevention. *Seishin Shinkeigaku Zasshi* 2009; 111: 674–679 (in Japanese).
16. The Bureau of Social Welfare and Public Health, Tokyo Metropolitan Government. *The factual investigation*

- report of suicide; interview research to the bereaved. Japan; 2009: 41–44.
17. The Society for the Study of Mental Health and Welfare. Support policy for people with mental disorders. In: The Society for the Study of Mental Health and Welfare (ed.). *The Mental Health and Welfare of Our Country: The Mental Health and Welfare Handbook*. Taiyo Press, Tokyo, 2010; 73–74.
 18. Luoma JB, Martin CE, Pearson JL. Contact with mental health and primary care providers before suicide: A review of the evidence. *Am. J. Psychiatry* 2002; 159: 909–916.
 19. Zisook S, Byrd D, Kuck J, Jeste DV. Command hallucination in outpatients with schizophrenia. *J. Clin. Psychiatry* 1995; 56: 462–465.
 20. Hawton K, Sutton L, Haw C, Sinclair J, Deeks JJ. Schizophrenia and suicide: Systematic review of risk factors. *Br. J. Psychiatry* 2005; 187: 9–20.
 21. Harris EC, Barraclough B. Suicide as an outcome for mental disorders: A meta-analysis. *Br. J. Psychiatry* 1997; 170: 205–228.
 22. Yasuda M. A clinical study of suicidal behavior in schizophrenic patients. *Seishin Shinkeigaku Zasshi* 1992; 94: 135–170 (in Japanese).
 23. Walsh BW, Rosen PM. *Self-Mutilation: Theory, Research, and Treatment*. Guilford Press, New York, 1988.
 24. De Leo D, Evans R. Chapter 10: The impact of substance abuse policies on suicide mortality. In: De Leo D, Evans R (eds). *International Suicide Rates and Prevention Strategies*. Hogrefe and Huber, Cambridge, 2004; 101–112.
 25. Hawton K, Rodham K, Evans E. *By Their Own Young Hand: Deliberate Self-Harm and Suicidal Ideas in Adolescents*. Jessica Kingsley Publishers, London, 2006.
 26. Hill K. *The Long Sleep: Young People and Suicide*. Virago, London, 1995.
 27. Ando S, Matsumoto T, Omoya R et al. Clinical differences in the extent of suicide intent, depression, and dissociation between self-poisoning patients with mood disorder and those with personality disorder. *Seishin Igaku* 2009; 51: 749–759 (in Japanese).
 28. Hawton K, Simkin S, Deeks J et al. UK legislation on analgesic packs: Before and after study of long term effect on poisonings. *BMJ* 2004; 329: 1076–1079.
 29. Verhaak PFM. Determinants of the help seeking process: Goldberg and Huxley's first level and first filter. *Psychol. Med.* 1995; 25: 95–104.



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Research report

Mental disorders and suicide in Japan: A nation-wide psychological autopsy case–control study

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ABSTRACT

Background: The purpose of the present nationwide psychological autopsy case–control study is to identify the association between mental disorders and suicide in Japan, adjusting for physical conditions.

Methods: A semi-structured interview was conducted of the closest family members of 49 suicide completers and 145 gender-, age-, and municipality-matched living controls. The interview included sections of socio-demographic characteristics, physical conditions, and a psychiatric interview producing DSM-IV diagnoses of mental disorders prior to suicide (or at survey). We compared prevalences of mental disorders between the two groups, using conditional logistic regression.

Results: A significantly higher proportion with any mental disorder was found in the suicide group (65.3%) compared to the control group (4.8%) ($p = 0.003$, odds ratio [OR] = 7.5). The population attributable risk proportion associated with mental disorder was 0.24. Mood disorder, particularly major depressive disorder, was the most strongly associated with suicide ($p < 0.001$). Anxiety disorder, alcohol-related disorder, and brief psychotic disorder were also significantly associated with suicide ($p < 0.05$). These patterns were unchanged after adjusting for serious chronic physical conditions.

Limitations: The present study had some limitations, such as small sample size, sampling bias and information bias.

Conclusions: Most mental disorders, particularly mood disorder, were significantly associated with a greater risk of suicide in Japan, independent of physical conditions. Mental disorders are a major target of suicide prevention programs in Japan.

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1. Introduction

Suicide is a serious health problem all over the world today. Previous research has indicated that approximately one million

people per year die worldwide because of suicide (Takahashi, 2006). In Japan, the number of suicides has increased rapidly over the last several decades, to over 30,000 in 1998, and has remained high to the present (Cabinet Office of Japan, 2009). Although multiple factors are known to influence suicide, such as social isolation, unemployment, financial problems, stressful life events, personal or familial history of suicide, and somatic diseases (Aihara and Iki, 2003; Fujioka et al., 2004;

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Fushimi et al., 2005; Hall et al., 1999; Sechter et al., 1991; Zhang et al., 2004), a mental disorder is one of the most important risk factors (Barracough et al., 1974; Cheng, 1995; Tanney, 2000). Previous psychological autopsy case–control studies have indicated a strong relationship between suicide and mental disorders (Cavanagh et al., 2003; Chen et al., 2006; Kelly and Mann, 1996). Thus, 60 to 90% of suicide completers had some kind of mental disorder immediately prior to death (Arsenault-Lapierre et al., 2004; Cheng et al., 2000; Phillips et al., 2002). The risk of suicide is high among those with mental disorders, with an estimated 5 to 15-fold increased risk (Harris and Barracough, 1997). Previous meta-analyses reported that specific mental disorders were associated with a higher risk of suicide, including mood disorders (summary odds ratio [SOR] = 13.4) (Yoshimasu et al., 2008), substance-related disorders (SOR = 5.2) (Yoshimasu et al., 2008), personality disorders (SOR = 4.5) (Arsenault-Lapierre et al., 2004), and psychotic disorders (SOR = 6.6) (Arsenault-Lapierre et al., 2004). These previous studies have shown that the relative risk of suicide associated with mental disorders is fairly consistent among countries, including Western countries and Asian countries such as China and Taiwan (Barracough et al., 1974; Cavanagh et al., 2003; Cheng et al., 2000). However, only a limited number of previous studies adjusted for chronic physical conditions in investigating the association between mental disorders and suicide (Cheng et al., 2000), although chronic physical conditions are also known to be risk factors for suicide (Chynoweth et al., 1980; Conwell et al., 2000) and chronic physical conditions are often comorbid with mental disorders (Prince et al., 2007).

In Japan, two previous prospective studies have also shown that depressive disorders (Takahashi et al., 1998) or depressive symptoms (Tamakoshi et al., 2000) were associated with about a ten-fold higher risk of suicide. However, the association of suicide with a broad range of mental disorders other than depression in Japan is still not clear. There is a possibility that the suicidal risk factors may be different between countries and cultures. First, prevalences of mental disorders are much lower among Asian countries such as Japan and China than among Western countries (Demyttenaere et al., 2004). In addition, the degree of the contribution of mental disorders to current suicide phenomena in Japan after its drastic increase in 1998 is not clear, although it is believed that the increase was triggered largely by the economic recession (Motohashi, 2001). It would be useful for developing suicide prevention programs to know if mental disorders are associated with suicide more or less strongly in Japan's current situation.

The purpose of the present study is to identify the strength of association between mental disorders and suicide during this period of increased suicide rate (here, specifically, the years 2006–2009) in Japan, by using a case–control study design with psychological autopsy. This was the first nationwide case–control study in Japan on the association between mental disorders and suicide using psychological autopsy. We compared prevalences of selected mental disorders prior to death (or at survey) diagnosed using a semi-structured interview between 49 suicide cases and 145 gender-, age- and municipality-matched living-controls in different areas of Japan, adjusting for serious chronic physical conditions.

2. Subjects and methods

2.1. Subjects

2.1.1. Suicide cases

The suicide group consisted of those who had died by suicide from January 2006 to December 2009, whose bereaved consulted the prefectural Mental Health Welfare Centers (MHWCs) to seek support, and any of whose family members consented to participate in the study. As of December 2009, we had collected information on 52 Japanese suicide cases from 54 MHWCs. These cases were reported from diverse areas of Japan including: Hokkaido and Tohoku ($n=7$; 18.4%), Kanto-Shinetsu ($n=16$; 32.7%), Tokai-Hokuriku and Kinki ($n=17$; 34.7%), Chugoku and Shikoku ($n=4$; 8.1%), and Kyushu and Okinawa ($n=3$; 6.0%).

2.1.2. Controls

Controls were living community residents matched to suicide cases by gender, age (five-year age groups), and municipality. For each case, up to 15 controls were randomly selected from the population registry, hoping that at least 3 matched-controls would be available for most cases. A professional interviewer from a survey company received a one-day instrument-specific training and contacted each control first by a mailed invitation letter, and then by visiting the home if there was no response to the mailed invitation. If a control agreed to participate in the study, an interviewer further contacted a family member who was most close to the control, and conducted a face-to-face interview of this family member. The survey of a control person was terminated if he/she did not have any other person in his/her household. The survey of the controls was conducted from October to November, 2009. Among possible controls (15 for each of 52 cases) initially selected, 152 controls (20.4%) and their family members agreed to participate in the study. However, after data collection, it turned out that for three suicide cases, gender was wrongly coded. Thus we excluded these three cases and their seven controls from the analyses. The final dataset included 49 cases and 145 controls, with 83.0% male gender and the average number of controls being 3.0 (SD, 1.1) for each case.

2.2. Procedure

In the present study, the information for both groups (suicides and controls) was collected from one family member, via the semi-structured interview. The informant was determined by the following conditions: for the suicide group, the informant was the closest bereaved, who had lived together with the subject or had continued in intimate contact with the subject before death, and who was selected from among the bereaved in the order of spouse, parent, and child where two or more closest bereaved were found; for the control group, the informant was a closest family member who lived with the control case, similar to the informants for the suicide group.

A semi-structured interview was carried out based on the assessment instrument, the Japanese version of an interview schedule for a psychological autopsy. The items of this instrument included questions about family environment, history of suicide attempts, life history, socio-economic and physical

health status, and psychiatric diagnosis according to the DSM-IV criteria at the time of death.

The interview for the suicide group was conducted by the local investigators, a pair of a psychiatrist and other mental health professional including a public health nurse, who participated in a three-day training for our study. The local investigators requested participation in our study of all of the bereaved who visited MHWCs for support or attended “survivors” meetings provided at the MHWCs. The data collected from the bereaved was anonymized and sent to the Center for Suicide Prevention, National Institute of Mental Health in Japan. For the control group, the interview data collecting and coding were carried out by the staff of the survey company.

The study was approved by the Research Ethics Committee of the Faculty of Medicine/Graduate School of Medicine, The University of Tokyo, Japan, and the Ethics Committee of the National Institute of Mental Health, National Center of Neurology and Psychiatry Japan.

2.3. Instrument

The instrument was initially developed based on one from the Beijing Suicide Research and Prevention Center in China (Phillips et al., 2002) and further modified through a small pilot study and a preliminary study of 25 suicide cases to accommodate the situation and interest in Japan. The instrument consisted of eight sections: sociodemographic characteristics (gender, age, education, marital status, etc.), previous suicidal tendencies including suicide attempt (and characteristics of completed suicide for the cases), childhood and school experience, job characteristics (for those employed), financial problems, quality of life, physical conditions, and mental disorders. In this study, variables from the sociodemographic characteristics, physical conditions, and mental disorders sections were used.

2.3.1. Mental disorders

In this study, the DSM-IV diagnoses of mental disorders of the cases at the time of death and of the controls at the time of investigation were assessed through a psychiatric structured interview schedule which is a part of the instrument. The psychiatric structured interview schedule was also based on the assessment used in the psychological autopsy study conducted in China (Phillips et al., 2002), on the Structured Clinical Interview for DSM-IV (SCID), and on others. In order to develop the Japanese version of this instrument, we translated the original version into Japanese and also modified it by adapting questions from the SCID Axis I disorders. In addition, we further modified the Japanese instrument through a series of pilot studies, reflecting interviewer experiences and opinions of the family of a suicide case.

The diagnoses of mental disorders made by the instrument included alcohol-related disorders (alcohol dependence, alcohol abuse), drug-related disorders (drug dependence, drug abuse), mood disorders (major depressive disorder, dysthymic disorder, and bipolar I and II disorders), psychotic disorders (schizophrenia, brief psychotic disorder, and other psychotic disorder), anxiety disorders (panic disorder, generalized anxiety disorder [GAD], and acute and post-traumatic stress disorders). The table in the Appendix A shows the validity of

the instrument for the diagnoses of some of these mental disorders, including concordance rates (%) and kappa coefficients for the DSM-IV diagnoses made by the interview and those made by a psychiatrist in the same interview of 74 suicide cases from previous pilot studies and the present study. Concordance of mental disorders between both diagnostic procedures was over 77% for every mental disorder examined. The kappa coefficients (k s) were higher for panic disorder ($k=1.00$) and for alcohol dependence ($k=0.80$); the kappa coefficients were moderate or slightly lower for dysthymic disorder ($k=0.33$) and for psychotic disorders ($k=0.48$). These data provided some evidence for the validity of the diagnosis of mental disorders using this instrument.

2.3.2. Physical conditions

Variables concerning physical conditions included serious chronic physical conditions, somatic symptom in the past 1 month, and hospitalization in the past 1 year. For serious chronic physical conditions, participants were asked if the person (i.e., a case or control) had serious chronic physical illness which might put his/her life at risk or strongly affect his/her daily life. If the response was yes, the person was coded as having a serious chronic physical condition. For somatic symptoms, participants were asked if the person had any somatic symptoms lasting 1 week or longer in the past 1 month. If the response was yes, the person was coded as having had somatic symptoms in the past month. For hospitalization, respondents were asked if the person had been hospitalized because of a physical illness during the past 1 year. If the response was yes, the person was coded as having been hospitalized for physical conditions.

2.3.3. Suicide-related characteristics

Suicide-related characteristics were only asked of the respondents for the cases. These included suicide method (hanging, jumping, drowning, poisoning by drugs or chemicals, inhalation of gas), the place of committing suicide (at home, at the office, inside a building other than home, in a vehicle, outdoor, other), and the time period from suicide to the investigation (in months).

2.3.4. Socio-demographic characteristics

Socio-demographic variables included gender, age in years (or age of death for the cases), education, marital status, and employment status at the time of suicide (or at the time of survey for the controls), and household income (in yen) in the past year. Age was classified into 20–30, 35–44, 45–64, 65+ years old. Education was categorized into junior high school graduate (11 years or less of education), high school graduate (12–15 years), and college graduate or higher (16+ years). Marital status was dichotomized into married and not married at the time of death. Employment status was dichotomized into employed and not employed (unemployed, retired, house-keeping, students).

2.4. Statistical analysis

We first compared the frequency (%) or mean (with standard deviation, SD) of demographic characteristics and physical conditions between the suicide group ($N=49$) and the control group ($N=145$). Then we compared prevalence (%)

Table 1
Sociodemographic characteristics and physical conditions of suicide cases and controls.

	Suicide cases (N = 49)	Controls (N = 145)	P ^a	Odds ratio (95%CI) ^a
	n (%)	n (%)		
Gender				
Male	41 (83.7)	120 (82.8)	REF	1
Female	8 (16.3)	25 (17.2)	0.899	0.85 (0.45–2.03)
Age (years)				
20–34	13 (26.5)	35 (24.1)	REF	1
35–44	14 (28.6)	40 (27.6)	0.910	0.96 (0.45–2.04)
45–64	14 (28.6)	21 (33.8)	0.608	0.82 (0.39–1.75)
65 or older	8 (16.3)	21 (14.5)	0.967	1.02 (0.42–2.46)
Education				
Junior high school graduate (11 years or less)	14 (28.6)	24 (16.6)	0.047	2.93 (1.02–8.46)
High school graduate (12–15 years)	22 (44.9)	72 (49.7)	0.575	1.27 (0.55–2.94)
College graduate (16 years or more)	13 (26.5)	48 (33.1)	REF	1
Marital status				
Married	31 (63.3)	117 (80.7)	REF	1
Not married	18 (36.7)	28 (19.3)	0.003	5.14 (1.75–15.09)
Employment status				
Employed	34 (69.4)	119 (82.1)	0.009	0.20 (0.06–0.67)
Not employed	15 (30.6)	26 (17.9)	REF	1
Household income (million yen/year) ^b	Mean(SD) 650.9 (612.7)	Mean(SD) 587.8 (352.7)	0.126	NA
Chronic serious physical conditions (yes)	n (%) 13 (26.5)	n (%) 24 (16.6)	0.098	2.01 (0.88–4.57)
Somatic symptom in the past month (any) ^c	31 (68.9)	15 (11.3)	<0.001	15.11 (5.79–39.46)
Hospitalization in the past year (yes) ^d	9 (22.0)	8 (7.0)	0.024	4.83 (1.23–18.91)

^a For a difference between the suicide cases and the controls (conditional logistic regression) compared from a reference group indicated by REF. NA: not applicable.

^b Based on 43 cases and 80 matched controls because of missing responses.

^c Based on 45 cases and 133 matched controls because of missing responses.

^d Based on 41 cases and 115 matched controls because of missing responses.

of each mental disorder between the two groups. The statistical significance of differences in frequencies or averages of these variables was tested by using conditional logistic regression, since the number of the controls to one case varied from one to six among cases. We also calculated an odds ratio (with 95% confidential intervals, 95% CI) of suicide associated with a categorical variable. We conducted a further analysis to examine for any unique association between a mental disorder and suicide adjusting for a major variable of physical condition, i.e., serious chronic physical conditions, and any demographic characteristic which was found to be statistically significantly different between the groups. A population attributable risk percent (PARP) of suicide associated with mental disorders was estimated. The statistical analyses were performed using the Predictive Analytic Software, Version 17.0 (SPSS Inc, Chicago, Illinois). The level of significance was set at 0.05 (two-tailed).

3. Results

3.1. Demographic characteristics and physical conditions of cases and controls

Table 1 compares demographic characteristics and physical conditions between the suicide and control groups. The suicide group had a significantly higher proportion of junior high school graduates (under 11 years; $p < 0.05$). Also, the suicide group had a significantly higher proportion of those not married than the control group ($p < 0.05$). The suicide group had a significantly lower proportion of being employed than the

controls ($p < 0.01$). For physical conditions, the suicide group had a significantly higher proportion of those having somatic symptoms in the past month ($P < 0.001$), and also had a significantly higher proportion of history of hospitalization in the past year ($p < 0.05$). While the difference was only marginally statistically significant, the suicide group had a slightly higher proportion of serious chronic conditions compared with the control group ($p < 0.10$).

3.2. Suicide-related characteristics of cases

Table 2 shows suicide-related characteristics of the suicide group. For the methods of suicide, the most frequent method was hanging, which was used by three out of five cases, followed by inhaling gas and jumping. The most common place of committing suicide was home. The period from suicide to the investigation was 17.4 months on average with SD of 14.7 months, ranging from 2 to 77 months.

3.3. Association between mental disorders and suicide

A significantly higher prevalence of any mental disorder was found in the suicide group than in the control group ($p = 0.003$, $OR = 7.48$) (Table 3). Among the disorder categories, mood disorders were the most common diagnosis among the cases. Any mood disorder was significantly associated with a 6.6 times higher risk of suicide ($p < 0.001$). For specific diagnoses of mental disorders, major depressive disorder showed the highest odds ratio ($p < 0.001$, $OR = 6.56$). Any alcohol-related disorder, alcohol dependence, brief psychotic disorder, any anxiety disorder, and

GAD were significantly associated with a higher risk of suicide, with ORs ranging from 3 to 4 ($p < 0.05$). Drug abuse and panic disorder were marginally significantly associated with a higher risk of suicide ($p < 0.10$). None of the suicide cases or controls had drug abuse, bipolar I/II disorders, schizophrenia, other psychotic disorders, acute stress disorder, or post-traumatic stress disorder.

After adjusting for demographic variables significantly different between the suicide cases and controls (i.e., marital status, education, and employment) and serious chronic physical conditions, some of the mental disorders were still significantly associated with suicide. These were any mental disorder ($p < 0.001$, OR = 7.08), any mood disorder ($p < 0.001$, OR = 5.89) and major depressive disorder ($p < 0.001$, OR = 6.21), any alcohol-related disorder ($p < 0.001$, OR = 3.87), alcohol dependence ($p = 0.003$, OR = 3.69) and abuse ($p = 0.041$, OR = 4.58), any anxiety disorder ($p = 0.003$, OR = 3.67), panic disorder ($p = 0.024$, OR = 5.52), and GAD ($p = 0.022$, OR = 3.10).

A PARP was estimated to be 0.25 for any mental disorders, based on the OR of 7.5 and the prevalence of any mental disorder in the controls (5%). A PARP for mood disorders was estimated to be 0.09, based on the OR of 6.2 and the prevalence of mood disorders in the controls (2%).

4. Discussion

In this nationwide psychological autopsy case-control study of suicide, approximately 65% of suicide cases were estimated to have been suffering some mental disorder prior to death. Mental disorders were significantly associated with higher risk of suicide. Any mental disorder, in particular, mood disorders as a disease category and major depressive disorder as a specific diagnosis, were strongly associated with suicide. The association remained nearly the same after adjusting for serious chronic physical conditions and demographic variables. The estimated PARPs indicate that mental disorders and mood disorders explained 24% and 9% of suicide.

Prevalence of any mental disorder prior to death (65%) among suicide cases in this study was similar to that reported from a study of suicide attempters in Japan (Asukai, 1994). The prevalence was lower than those of other previous studies,

for instance, the WHO report, where 96% of suicides had some diagnosis of mental disorder (Isometsa, 2001). This may be attributable to a lower prevalence of mental disorders in Japan compared with other countries such as the US and Europe (Demyttenaere et al., 2004). Mental disorders as a whole were strongly associated with suicide, with the OR of 7.5. Mental disorders were still significantly associated with a 7.1 times higher risk of suicide after adjusting for serious chronic physical conditions, suggesting that mental disorders are a strong risk factor for suicide independent of physical conditions in Japan. However, the OR associated with mental disorders in this study was slightly smaller than ORs reported from previous studies (summary OR = 10.5) (Arsenault-Lapierre et al., 2004), while a wide range of ORs (5 to 15) were reported from other previous studies (Harris and Barraclough, 1997). Although our observed OR was within this range, mental disorders may be associated with a relatively smaller risk of suicide in Japan currently than in other countries. The PARP suggests that about one-fourth of suicides are explained by mental disorder. While a certain proportion of suicides could be attributable to mental disorders, a larger proportion remains to be explained possibly by other social and individual factors.

Both mood disorders and major depressive disorder were associated with a 6–7 times higher risk of suicide, which was the largest among mental disorders. This is consistent with previous psychological autopsy studies (Arsenault-Lapierre et al., 2004). However, a summary odds ratio associated with major depressive disorder from 17 previous studies was reported as 13.4 (Yoshimasu et al., 2008). Again, our observed ORs were much lower than this, by almost half. Consequently, and because of its lower prevalence, according to the estimated PARP, only 9% of suicides were explained by mood disorders. The ORs were also lower than those reported from previous prospective studies on depression and suicide in Japan (Takahashi et al., 1998; Tamakoshi et al., 2000). Mood disorders may be less associated with suicide in Japan, at least in the current situation, than in other countries. A possible explanation is that there might be heterogeneity in risk factors of suicide by gender and age group (Yoshimasu et al., 2008). For instance, it has been reported that depression is more associated with suicide among women and the elderly (Yoshimasu et al., 2008). Another possible explanation is that in a collective culture, such as Japan, people are living with close family and social relationships, which may prevent suicide among those with mood disorders to some extent. However, because the magnitude of the association is still large, we believe that mood disorders or major depressive disorder should still be a target of suicide prevention programs in Japan. It is also possible that the assessment of mood disorders may not be accurate. Participants may have not identified or may have under-reported depressive mood and related symptoms of depression, because stigma toward mental disorders is still high in Japan, and, for the suicide cases, somatic symptoms may mask symptoms of depression (Takahashi, 2001; Yoshimasu et al., 2009). We could not evaluate the suicide risk associated with bipolar disorders, because the disorders were not observed in the suicide or control group in this study. This is probably due to an extremely low prevalence of bipolar disorders in the community population of Japan (Kawakami et al., 2005). However, previous studies have showed a higher risk

Table 2

Suicide-related characteristics of suicide cases (N = 49).

	n (%)
Method of suicide ^a	
Hanging	30 (61.2)
Jumping	7 (14.3)
Drowning	2 (4.1)
Poisoning (drugs and chemicals)	2 (4.1)
Inhaling gas	8 (16.3)
Location of suicide	
Home	23 (46.9)
Office	3 (6.1)
Indoor (other than home)	4 (8.2)
In a vehicle	8 (16.3)
Outdoor	9 (18.4)
Other	2 (4.1)
	Mean (SD)
Period from suicide to the investigation (months)	17.4 (14.7)

^a When multiple methods were reported, only one major method is listed.

Table 3

Comparison of prevalences of DSM-IV mental disorders diagnosed based on a semi-structured interview between suicide cases and controls.

Mental disorder ^a (DSM-IV)	Suicide cases (N = 49)	Controls (N = 145)	Crude		Multivariate ^b	
	n (%)	n (%)	Odds ratio (95%CI)	P	Odds ratio (95%CI)	P
Alcohol-related disorders						
Alcohol dependence	7 (14.3)	4 (2.8)	2.77 (1.25–6.17)	0.012	3.69 (1.58–8.58)	0.003
Alcohol abuse	2 (4.1)	–	4.09 (0.99–16.82)	0.051	4.58 (1.07–19.69)	0.041
Any alcohol-related disorder	9 (18.4)	4 (2.8)	3.13 (1.52–6.46)	0.002	4.14 (1.92–8.92)	<0.001
Drug-related disorders						
Drug dependence	2 (4.1)	–	4.09 (0.99–16.82)	0.051	3.04 (0.63–14.66)	0.167
Mood disorders						
Major depressive disorder	22 (44.9)	–	6.56 (3.74–11.52)	<0.001	6.21 (3.45–11.17)	<0.001
Dysthymic disorder	2 (4.1)	2 (1.4)	2.02 (0.49–8.32)	0.330	1.60 (0.35–7.30)	0.544
Any mood disorder	24 (49.0)	2 (1.4)	6.20 (3.54–10.86)	<0.001	5.89 (3.29–10.52)	<0.001
Psychotic disorders						
Brief psychotic disorder	4 (8.2)	–	4.22 (1.52–11.74)	0.006	2.42 (0.71–8.29)	0.158
Anxiety disorders						
Panic disorder	2 (4.1)	–	4.09 (0.99–16.82)	0.051	5.52 (1.25–24.34)	0.024
Generalized anxiety disorder	5 (10.2)	1 (0.7)	3.56 (1.41–8.98)	0.007	3.10 (1.18–8.13)	0.022
Any anxiety disorder	6 (12.2)	1 (0.7)	3.73 (1.59–8.76)	0.003	3.45 (1.43–8.31)	0.006
Any mental disorder	32 (65.3)	7 (4.8)	7.48 (4.15–13.47)	<0.001	7.08 (3.90–12.87)	<0.001

–: no participant had this disorder.

^a Drug abuse, bipolar I/II disorders, schizophrenia, and other psychotic disorders, acute stress disorder, or posttraumatic stress disorder were not observed in any of the two groups.^b Adjusted for education, marital status, employment status, and chronic physical condition.

of suicide among patients with bipolar I and II disorders (Pompili et al., 2009; Rihmer and Kiss, 2002). Future research should evaluate the suicidal risk associated with bipolar disorders in Japan, with a larger data set.

Anxiety disorders (such as GAD), alcohol-related disorders (such as alcohol dependence), and brief psychotic disorder were significantly associated with a 3–4 times higher risk of suicide. This pattern was unchanged after adjusting for serious chronic physical conditions. This suggests that these disorders are also associated with suicide in Japan independent of physical conditions. This is consistent with previous studies (Arsenault-Lapierre et al., 2004; Yoshimasu et al., 2008). The observed OR of suicide associated with anxiety disorders (4.07) was slightly higher than that reported among other countries (summary OR = 2.43) (Arsenault-Lapierre et al., 2004). Anxiety disorders may have a greater impact on suicide in Japan compared to other countries. For instance, GAD lasts 6 months or longer by definition, causing withdrawal from social activities and isolation, which may be important for suicide in Japan. However, it should be noted that anxiety disorders tend to be highly comorbid with mood disorders. The present finding may be confounded by such comorbidity between mood and anxiety disorders.

Alcohol-related disorders were associated with a 3.8 times higher risk of suicide, which was slightly lower than that reported by previous studies (SOR = 5.2) (Yoshimasu et al., 2008), but within range. Alcohol-related disorders, particularly alcohol dependence, seem to be important risk factors for suicide in Japan, as well as in other countries. Alcohol-related disorders deserve more attention in developing suicide prevention programs in Japan.

Psychotic disorders are also known to be a risk factor for suicide (Arsenault-Lapierre et al., 2004). In the present study, brief psychotic disorder was associated with a 4 times higher (2.4 times higher but non-significant after adjusting for physical conditions) risk of suicide. The degree of association was

smaller than that previously reported for psychotic disorders (SOR = 6.6) (Arsenault-Lapierre et al., 2004). However, the present study could not estimate a relative risk associated with schizophrenia, a core disorder among psychotic disorders, because there were no cases of the disorder in the suicide or control groups. Thus the association between psychotic disorders and suicide may be underestimated in this study.

In the present study, those with serious chronic physical conditions had a marginally significant and almost two times greater risk of suicide. This was concordant with a previous study (Cheng et al., 2000) and also consistent with previous findings that suicide rate is higher among people with severe physical diseases, such as cerebrovascular disease, cancer, and multiple sclerosis (Chynoweth et al., 1980; Conwell et al., 2000). In addition, somatic symptoms in the past month were also associated with suicide, although such somatic symptoms may be part of the symptoms of a mental disorder. Serious chronic physical conditions and somatic symptoms may also be important risk factors for suicide in Japan, since they can impair daily living functions, such as mobility, self-care, social interaction, and role functioning (Kawakami et al., 2005), causing withdrawal from social interactions and isolation, which may be related to suicide. These physical conditions should also be considered in planning suicide prevention programs.

4.1. Limitations

The present findings should be interpreted with caution because of several limitations. First, the sample size was relatively small. We may have missed some important associations because of lack of statistical power. We could not examine the findings by subgroups based on gender and age. Second, the sampling was likely to be biased, since case-finding of the suicide cases was not random, but based on information from mental health and welfare centers. The subjects were limited to suicide completers whose relatives participated in a survivor

support program provided by the centers. Suicide completers who lived alone were not included, which may have resulted in a greater proportion of those married in the suicide group. Additionally, the response rate for the controls was low (20%), which also may have caused a selection bias. Third, the most serious bias was likely to be information bias. In common with most psychological autopsy studies, the informants in the suicide group knew the purpose of the study. The informant was likely to associate several factors in his/her mind with his/her family's suicide and thus tend to over-report such factors. In addition, the interviewer also knew who was in the suicide group or not. The interviewer may be more likely to pick up factors which he/she thought important for suicide. The other concern with collecting information is that there was a several-year gap between suicide and the survey for some cases. An informant may not remember what happened to the case, which in general could result in null findings. Fourth, in our study, subthreshold mental disorders were not considered. Balázs showed a substantial suicidal risk associated with subthreshold disorders not meeting the full criteria required according to the DSM-IV (Balázs et al., 2000). The estimated PARP of suicide associated with mental disorders might be higher if we included the subthreshold disorders. Subthreshold forms of mental disorders should be examined in future research in Japan. Finally, while we tested the validity of the instrument for assessing mental disorders by comparing the semi-structured interview-based diagnoses with clinical diagnoses, the instrument was not fully validated against diagnoses made by a well-established structured interview like SCID-IV. The interview for the section on mental disorders was made by a psychiatrist for the suicide group, but it was made by a professional interviewer for the control group. In addition, the semi-structured interview did not include diagnoses of personality disorders.

5. Conclusion

The present nationwide psychological autopsy case–control study demonstrated that mental disorders were significantly associated with a greater risk of suicide in Japan, independent of physical conditions. Mood disorders including major depressive disorder were the most strongly associated with suicide, while anxiety disorders, alcohol-related disorders, and brief psychotic disorder were also significantly associated. While the relative risks associated with these mental disorders were slightly lower than those previously reported in other countries, mental disorders, particularly mood disorders, are a major target of suicide prevention programs in Japan.

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Conflict of interest

The authors declare that they have no competing interests.

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Appendix A. Concordance between diagnoses made by the semi-structured interview used in this study and clinical diagnoses by psychiatrists for selected DSM-IV mental disorders among 74 suicide cases

DSM-IV diagnoses of mental disorders	Structured interview	Clinical diagnosis	Concordance (%)	Kappa
	Prevalence (%)	Prevalence (%)		
Alcohol-related disorders	10 (13.5)	13 (17.6)	93.2	0.74
Alcohol dependence	8 (10.8)	9 (12.2)	96.0	0.80
Alcohol abuse	2 (2.7)	4 (5.4)	97.3	0.65
Mood disorders	34 (45.9)	47 (63.5)	77.0	0.55
Major depressive disorder	29 (39.2)	39 (52.7)	78.4	0.57
Dysthymic disorder	3 (4.1)	13 (17.6)	86.5	0.33
Psychotic disorders	8 (10.8)	7 (9.5)	90.5	0.48
Anxiety disorders	9 (12.2)	9 (12.2)	91.9	0.62
Panic disorder	3 (4.1)	3 (4.1)	100.0	1.00
Generalized anxiety disorder	8 (10.8)	8 (10.8)	91.9	0.58 ^a

^aThe hierarchical rule of DSM-IV was not applied. A subject may have more than one mental disorder.

References

- Aihara, H., Iki, M., 2003. An ecological study of the relations between the recent high suicide rates and economic and demographic factors in Japan. *Journal of Epidemiology* 13, 56–61.
- Arsenault-Lapierre, G., Kim, C., Turecki, G., 2004. Psychiatric diagnoses in 3275 suicides: a meta-analysis. *BMC Psychiatry* 4, 37.
- Asukai, N., 1994. Mental disorder as a risk factor of suicide; a clinical study of failed suicides. *Seishin Shinkeigaku Zasshi* 96, 415–443 (in Japanese).
- Balázs, J., Bitter, I., Lecrubier, Y., Csiszér, N., Ostorharics, G., 2000. Prevalence of subthreshold forms of psychiatric disorders in persons making suicide attempts in Hungary. *European Psychiatry* 15, 354–361.
- Barracough, B., Bunch, J., Nelson, B., Sainbury, P., 1974. A hundred cases of suicide: clinical aspects. *The British Journal of Psychiatry* 125, 355–373.
- Cabinet Office of Japan, 2009. The White Paper for Countermeasures to Suicide. Tokyo.
- Cavanagh, J.T., Carson, A.J., Sharpe, M., Lawrie, S.M., 2003. Psychological autopsy studies of suicide: a systematic review. *Psychological Medicine* 33, 395–405.
- Chen, E.Y., Chan, W.S., Wong, P.W., Chan, S.S., Chan, C.L., Law, Y.W., Beh, P.S., Chan, K.K., Cheng, J.W., Liu, K.Y., et al., 2006. Suicide in Hong Kong: a case–control psychological autopsy study. *Psychological Medicine* 36, 815–825.
- Cheng, A.T., 1995. Mental illness and suicide. *Archives of General Psychiatry* 52, 594–603.
- Cheng, A.T., Chen, T.H., Chen, C.C., Jenkins, R., 2000. Psychosocial and psychiatric risk factors for suicide: case–control psychological autopsy study. *The British Journal of Psychiatry* 177, 360–365.
- Chynoweth, R., Tonge, J.L., Armstrong, J., 1980. Suicide in Brisbane: a retrospective psychosocial study. *The Australian and New Zealand Journal of Psychiatry* 14, 37–45.
- Conwell, Y., Lyness, J.M., Duberstein, P., et al., 2000. Completed suicide among older patients in primary care practices: a controlled study. *Journal of American Geriatrics Society* 48, 23–29.
- Demyttenaere, K., Bruffaerts, R., Posada-Villa, J., Gasquet, I., Kovess, V., Lepine, J.P., Angermeyer, M.C., Bernert, S., de Girolamo, G., Morosini, P., Polidori, G., Kikkawa, T., Kawakami, N., Ono, Y., Takeshima, T., Uda, H., Karam, E.G., Fayyad, J.A., Karam, A.N., Mneimneh, Z.N., Medina-Mora, M.E., Borges, G., Lara, C., de Graaf, R., Ormel, J., Gureje, O., Shen, Y., Huang, Y., Zhang, M., Alonso, J., Haro, J.M., Vilagut, G., Bromet, E.J., Gluzman, S., Webb, C., Kessler, R.C., Merikangas, K.R., Anthony, J.C., Von Korff, M.R., Wang, P.S., Brugha, T.S., Aguilar-Gaxiola, S., Lee, S., Heeringa, S., Pennell, B.E., Zaslavsky, A.M., Ustun, T.B., Chatterji, S., 2004. WHO World Mental Health Survey Consortium. Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization World Mental

- Health Surveys. *JAMA : The Journal of the American Medical Association* 291, 2581–2590.
- Fujioka, S., Abe, S., Hiraiwa, K., 2004. Lifetime social, psychological and physical background of suicides-research on the number of suicides during a year in Fukushima prefecture. *Seishin Shinkeigaku Zasshi* 106, 17–31 (in Japanese).
- Fushimi, M., Sugawara, J., Shimizu, T., 2005. Suicide patterns and characteristics in Akita, Japan. *Psychiatry and Clinical Neurosciences* 59, 296–302.
- Hall, R.C., Platt, D.E., Hall, R.C., 1999. Suicide risk assessment: a review of risk factors for suicide in 100 patients who made severe suicide attempts. Evaluation of suicide risk in a time of managed care. *Psychosomatics* 40, 18–27.
- Harris, E.C., Barraclough, B., 1997. Suicide as an outcome for mental disorders. *The British Journal of Psychiatry* 170, 205–228.
- Isometsa, E.T., 2001. Psychological autopsy studies – a review. *European Psychiatry* 16, 379–385.
- Kawakami, N., Takeshima, T., Ono, T., Uda, H., Hata, Y., Nakane, Y., Nakane, H., Iwata, N., Furukawa, T.A., Kikkawa, T., 2005. Twelve-month prevalence, severity, and treatment of common mental disorders in communities in Japan: preliminary finding from the World Mental Health Japan Survey 2002–2003. *Psychiatry and Clinical Neurosciences* 59, 441–452.
- Kelly, T.M., Mann, J.J., 1996. Validity of DSM-III-R diagnosis by psychological autopsy: a comparison with clinician ante-mortem diagnosis. *Acta Psychiatrica Scandinavica* 94, 337–343.
- Motohashi, Y., 2001. Suicide in Japan. *Lancet* 357, 61130–61136.
- Phillips, M.R., Yang, G., Zhang, Y., Wang, L., Ji, H., Zhou, M., 2002. Risk factors for suicide in China: a national case-control psychological autopsy study. *Lancet* 360, 1728–1736.
- Pompili, M., Rihmer, Z., Innamorati, M., Lester, D., Girardi, P., Tatarelli, R., 2009. Assessment and treatment of suicide risk in bipolar disorders. *Expert Review of Neurotherapeutics* 9, 109–136.
- Prince, M., Patel, V., Saxena, S., Maj, M., Maselko, J., Phillips, M.R., Rahman, A., 2007. No health without mental health. *Lancet* 370, 859–877.
- Rihmer, Z., Kiss, K., 2002. Bipolar disorders and suicidal behaviour. *Bipolar Disorders* 4 (S-1), 21–25.
- Sechter, D., Bonin, B., Bertschy, G., Vandel, S., Bizouard, P., 1991. Prediction of suicide risk. *L'Encéphale* 17, 361–364.
- Takahashi, Y., 2001. Depression and suicide. *JMAJ* 44, 359–363.
- Takahashi, Y., 2006. Guideline for suicide prevention of UN/WHO. In: Takahashi, Y. (Ed.), *STOP! Suicide*. Kaimeisha, Tokyo, pp. 18–31 (in Japanese).
- Takahashi, K., Naito, H., Morita, M., Suga, R., Oguma, T., Koizumi, T., 1998. Suicide prevention for the elderly in Matsunoyama Town, Higashikubiki County, Niigata Prefecture: psychiatric care for elderly depression in the community. *Seishin Shinkeigaku Zasshi* 100, 469–485 (in Japanese).
- Tamakoshi, A., Ohno, Y., Yamada, T., Aoki, K., Hamajima, N., Wada, M., Kawamura, T., Wakai, K., Lin, Y.S., 2000. Depressive mood and suicide among middle-aged workers: findings from a prospective cohort study in Nagoya, Japan. *Journal of Epidemiology* 10, 173–178.
- Tanney, B.L., 2000. Psychiatric diagnoses and suicidal acts. In: Marris, R.W., Berman, A.L., Sylvester, M.M. (Eds.), *Comprehensive Textbook of Suicidology*. The Guilford Press, New York, pp. 311–341.
- Yoshimasu, K., Kiyohara, C., Miyashita, K., 2008. Suicidal risk factors and completed suicide: meta-analyses based on psychological autopsy studies. *Environmental Health and Preventive Medicine* 13, 243–256.
- Yoshimasu, K., Kondo, T., Tokunaga, S., Kanemitsu, Y., Sugahara, H., Akamine, M., Fujisawa, K., Miyashita, K., Kubo, C., 2009. Mental and somatic symptoms related to suicidal ideation in patients visiting a psychosomatic clinic in Japan. *International Journal of General Medicine* 29, 163–170.
- Zhang, J., Conwell, Y., Zhou, L., Jiang, C., 2004. Culture, risk factors and suicide in rural China: a psychological autopsy case control study. *Acta Psychiatrica Scandinavica* 110, 430–437.

Regular Article

Sex differences in risk factors for suicidality among Japanese substance use disorder patients: Association with age, types of abused substances, and depression

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Aim: The aim of this study was to identify risk factors for suicide in Japanese substance use disorder (SUD) patients, adjusting for age and sex, and to examine sex differences in suicide risk among these patients.

Methods: A self-reporting questionnaire on age, sex, types of abused substances, current depression, and suicidality was administered to 1420 SUD patients who consecutively visited seven hospitals specializing in SUD treatment during the month of December 2009. Unadjusted/adjusted odds ratios of factors associated with suicidality were calculated for each sex.

Results: The multivariate analysis using the total sample identified younger age, female sex, and current depression as risk factors for severe suicidality in SUD patients. The multivariate analysis by each sex

demonstrated that younger age and current depression were associated with severe suicidality in male SUD patients. Only current depression was associated with severe suicidality in female patients.

Conclusion: Current depression is a risk factor for suicide in SUD patients common in both Western countries and Japan, although in Japanese SUD patients both younger age and female sex were more closely associated with severe suicidality than aspects of SUD. Additionally, young male SUD patients are speculated to have psychosocial features associated with suicidality in common with female SUD patients.

Key words: depression, risk factor, substance use disorder, suicide.

SUBSTANCE USE DISORDER (SUD) is an important risk factor associated with suicide. Many psychological autopsy studies have estimated that

SUD is the second most common mental disorder in suicide-completers, following depressive disorder.^{1,2} DeLeo and Evans³ proposed that SUD may increase a patient's suicide risk through both indirect and direct mechanisms. An indirect mechanism operates when SUD causes unemployment, divorce, separation from family, imprisonment, and/or psychiatric problems, worsening one's economic and psychosocial situations. A direct mechanism operates when the pharmacological effects of the abused substance disinhibit impulsivity, promoting aggression toward oneself.

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Several Western studies^{4–6} have identified risk factors for suicidal behavior in SUD patients. A meta-analysis by Harris and Barraclough⁴ compared standardized mortality rates for suicide among SUD patients according to substances abused, reporting that patients who abused prescribed psychotropic drugs, opiates, or multiple substances had higher suicide mortality rates than those with alcohol or cannabis use disorder. An epidemiologic study using national survey data⁵ estimated that individuals abusing alcohol, inhalants, and opiates tend to attempt suicide more frequently, though suicidality is more closely associated with abusing multiple substances than with abusing any particular type of substance. A cohort study conducted by Davis *et al.*⁶ indicated that the co-occurrence of depression might heighten the suicide risk of individuals with SUD.

However, it is unclear whether risk factors identified through Western studies also apply to Japanese SUD patients because the types of substances commonly abused in Japan are different from those commonly abused in Western countries. For example, few SUD patients in Japan abuse opiates unlike in Western countries, while methamphetamine has been the most serious drug-related problem since the 1950s in Japan.⁷ It is the most abused substance other than alcohol among Japanese SUD patients.⁸

In this context, we previously revealed that Japanese patients with methamphetamine use disorders or who abused prescribed psychotropic drugs were more likely to have a history of attempted suicide and the presence of suicide ideation than those with alcohol use disorder.⁸ However, that study has two important shortcomings. First, SUD patients simultaneously abusing more than two types of substances were not considered because they were excluded from the subjects to be analyzed. Second, the comparison was not adjusted for age and sex. In our previous study,⁸ the methamphetamine abusers were younger than alcohol abusers, and those who abused prescribed psychotropic drugs included a larger proportion of female subjects. These findings suggest that severe suicidality of SUD patients may not be associated with types of abused substances, but with age and sex. To our knowledge, there have been no Japanese studies that have addressed these shortcomings.

The purpose of the present study was to identify risk factors for suicide in Japanese SUD patients adjusting for age and sex, and to examine sex differences in suicide risk among these patients.

METHODS

Subjects

A pool of 1650 outpatients with a DSM-IV-TR diagnosis of psychoactive substance use disorders who consecutively visited seven hospitals specializing in SUD treatment during the month of December 2009 was identified. These hospitals were representative medical facilities for SUD treatment located in five areas of Japan: three in the Kanto area (including metropolitan Tokyo) and one each in the Tohoku/Hokkaido, Tokai/Hokuriku, Chugoku/Shikoku, and Kyushu/Okinawa areas. A total of 1420 SUD patients (86.1%; 1113 men and 307 women; mean age \pm SD: total, 50.5 ± 13.3 years; men, 52.3 ± 12.9 years; women, 43.0 ± 11.7 years) consented to participate.

This study was approved by the ethics committee of the National Center of Neurology and Psychiatry.

Variables

Age, sex, and types of substances abused

A self-reporting questionnaire comprising questions on sex, age, and types of substances abused was administered to all participants.

The question used to identify types of abused substances was 'Which types of substances caused the problems for which you received hospital treatment?' Participants were requested to select all types of substance abuse applicable from four categories: alcohol abuse, methamphetamine abuse, other illicit drug abuse (cannabis, opiates, organic solvents, and various psychedelics, including lysergic acid diethylamide and 3,4-methylenedioxy-N-methylamphetamine), and abuse of prescribed psychotropic drugs (hypnotics and anti-anxiety drugs). If participants selected more than two substances, the category used was multi-substance abuse.

Current co-occurrence of depressive disorder

The Kessler 10 (K10), a brief self-reporting questionnaire that screens for depressive disorder,⁹ was employed to assess current co-occurrence of depressive disorder. This scale consists of 10 items used to identify symptoms of depression experienced within the last week. The validity and reliability of the Japanese version have been established, and a score of more than 25 points indicates the presence of DSM-IV major depressive disorder.¹⁰ We defined a

score greater than 25 as current co-occurrence of depression in this study.

Suicidality

The suicide risk subsection of the Japanese version 5.0.0 of the Mini International Neuropsychiatric Interview (M.I.N.I.),¹¹ an established, structured interview schedule that screens for psychiatric disorders,¹² was employed to assess suicidality. This subsection consists of six items that identify any suicide-related episodes or phenomena, including suicidal ideation and suicide attempts, within the last month. In the Japanese version of the 'M.I.N.I.' booklet, written by Sheehan and Lecrubier, and translated by Otsubo *et al.*,¹³ the scores for each answer are weighted according to their importance in predicting future suicide (e.g. lifetime histories of attempting suicide = 4; presence of having suicidal ideation within a month = 6; planning or attempting suicide within a month = 10), although the validity of this scoring system has not been completely established.^{11,12} According to Sheehan and Lecrubier,¹³ a total score of more than 10 points out of the possible 33 indicates a high risk for suicide, while a score from 1 to 5 and from 6 to 9 indicates a low and moderate risk, respectively.

In the present study, we used each of these six items in the self-reporting questionnaire, and defined a high risk (M.I.N.I. suicide risk ≥ 10) as severe suicidality. Their internal consistency was established in our sample (Cronbach's α was 0.772).

Statistical analyses

The self-reporting questionnaire was completed anonymously and collected immediately. To determine which factors were associated with severe suicidality, logistic regression analysis was employed for the seven variables (age, current depression, alcohol abuse, methamphetamine abuse, other illicit drug abuse, abuse of prescribed psychotropic drugs, and multi-substance abuse), and the unadjusted and adjusted odds ratios (OR) were calculated for both sexes and for each sex separately. *P*-values less than 0.05 were accepted as indicating significance, and all were two-tailed. All statistical analyses were performed using SPSS software for Windows (version 17.0; SPSS, Chicago, IL, USA).

RESULTS

Of the 1420 SUD patients, 1118 (78.7%) reported alcohol abuse, 190 (13.4%) reported methamphet-

amine abuse, 62 (4.7%) reported abuse of prescribed psychotropic drugs, 25 (1.8%) reported other illicit drug abuse, and 171 (12.0%) met the conditions for multi-substance abuse. The mean score (SD) of the K10 was 22.6 (10.3) in the total sample (men, 21.3 [9.6]; women, 27.2 [11.1]), and that of M.I.N.I. suicide risk subsection was 9.6 (12.1) (men, 8.0; women, 15.3 [13.3]). Additionally, 534 (37.6%) scored above the limit for depression on the K10, and 495 (34.9%) showed severe suicidality on the M.I.N.I. suicide risk subsection.

Table 1 shows the results of logistic regression analyses for severe suicidality adjusted by sexes. Bivariate analysis demonstrated that younger age, female sex, current depression, methamphetamine abuse, abuse of prescribed psychotropic drugs, and multi-substance abuse were significantly positively associated and alcohol abuse was significantly negatively associated with severe suicidality in SUD patients. Multivariate analysis identified four of these variables, younger age, female sex, current depression, and multi-substance abuse, as being significantly associated with severe suicidality.

Table 2 shows the results of logistic regression analyses for severe suicidality in male SUD patients. Bivariate analysis demonstrated that younger age, current depression, methamphetamine abuse, abuse of prescribed psychotropic drugs, and multi-substance abuse were significantly positively associated and alcohol abuse was significantly negatively associated with severe suicidality. Multivariate analysis identified two of these variables, younger age and current depression, as being significantly associated with severe suicidality in male subjects.

Table 3 shows the results of logistic regression analyses for severe suicidality in female SUD patients. Bivariate analysis demonstrated that younger age, current depression, and multi-substance abuse were significantly positively associated and alcohol abuse was significantly negatively associated with severe suicidality. Multivariate analysis identified only one of these variables, current depression, as being significantly associated with severe suicidality in female subjects.

DISCUSSION

To the best of our knowledge, this is the first study to identify risk factors for suicide in Japanese SUD patients adjusting for age and sex, and to examine sex differences in suicide risk among these patients.

Table 1. Logistic regression analyses for severe suicidality of outpatients with substance use disorder ($n = 1420$)

Dependent variables	Independent variables	Severe suicidality ($n = 495$)		Non-severe suicidality ($n = 925$)		Bivariate analysis			Multivariate analysis		
		Mean	SD	Mean	SD	B	Unadjusted OR	95%CI	B	Adjusted OR	95%CI
		<i>n</i>	%	<i>n</i>	%						
Severe suicidality (M.I.N.I. suicide risk ≥ 10)	Age (years)	45.1	11.9	53.0	13.0	-0.049	0.952***	0.943–0.961	-0.027	0.973***	0.962–0.985
	Sex (female percentage: male = 0, female = 1)	161/495	32.5%	149/920	16.2%	0.938	2.555***	1.974–3.308	0.452	1.571**	1.150–2.146
	Current depression (K10 score ≥ 25 ; absence = 0, presence = 1)	346/492	70.3%	188/913	20.6%	2.213	9.139***	7.108–11.750	1.984	7.271***	5.580–9.476
	Alcohol abuse (absence = 0, presence = 1)	350/495	70.7%	768/920	83.5%	-0.739	0.478***	0.368–0.620	0.100	1.106	0.726–1.684
	Methamphetamine abuse (absence = 0, presence = 1)	94/495	19.0%	96/920	10.4%	0.699	2.012**	1.478–2.379	0.140	1.151	0.720–1.839
	Other illicit drug abuse (absence = 0, presence = 1)	8/495	1.6%	17/920	1.8%	-0.136	0.873	0.374–2.036	-0.521	0.594	0.211–1.674
	Prescribed-psychotropic drug abuse (absence = 0, presence = 1)	34/495	6.9%	28/920	3.0%	0.854	2.350**	1.407–3.923	0.095	1.100	0.579–2.091
	Multi-substance abuse (absence = 0, presence = 1)	99/495	20.0%	72/920	7.8%	1.080	2.944***	2.125–4.080	0.490	1.632*	1.107–2.405

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$. M.I.N.I., Mini International Neuropsychiatric Interview; OR, odds ratio, CI, confidence interval.

Although previous Western studies have identified several risk factors for suicide, including abusing prescribed psychotropic drugs,⁴ abusing multiple substances,⁵ and co-occurrence of depression,⁶ such

findings were obtained from samples that included few methamphetamine abusers.

In the present study, multivariate analysis identified three variables, younger age, female sex, and

Table 2. Logistic regression analyses for severe suicidality of male outpatients with substance use disorder ($n = 1113$)

Dependent variables	Independent variables	Severe suicidality ($n = 334$)		Non-severe suicidality ($n = 779$)		Bivariate analysis			Multivariate analysis		
		Mean	SD	Mean	SD	B	Unadjusted OR	95%CI	B	Adjusted OR	95%CI
		<i>n</i>	%	<i>n</i>	%						
Severe suicidality (M.I.N.I. suicide risk ≥ 10)	Age (years)	47.6	11.8	54.4	12.8	-0.044	0.957***	0.947–0.968	-0.280	0.972***	0.959–0.985
	Current depression (K10 score ≥ 25 ; absence = 0, presence = 1)	227/331	68.6%	141/769	18.3%	2.265	9.628***	7.195–12.883	2.107	8.227***	6.039–11.207
	Alcohol abuse (absence = 0, presence = 1)	249/334	74.6%	660/774	85.3%	-0.681	0.506***	0.369–0.694	0.231	1.260	0.748–2.121
	Methamphetamine abuse (absence = 0, presence = 1)	57/334	17.1%	70/774	9.0%	0.735	2.086***	1.433–3.036	0.237	1.268	0.710–2.263
	Other illicit drug abuse (absence = 0, presence = 1)	6/334	1.8%	16/774	2.1%	-0.134	0.875	0.336–2.255	-0.542	0.582	0.184–1.841
	Prescribed-psychotropic drug abuse (absence = 0, presence = 1)	21/334	6.3%	19/774	2.5%	0.989	2.690**	1.426–5.072	0.488	1.629	0.736–3.603
	Multi-substance abuse (absence = 0, presence = 1)	61/334	18.3%	55/774	7.1%	1.072	2.921***	1.977–4.315	0.404	1.498	0.939–2.390

** $P < 0.01$, *** $P < 0.001$. M.I.N.I., Mini International Neuropsychiatric Interview; OR, odds ratio, CI, confidence interval.

Table 3. Logistic regression analyses for severe suicidality of female outpatients with substance use disorder (*n* = 307)

Dependent variables	Independent variables	Severe suicidality (<i>n</i> = 161)		Non-severe suicidality (<i>n</i> = 146)		Bivariate analysis			Multivariate analysis		
		Mean	SD	Mean	SD	B	Unadjusted OR	95%CI	B	Adjusted OR	95%CI
		<i>n</i>	%	<i>n</i>	%						
Severe suicidality (M.I.N.I. suicide risk ≥ 10)	Age (years)	40.4	10.7	45.8	12.1	−0.044	0.957***	0.937–0.977	−0.022	0.979	0.954–1.004
	Current depression (K10 score ≥ 25 ; absence = 0, presence = 1)	119/161	73.9%	47/144	32.6%	1.758	5.800***	3.568–9.428	1.682	5.376***	3.182–9.082
	Alcohol abuse (absence = 0, presence = 1)	101/161	62.7%	108/146	74.0%	−0.524	0.592*	0.363–0.965	−0.171	0.843	0.409–1.740
	Methamphetamine abuse (absence = 0, presence = 1)	37/161	23.0%	26/146	17.8%	0.363	1.423	0.814–2.487	−0.058	0.944	0.423–2.104
	Other illicit drug abuse (absence = 0, presence = 1)	2/161	1.2%	1/146	0.7%	0.601	1.824	0.164–20.327	0.029	1.029	0.063–16.880
	Prescribed psychotropic drug abuse (absence = 0, presence = 1)	13/161	8.1%	9/146	6.2%	0.290	1.337	0.554–3.227	−0.553	0.575	0.201–1.649
	Multi-substance abuse (absence = 0, presence = 1)	38/161	23.6%	17/146	11.6%	0.852	2.344**	1.257–4.371	0.654	1.922	0.946–3.907

P* < 0.05, *P* < 0.01, ****P* < 0.001. M.I.N.I., Mini International Neuropsychiatric Interview; OR, odds ratio, CI, confidence interval.

current depression, as suicide risk factors in Japanese SUD patients, although bivariate analysis demonstrated that, in addition to these, methamphetamine abuse, abuse of prescribed psychotropic drugs, and multi-substance abuse were significantly associated with severe suicide risk, as previous studies^{4,5,8} have indicated. These findings suggest that suicide risk in SUD patients may be more closely associated with two demographic variables and one psychiatric disorder other than SUD type (e.g. methamphetamine or prescribed psychotropic drugs) and number of abused substances (e.g. simultaneously abusing more than two types of substances).

Although it is not surprising that current depression is an important risk factor for suicide in SUD patients common in both Western countries^{1,2,14} and Japan,¹⁵ it is of interest that both younger age and female sex were more closely associated with severe suicidality than aspects of SUD. We speculate that these demographic factors may indirectly reflect serious psychosocial problems that the SUD patients have been experiencing. As to younger age, Cloninger *et al.*¹⁶ and Brown *et al.*¹⁷ suggested that early onset of SUD may be promoted by childhood episodes of attention-deficit/hyperactivity disorder (ADHD) and other conduct problems, and a birth cohort study by Sourander *et al.*¹⁸ reported that hyperkinetic tendencies and conduct problems at

the age of 8 years may be predictive of suicide in men in early adulthood, as well as early onset of substance abuse.

On the other hand, as to female sex, Lacy and Evans¹⁹ found that a substantial number of female SUD patients showed self-destructive behaviors, including repetitive self-injury and repeated suicide attempts accompanied by comorbid eating disorders, particularly bulimia nervosa, and conceptualized this clinical subgroup of female SUD patients as 'multi-impulsive bulimia.' Majewska²⁰ and Clark *et al.*²¹ also revealed that female SUD patients were more likely to have been childhood victims of physical, sexual, and psychological abuse, and neglect, all of which have been identified as important risk factors for suicidal behavior in adulthood.²²

Based on these findings, we suppose that the two demographic variables, younger age and female sex, may reflect the SUD patients with early onset of substance abuse impacted by psychosocial problems in childhood and adolescence (e.g. presence of ADHD and the other conduct problems, and 'multi-impulsive bulimia', and childhood histories of maltreatment, as risk factors identified by the Western studies^{16–21}). In this context, younger age and female sex may indicate a subgroup with severe suicidality in Japanese SUD patients similar to that in Western SUD patients. Future studies that include detailed

information of childhood psychosocial events are necessary to confirm this argument.

The present study also demonstrated sex differences in suicide risk in SUD patients. Although current depression was a common risk factor for suicidality in both male and female SUD patients, younger age was a risk factor for suicidality only in male patients, and no risk factors other than current depression were identified in female patients. Perhaps the female SUD patients had similar psychosocial features to the younger population of male patients given that the female patients were considerably younger than the men (men: 52.3 ± 12.9 years; women: 43.0 ± 11.7 , $P < 0.001$). This leads us to speculate that young male SUD patients may have psychosocial features associated with suicidality in common with female SUD patients.

This study has several limitations. First, sampling bias cannot be excluded, given that subjects were drawn only from patients who consulted one of seven hospitals specializing in SUD treatment, though each of these hospitals is a representative medical institution for its region. Second, data were cross-sectionally acquired via self-reporting questionnaires rather than through structured interviews. Third, the outcome of the present study was 'severe suicide risk' as determined by the M.I.N.I, not prognosis of suicide completion. Fourth, the M.I.N.I. was employed as self-reporting questionnaire in this study, although it was originally developed as a semi-structured interview schedule. Fifth, although in the suicidality section of the M.I.N.I. the scores for each answer are weighted according to their importance in predicting future suicide, the validity of this scoring system has not been completely established.^{11–13} Lastly, comorbid psychiatric disorders other than depressive disorder were not considered, and data on psychosocial and economic variables were insufficient for all patients. Despite these limitations, this report is of value because it is the first to identify suicide risk factors among Japanese SUD patients, adjusting for age and sex differences.

Conclusion

The present study demonstrated that younger age, female sex, and current depression were independent risk factors for severe suicidality in Japanese SUD patients. Although current depression is a risk factor for suicide in SUD patients common in both Western

countries and Japan, in Japanese SUD patients both younger and female subjects were more closely associated with severe suicidality than aspects of SUD.

Our study also showed that current depression was a common risk factor for suicidality in both male and female SUD patients while only in male patients, younger age was a risk factor for suicidality. Young male SUD patients are speculated to have a risk of suicide equal to that of female SUD patients.

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REFERENCES

1. Chynoweth R, Tonge JI, Armstrong J. Suicide in Brisbane: A retrospective psychosocial study. *Aust. N. Z. J. Psychiatry* 1980; 14: 37–45.
2. Lönnqvist JK, Henriksson MM, Isometsä ET *et al.* Mental disorders and suicide prevention. *Psychiatry Clin. Neurosci.* 1995; 49: S111–S116.
3. De Leo D, Evans R. The impact of substance abuse policies on suicide mortality. In: De Leo D, Evans R (eds). *International Suicide Rates and Prevention Strategies*. Hogrefe & Huber, Cambridge, MA, 2004; 101–112.
4. Harris EC, Barraclough B. Suicide as an outcome for mental disorders. A meta-analysis. *Br. J. Psychiatry* 1997; 170: 205–228.
5. Borges G, Walters EE, Kessler RC. Associations of substance use, abuse, and dependence with subsequent suicidal behavior. *Am. J. Epidemiol.* 2000; 151: 781–789.
6. Davis LL, Rush JA, Wisniewski SR *et al.* Substance use disorder comorbidity in major depressive disorder: An exploratory analysis of the Sequenced Treatment Alternatives to Relieve Depression cohort. *Compr. Psychiatry* 2005; 46: 81–89.
7. Matsumoto T, Kamijo A, Miyakawa T *et al.* Methamphetamine in Japan: The consequences of methamphetamine abuse as a function of route of administration. *Addiction* 2002; 97: 809–818.
8. Matsumoto T, Matsushita S, Okudaira K *et al.* A study on differences of suicide risk in substance use disorder patients by types of an abused substance: A comparison among alcohol, amphetamine, and sedative, hypnotic or anxiolytic use disorder patients. *Jpn. J. Alcohol. Drug Stud.* 2010; 45: 530–542 (in Japanese).

9. Kessler RC, Barker PR, Colpe LJ *et al.* Screening for serious mental illness in the general population. *Arch. Gen. Psychiatry* 2003; **60**: 184–189.
10. Furukawa TA, Kessler RC, Slade T, Andrews G. 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.* 2003; **33**: 357–362.
11. Otsubo T, Tanaka K, Koda R *et al.* Reliability and validity of Japanese version of the Mini International Neuropsychiatric Interview. *Psychiatry Clin. Neurosci.* 2005; **59**: 517–526.
12. Sheehan DV, Lecrubier Y, Sheehan KH *et al.* The Mini International Neuropsychiatric Interview (M.I.N.I.): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *J. Clin. Psychiatry* 1998; **59**: 22–33.
13. Sheehan DV, Lecrubier Y. (Translated by Otsubo T, Miyaoka H, Kamijima K) *M.I.N.I. Mini International Neuropsychiatric Interview*. Japanese version 5.0.0, Seiwa Shoten, Tokyo, 2003.
14. Barraclough B, Bunch J, Nelson B, Sainsbury P. A hundred cases of suicide: Clinical aspects. *Br. J. Psychiatry* 1974; **125**: 355–373.
15. Hirokawa S, Matsumoto T, Katsumata T *et al.* Psychosocial and psychiatric characteristics of suicide completers who consulted a psychiatrist prior to death: A psychological autopsy study. *Jpn. Bull. Soc. Psychiatry* 2010; **18**: 341–351 (in Japanese).
16. Cloninger C, Sigvardsson S, Bohman M. Childhood personality predicts alcohol use in young adults. *Alcoholism* 1988; **12**: 494–505.
17. Brown SA, Cleghorn A, Schuckit MA, Myers MG, Mott MA. Conduct disorder among adolescent alcohol and drug abusers. *J. Stud. Alcohol* 1996; **57**: 314–324.
18. Sourander A, Klomek AB, Niemelä S. Childhood predictors of completed and severe suicide attempts: Findings from the Finnish 1981 Birth Cohort Study. *Arch. Gen. Psychiatry* 2009; **66**: 398–406.
19. Lacey JH, Evans CD. The impulsivist: A multi-impulsive personality disorder. *Br. J. Addict.* 1986; **81**: 641–649.
20. Majewska MD. Cocaine addiction as a neurological disorder: Implications for treatment. *NIDA Res. Monogr.* 1996; **163**: 1–26.
21. Clark DB, Lesnick L, Hegedus AM. Traumas and other adverse life events in adolescents with alcohol abuse and dependence. *J. Am. Acad. Child Adolesc. Psychiatry* 1997; **36**: 1744–1751.
22. Bruffaerts R, Demyttenaere K, Borges G *et al.* Childhood adversities as risk factors for onset and persistence of suicidal behavior. *Br. J. Psychiatry* 2010; **197**: 20–27.