



# Epidemiological aspects of intermittent explosive disorder in Japan; prevalence and psychosocial comorbidity: Findings from the World Mental Health Japan Survey 2002–2006

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## ARTICLE INFO

### Article history:

Received 5 June 2009

Received in revised form 16 July 2010

Accepted 20 July 2010

### Keywords:

Intermittent explosive disorder

Epidemiology

Japanese

## ABSTRACT

The purpose of the present study is to evaluate the prevalence of intermittent explosive disorder (IED) as well as its comorbidity with other mental disorders in a Japanese community sample. Subjects were 4,134 residents in selected sites in Japan. Diagnoses of mental disorders are based on the World Mental Health Survey Initiative Version of the World Health Organization Composite International Diagnostic Interview. Lifetime and 12-month prevalence of IED were 2.1% and 0.7%, respectively, whereas those of narrow IED were 1.2% and 0.6%, respectively. Male gender and young age were positively associated with an increased prevalence of IED. Mood and anxiety disorders as well as suicidal ideation were shown to be associated with IED in both genders. The overall association between anxiety disorders and IED was stronger in women than in men. Positive association of substance use problems with IED was also observed. Similar findings were observed between those psychosocial factors and narrow IED. These results suggest that people having those mixed complications might have a high suicidal risk. Further research using psychological measures for anger suppression will lead to more thorough understanding of the effects of IED on psychosocial comorbidity and suicidal risk.

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## 1. Introduction

Intermittent explosive disorder (IED) is characterized by discrete episodes of aggressive impulses that result in serious assaultive acts towards people or destruction of property, and is classified by the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) as one of the impulse-control disorders (American Psychiatric Association, 2000). This disorder causes major social or familial disruptions to patients, who are sometimes obliged to resign from their position or divorce because of their behavioral problems.

Formerly, few epidemiological studies had been conducted with regard to this disorder, and a lack of reliable clinical evidence regarding diagnosis, treatment, or prognosis was all too common (Olvera, 2002). This was partly due to the instability of the definition of IED, which has changed over the years, resulting in inconsistent findings on IED prevalence (Olvera, 2002). Some studies have assessed the prevalence of IED among psychiatric clinical-based populations (Coccaro et al., 1998; Lejoyeux et al., 1999; Olvera, 2002). Prevalence estimated at approximately 25% was reported among

patients with personality disorders with impulsive-aggressive behavior (Coccaro et al., 1998) or alcohol dependence (Lejoyeux et al., 1999), whereas prevalence among the general population of psychiatric outpatients was reported to be 3.1–6.5% (Olvera, 2002). It was also reported that 2% of all people admitted to a university hospital psychiatric service were diagnosed as IED, among whom 80% were males (Kaplan and Sadock, 1998). Coccaro (2000) indirectly estimated the community rate of IED at 0.9–1.8% based on the previous clinical and population-based studies.

Recently, however, several epidemiological studies of IED were conducted in general populations (Coccaro et al., 2004; Kawakami et al., 2005; Kessler et al., 2006; Ortega et al., 2008; Fincham et al., 2009). Although the previous clinically based studies have reported a low prevalence of IED, the population-based prevalence of IED in recent reports has been shown to be higher than previously thought (Coccaro et al., 2004; Kessler et al., 2006; Fincham et al., 2009). In addition, a high level of comorbidity is noted with mood, anxiety, and substance-related disorders (Kessler et al., 2006; Amara et al., 2007; Ortega et al., 2008; Fincham et al., 2009). Since the former two categories are also strongly associated with substance-related disorders, it is important to evaluate the actual situation of the association between substance use and IED in a general population, so as to establish an effective IED treatment strategy.

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Previous studies of IED took no account of the viewpoints of cross-cultural factors, in spite of the fact that behavioral problems related to impulsivity-control are likely to be strongly affected by cultural circumstances. In general, Japanese tend to more readily suppress their emotions, (especially overt anger) than Westerners or other Asian populations. This cultural proclivity may, to some extent, affect plain behavioral problems such as IED among Japanese.

The purpose of the present study is to evaluate both a lifetime and 12-month prevalence of IED as well as the comorbidity of mood, anxiety, and substance-related disorders with IED together with associations with behavioral problems caused by commonly used drugs, and suicidal ideation in a Japanese community sample based on data specific to Japan that were collected between 2002 and 2006 as part of the World Mental Health Surveys (WMH-J 2002-06 Survey) (WHO World Mental Health Survey Consortium, 2004).

## 2. Methods

### 2.1. Subjects

Eleven community populations in Japan were selected as study sites in 2002–2006. The sites included three urban cities and eight rural municipalities. At each survey site, random sample was selected from residents aged 20 years or older based on a voter registration list or a resident registry. Residents who could not speak Japanese, had moved, died, or were hospitalized at the time of the survey were excluded. After a letter of invitation was sent or a welfare commissioner sounded out a resident's opinion, trained interviewers contacted the subjects and interviewed those who agreed to participate in the survey using a standardized instrument. A total of 4,134 concerned community residents participated during the study period. The final response rate was estimated to be 55.1%, except in Nagasaki City where a different survey method had been used (response rate 26%). The response rate at 10 sites ranged from 41 to 82%.

In the present survey, an internal sampling strategy was used to reduce a respondent's burden by dividing the interview into two parts (Kawakami et al., 2005). Part I included a diagnostic assessment, which all respondents were required to complete. Part II covered information about the correlates of a disorder. A subsample of part I respondents who met the criteria for any mental disorder, and a probability subsample of approximately 10% of other respondents were given part II ( $n = 1,725$ ). As mentioned below, when we use information from part II data, the subjects should be restricted to part II only to compensate for the difference in weighted values between parts I and II. Thus, the present analyses principally included part I data, except for analyses of the association between substance-related problems and IED.

To compensate for differences between the sample and population characteristics due to frame under-coverage, non-response and sampling variability, all samples were weighted to adjust for differential probabilities of selection and were post-stratified to match the population distributions on the cross-classification for sex and age, for which the non-response weight in a given group for sex and age was the inverse of the response rate in this category (Kawakami et al., 2005).

### 2.2. Assessments of mental disorders

#### 2.2.1. Intermittent explosive disorder

Three or more lifetime anger attacks were required to apply the DSM-IV criterion A for IED requirement of "several attacks." With special reference to the report by Kessler et al. (2006) who used almost the same methods as ours, we also created a narrow definition of lifetime IED that requires three attacks in the same year as described in that paper. Furthermore, we created a "broad only" category which was defined as three or more lifetime attacks without ever having as many as three attacks in a single year. Similarly, a narrow definition of 12-month IED required three attacks in the past 12 months, whereas a broad definition required three lifetime attacks and at least one attack in the past 12 months. Although Kessler et al. (2006) created "intermediate only" and "broad only" categories, we did not use such categories because the numbers of "intermediate only" and "broad only" in our sample were three and one, respectively, which was extremely few compared with those reported by Kessler et al. (2006).

DSM-IV criterion B for IED requires the aggressive "grossly out of proportion to any precipitating psychosocial stressor," and criterion C excludes the possibility that the anger attack is caused by other mental or organic disorders as well as by the direct effect of a substance. These criteria were ascertained according to the prescribed interview procedures of World Mental Health Survey Initiative Version of the World Health Organization Composite International Diagnostic Interview (WMH-CIDI) described below.

Impairment due to lifetime IED was assessed by property damage as well as the number of times the respondent or someone sought medical attention due to an injury caused by the respondent's anger attacks. On the other hand, 12-month questions ask respondents to rate the extent to which their IED interfered with their life and activities during the past 12 months using the Sheehan Disability Scale (Leon et al., 1997), which are visual analogue scale with 0–10 points that ask how much a disorder interfered with

home management, work, social life, and personal relationships. A score of seven or more was defined as a severe or very severe condition.

#### 2.2.2. Mood and anxiety disorders

The Mini-International Neuropsychiatric Interview (M.I.N.I.), which is widely used as a convenient structured diagnostic interview, deals with 10 mental disorders which can be categorized into mood and anxiety disorders, based on the standard of a 12-month prevalence of 0.5% or more (Sheehan et al., 1998). Among these 10 categories, we used bipolar I and II disorders instead of mania. Obsessive-compulsive disorder was not assessed in the present survey, while post traumatic stress disorder was examined in part II data. Therefore, we chose the following nine disorders for evaluating the comorbidity of mood and anxiety disorders with IED: Anxiety disorders (panic disorder [PD], agoraphobia with/without panic disorder [AGO], specific phobia [SP], social phobia [SO], and generalized anxiety disorder [GAD]); Mood disorders (major depressive disorder [MDD], dysthymia [DYS], and bipolar I and II disorders).

Details regarding factors such as training of interviewers, field procedures, and survey instruments were given elsewhere (Kawakami et al., 2005). WMH-J diagnoses are based on WMH-CIDI (Kessler and Üstün, 2008), a fully structured lay-administered diagnostic interview that generates data on both the International Classification of Diseases, 10th Revision (ICD-10) (World Health Organization, 1993) and DSM-IV (American Psychiatric Association, 1994). In the present study, DSM-IV criteria were used for diagnoses of the above mental disorders.

The diagnostic hierarchy rules of DSM-IV (National Comorbidity Survey, 2005) were used for IED, GAD, MDD, and DYS. Since there were very few subjects in the 12-month prevalence category, we used the lifetime prevalence of these disorders for the analyses regarding the comorbidity with IED. In addition, the association between the lifetime prevalence of serious suicidal ideation and IED was also evaluated.

#### 2.2.3. Substance use

In the same way as the comorbidity analyses of mood and anxiety disorders, the associations between IED and final diagnosis of substance-related disorders by DSM-IV criteria, such as alcohol abuse and dependence, drug abuse and dependence were also evaluated according to the interview procedure of WMH-CIDI, in which each DSM-IV item was transformed into corresponding question. The current interview list included three categories of the relevant substances or drugs, i.e., every kind of beverage containing alcohol (e.g., beer, wine, whisky, vodka), medical drugs (e.g., analgesics, benzodiazepines, methylphenidates), and some illegal substances in Japan (e.g., cannabis, cocaine, marijuana, heroin). These substances or drugs are listed in the diagnostic criteria of substance-related disorders in DSM-IV.

Among these drugs, the commonly used medications that were readily available, such as analgesics, tranquilizers (e.g., benzodiazepines), and methylphenidates were possible agents affecting IED symptoms at the level of daily life. Hence, we evaluated the relation between IED and the use of such drugs (except for medical purposes) by relevant questions included in WMH-CIDI. Those drugs should be used for medical purposes only according to a physician's instructions, because they can often cause substance-related disorders such as dependence or abuse. The experiences of such drug use were ascertained by showing the respondents a list of relevant drugs for supporting their recall.

In addition, the association between a history of alcohol-related issues as well as the possibility of their occurrence and IED was also evaluated. Such experiences included troubles in coping with social or familial obstacles, interpersonal difficulties caused by drinking, driving drunk, or having been arrested for that offence. Questions regarding the above problems were also extracted from WMH-CIDI questions for the diagnosis of alcohol abuse. In addition, these alcohol abuse and dependence symptoms such as alcohol tolerance, withdrawal symptoms, or failure of temperance among subjects with lifetime IED within the recent 12 months were confirmed. Harmful effects due to drinking within the past 12 months were also assessed by questions regarding five domains in physical or social impairments (i.e., harm to physical health, damage to family, impulsive action with regret, breach of trust, and feeling of unhappiness). Further, the comorbid status was evaluated between lifetime IED, and diagnoses of alcohol abuse and dependence within one month.

The use of obviously illicit drugs such as cannabis, cocaine, or marijuana was not taken into account because the characteristics of the drug users were considered not to be representative of the general population (i.e., extremely anti-social), and the number of subjects available for analysis was very few.

### 2.3. Statistical analysis

Comparisons of courses or severities between narrow and 'broad only' groups in lifetime IED were conducted by analysis of variance. In these comparisons and the following descriptive analysis of 12-month IED, subjects who reported their number of lifetime attacks to be more than (number of years with attacks  $\times$  highest number of annual attacks) or those with missing values of such variables were excluded because their recollection of the cause of the anger attacks was considered to be inaccurate ( $n = 25$  for lifetime IED, and  $n = 10$  for 12-month IED).

Logistic regression analysis was used in the following three steps. First, bivariate or multivariate logistic regression models were computed to determine the association of lifetime and 12-month IED with demographic and personal characteristics. In these regression models, analyses for IED and narrow IED were conducted separately, because narrow IED is considered to be clinically more

significant than IED or 'broad only' IED. In addition, analysis for 'broad only' lifetime IED was conducted. Second, age-adjusted models of logistic regression were computed to determine the association of a lifetime prevalence of IED with a corresponding prevalence of mental disorders and suicidal ideation. Analyses for narrow IED and IED were conducted separately also in these models. However, the number of lifetime 'broad only' IED ( $n = 24$ ) was too few to calculate the comorbidity between 'broad only' IED and those mental disorders. In those analyses, age was categorized into the two strata of  $<50$  or  $50+$ . Third, multiple logistic regression analysis was used to evaluate the association between drug use (except for medical purpose) or alcohol-related problems and IED. This analysis was conducted in part II samples since the relevant items used were restricted to that sub-sample. The outcome variables were IED (or narrow IED) assessed by 12-month and lifetime prevalence in the first and third analysis, with IED (or narrow IED) assessed by a lifetime prevalence only being used in the second analysis. In the analyses regarding narrow and 'broad only' IED, subjects with lifetime or 12-month IED but whose number of attacks was unknown were deleted ( $n = 12$  for lifetime narrow and 'broad only', one for 12-month narrow). The odds ratios (ORs) and their 95% confidence intervals (CIs) were obtained from the corresponding logistic regression coefficients and their design-adjusted standard errors.

Finally, we compared age of onset among subjects having IED and comorbid mental disorders by a paired  $t$ -test separately for lifetime IED and lifetime narrow IED.

$P$ -values (two-sided) less than 0.05 were considered statistically significant. All computations were performed using the SAS software package, version 9.1.3 (SAS Institute, Inc., Cary, NC, USA).

#### 2.4. Ethical considerations

Written informed consent was obtained from each respondent at each site. The protocol of the present survey was approved by the Research Ethics Committee of Okayama University (for the Okayama site), the Japan National Institute of Mental Health (for the Kagoshima site), Nagasaki University (for the Nagasaki site), Yamagata University (for the Yamagata site), and Juntendo University (for the Yokohama City).

### 3. Results

The subjects diagnosed with lifetime total IED numbered 52 for men and 28 for women. Mean ages (95% CIs) at the onset of the disease for men and women were 16.5 years (13.8–19.1), and 26.3 years (21.0–31.6), respectively. Only 4.2% of the subjects with IED had ever consulted a doctor or a psychological counselor about their anger attacks. On the other hand, 15 men and 12 women were diagnosed with 12-month IED.

Table 1 shows the course and property damage of lifetime IED, according to narrow IED as well as DSM-IV IED. Although the narrow group showed high number of attacks, the property damage and medical attention were rather less. In comparison with 'broad only' IED, narrow IED showed significantly higher number of lifetime attacks, more years with attacks, and greater highest number of annual attacks than 'broad only' IED (data not shown). Course and role impairment of 12-month IED are shown in Table 2. 76.5% of 12-month IED was classified as narrow group, showing a high number of 12-month attacks.

**Table 1**  
Course and property damage of lifetime DSM-IV IED and narrow IED.

	IED	Narrow IED <sup>a</sup>
	Mean (SE)	Mean (SE)
No. of cases	55	34
Course		
No. of lifetime attacks	14.3 (3.2)	19.8 (4.7)
No. of years with attacks	8.1 (1.0)	9.9 (1.3)
Highest no. of annual attacks	9.5 (2.9)	14.7 (4.5)
Severity		
Property damage, \$ <sup>b</sup>	1182.4 (544.7)	1024.2 (574.9)
Medical attention, per 100 cases <sup>c</sup>	70.7 (27.9)	59.6 (27.5)

<sup>a</sup> Narrow IED, three or more annual attacks in at least one year of life.

Subjects with missing values of the relevant items were excluded.

<sup>b</sup> Estimated cost of all the things ever damaged or broken in an anger attack (converted into US dollars with yen/dollar exchange rate of November 20, 2009),  $n = 17$  for narrow IED, 30 for IED.

<sup>c</sup> Number of times during an anger attack someone was hurt badly enough to need medical attention per 100 cases of intermittent explosive disorder,  $n = 29$  for narrow IED, 44 for IED.

**Table 2**

Course and impairment of 12-month DSM-IV IED and narrow IED.

	IED	Narrow IED <sup>a</sup>
No. of cases	17	13
12-month persistence, mean (SE)		
No. of 12-month attacks <sup>b</sup>	17.1 (8.7)	19.9 (10.1)
No. of weeks with attacks <sup>c</sup>	5.1 (0.7)	5.8 (0.8)
Severe or very severe role impairment <sup>d</sup> , % (SE)		
Home <sup>e</sup>	0.0	0.0
Work <sup>f</sup>	0.0	0.0
Interpersonal <sup>g</sup>	14.1 (4.8)	17.5 (6.0)
Social <sup>h</sup>	7.4 (7.4)	9.2 (9.2)
Any of the above	20.5 (11.8)	25.1 (14.4)

<sup>a</sup> Narrow IED, three or more past 12-month attacks. Subjects with missing values of the relevant items were excluded.

<sup>b</sup>  $n = 13$  for narrow IED, 16 for IED.

<sup>c</sup>  $n = 12$  for narrow IED, 15 for IED.

<sup>d</sup> Sheehan Disability Scale.

<sup>e,g,h</sup>  $n = 12$  for narrow IED, 16 for IED.

<sup>f</sup>  $n = 10$  for narrow IED, 14 for IED.

There were, however, no subjects with severe or very severe role impairment in home or work due to their anger attacks.

The lifetime and 12-month prevalence of IED according to personal and demographic factors are shown in Table 3. In both lifetime and 12-month prevalence, men showed higher rates of IED than women. As for other demographic factors, old age and low educational backgrounds were regarded as IED preventive factors as shown by ORs, while marital and employment status showed no material associations with IED. These tendencies became more obvious when narrow IED was used as a dependent variable (Table 4). Results of lifetime 'broad only' IED showed similar tendencies with those of IED (data not shown). Lifetime and 12-month prevalence of IED were 2.1% and 0.7%, respectively, whereas those of narrow IED were 1.2% and 0.6%, respectively. Lifetime prevalence of 'broad only' IED was 0.6%.

Comorbidity rates and associations of mental disorders and suicidal ideation with IED as evaluated by ORs according to gender are shown in Table 5. In both genders, the comorbidity of MDD was relatively high (approximately 15%). Comorbidity rates of anxiety

**Table 3**

Relations of demographic factors to lifetime and 12-month prevalence of DSM-IV IED ( $n = 4,134$ ).

Factor	Lifetime IED ( $n = 80$ )		12-month IED ( $n = 27$ )	
	% (SE)	OR (95% CI)	% (SE)	OR (95% CI)
Sex				
Male	2.9 (0.4)	2.3 (1.5–3.8)	0.9 (0.2)	1.4 (0.7–3.2)
Female	1.3 (0.2)	1.0	0.6 (0.2)	1.0
Age (yr)				
20–34	2.8 (0.7)	3.0 (1.4–6.5)	1.1 (0.4)	2.7 (0.8–8.9)
35–49	2.5 (0.5)	2.6 (1.3–5.5)	0.7 (0.3)	1.7 (0.5–5.8)
50–64	2.2 (0.4)	2.3 (1.1–4.7)	0.7 (0.3)	1.8 (0.6–5.6)
$\geq 65$	1.0 (0.3)	1.0	0.4 (0.2)	1.0
Education (yr) <sup>a</sup>				
$\leq 12$	1.5 (0.2)	0.5 (0.3–0.8)	0.6 (0.2)	0.5 (0.2–1.4)
13–15	2.3 (0.7)	0.7 (0.3–1.5)	0.6 (0.3)	0.6 (0.2–2.2)
$\geq 16$	3.2 (0.8)	1.0	1.1 (0.4)	1.0
Marital Status <sup>b</sup>				
Never married	2.2 (0.7)	1.0 (0.5–2.0)	0.9 (0.5)	1.2 (0.4–3.5)
Previously married	1.0 (0.4)	0.5 (0.2–1.1)	0.3 (0.2)	0.4 (0.1–1.7)
Married	2.2 (0.3)	1.0	0.8 (0.2)	1.0
Occupational Status <sup>c</sup>				
Unemployed <sup>d</sup>	1.5 (0.3)	0.7 (0.4–1.2)	0.6 (0.2)	0.8 (0.3–2.1)
Employed	2.2 (0.3)	1.0	0.7 (0.2)	1.0
Total	2.1 (0.2)		0.7 (0.1)	

<sup>a</sup>  $n = 3,902$ .

<sup>b</sup>  $n = 4,133$ .

<sup>c</sup>  $n = 3,922$ .

<sup>d</sup> Including looking for work, temporary layoff, retired, homemaker, student, maternity leave, illness/sick leave, and disabled.



**Table 4**

Relations of demographic factors to lifetime and 12-month prevalence of narrow IED ( $n=4,122$  for lifetime diagnosis, 4,133 for 12-month diagnosis).

Factor	Lifetime narrow IED ( $n=44$ )		12-month narrow IED ( $n=22$ )	
	% (SE)	OR (95% CI)	% (SE)	OR (95% CI)
Sex				
Male	1.5 (0.3)	2.0 (1.0–3.7) <sup>e</sup>	0.9 (0.2)	2.2 (0.9–5.6)
Female	0.8 (0.2)	1.0	0.4 (0.1)	1.0
Age (yr)				
20–34	1.7 (0.5)	4.8 (1.6–15.0)	1.1 (0.4)	3.3 (0.9–11.9)
35–49	1.3 (0.4)	3.7 (1.2–11.1)	0.6 (0.3)	1.8 (0.5–6.9)
50–64	1.3 (0.3)	3.6 (1.2–10.4)	0.5 (0.2)	1.5 (0.4–5.6)
≥65	0.4 (0.2)	1.0	0.3 (0.2)	1.0
Education (yr) <sup>a</sup>				
≤12	0.9 (0.2)	0.5 (0.2–1.2)	0.4 (0.1)	0.4 (0.1–1.0) <sup>f</sup>
13–15	1.4 (0.5)	0.9 (0.3–2.3)	0.6 (0.3)	0.6 (0.2–2.2)
≥16	1.7 (0.6)	1.0	1.1 (0.4)	1.0
Marital Status <sup>b</sup>				
Never married	1.5 (0.6)	1.3 (0.6–3.0)	0.9 (0.5)	1.4 (0.5–4.3)
Previously married	0.4 (0.3)	0.3 (0.1–1.2)	0.2 (0.2)	0.2 (0.03–1.8)
Married	1.2 (0.2)	1.0	0.6 (0.2)	1.0
Occupational Status <sup>c</sup>				
Unemployed <sup>d</sup>	0.9 (0.3)	0.8 (0.4–1.6)	0.5 (0.2)	0.9 (0.3–2.5)
Employed	1.2 (0.2)	1.0	0.6 (0.2)	1.0
Total	1.2 (0.2)		0.6 (0.1)	

Note. Subjects whose number of attacks was unknown were deleted ( $n=12$  for lifetime narrow, 1 for 12-month narrow).

<sup>a</sup>  $n=3,890$  for lifetime narrow, 3,901 for 12-month narrow.

<sup>b</sup>  $n=4,121$  for lifetime narrow, 4,132 for 12-month narrow.

<sup>c</sup>  $n=3,910$  for lifetime narrow, 3,921 for 12-month narrow.

<sup>d</sup> Including looking for work, temporary layoff, retired, homemaker, student, maternity leave, illness/sick leave, and disabled.

<sup>e</sup>  $P=0.037$ .

<sup>f</sup>  $P=0.059$ .

disorders such as GAD, SO, and SP were higher in women than in men. The comorbidity of bipolar disorder and IED was observed only in women suffering from bipolar II disorder, while there was no comorbidity of PD or AGO. Comorbidity rates of all mood disorders and IED in men and women were 15.2% and 26.6%, respectively, while 10.2% of men and 30.3% of women with IED were diagnosed with anxiety disorders. Any mood or anxiety disorders as well as a lifetime prevalence of suicidal ideation were statistically significantly or

**Table 5**

Comorbidity between mental disorders, suicidal ideation, and lifetime DSM-IV IED according to gender.

	Men with IED ( $n=52$ )		Women with IED ( $n=28$ )	
	% (SE)	OR (95% CI) <sup>a</sup>	% (SE)	OR (95% CI) <sup>a</sup>
Anxiety disorders				
Any anxiety disorder	10.2 (4.3)	1.9 (0.7–5.0)	30.3 (8.7)	5.6 (2.4–12.9)
Panic disorder	0.0		0.0	
Agoraphobia	0.0		0.0	
Specific phobia	6.3 (3.6)	2.3 (0.7–8.0)	12.5 (5.6)	3.4 (1.1–10.2)
Social phobia	2.3 (2.3)	1.2 (0.2–9.0)	11.9 (7.1)	12.5 (3.2–48.3)
GAD <sup>b</sup>	5.9 (3.2)	4.9 (1.4–17.1)	12.7 (6.4)	7.2 (2.4–21.9)
Mood disorders				
Any mood disorder	15.2 (5.2)	4.4 (2.0–10.0)	26.6 (10.2)	3.6 (1.5–9.0)
MDD <sup>c</sup>	15.2 (5.2)	4.8 (2.1–10.7)	13.7 (7.2)	1.6 (0.5–5.0)
Dysthymia	1.6 (3.8)	19.3 (3.9–95.7)	6.8 (4.9)	7.3 (1.6–34.2)
Bipolar I disorder	0.0		0.0	
Bipolar II disorder	0.0		6.1 (5.9)	81.9 (9.6–698)
Substance-related disorders				
Alcohol abuse	22.0 (7.2)	1.9 (0.8–4.5)	8.4 (8.1)	1.8 (0.2–14.5)
Alcohol dependence	2.9 (2.9)	1.6 (0.2–12.0)	0.0	
Drug abuse	0.0		0.0	
Drug dependence	0.0		0.0	
Suicidal ideation	18.9 (6.3)	2.4 (1.1–5.3)	23.0 (9.0)	2.4 (0.9–6.2)

<sup>a</sup> Age-adjusted odds ratio. Lifetime prevalence of IED was used as a dependent variable. References are those without relevant mental disorders or suicidal ideation.

<sup>b</sup> General anxiety disorder.

<sup>c</sup> Major depressive disorder.

possibly significantly associated with IED in both genders. Similar tendencies were observed when narrow lifetime IED was used as a dependent variable (Table 6). As for the comorbidity of substance-related disorders with IED and narrow IED, no subjects had both such disorders and IED, except for nine (seven for narrow) men and one woman with alcohol abuse, and one man with alcohol dependence (Table 5, Table 6).

The use of at least one of the following three categories of drugs (except those used for medical treatment), tranquilizers or similar drugs, methylphenidates or similar drugs (psychostimulants), and analgesics was statistically significantly associated with an approximately four-fold increased risk of a lifetime prevalence of IED (OR 3.7 95% CI 1.7–8.2). The association between the use of those substances and a 12-month prevalence of IED showed a tendency similar to that of lifetime prevalence, while it did not reach statistical significance, partly due to the small sample size with a 12-month prevalence of IED. The actual experiences of alcohol-related problems or their possibility were significantly associated with a lifetime prevalence of IED (OR 4.5 95% CI 1.1–17.9); however, again, the association of those with a 12-month prevalence of IED did not reach statistical significance. Among those with lifetime IED, 57.8% drank three or more times per week in the most frequent drinking year in their lives, and 83.3% drank three shots of liquor or more per drinking day in such a year. Only one subject with lifetime IED had any alcohol abuse or dependence symptoms within the most recent six months. Similarly, only one subject with lifetime IED experienced any harmful effects due to drinking within recent 12 months. No comorbidity was observed between lifetime IED and one-month prevalence of alcohol abuse or dependence diagnosis.

Comparisons of the age of onset between lifetime IED (DSM-IV and narrow) and comorbid mental disorders are shown in Table 7. Average age of onset was significantly younger (earlier) for SP than for IED and narrow IED. Average age of onset was marginally significantly older (later) for MDD than for IED, and for alcohol abuse than for narrow IED ( $P<0.10$ ).

**Table 6**

Comorbidity between mental disorders, suicidal ideation, and lifetime narrow IED according to gender.

	Men with narrow IED ( $n=27$ )		Women with narrow IED ( $n=17$ )	
	% (SE)	OR (95% CI) <sup>a</sup>	% (SE)	OR (95% CI) <sup>a</sup>
Anxiety disorders				
Any anxiety disorder	11.2 (5.7)	2.1 (0.6–7.2)	39.3 (12.1)	8.2 (3.0–22.6)
Panic disorder	0.0		0.0	
Agoraphobia	0.0		0.0	
Specific phobia	7.6 (5.3)	2.8 (0.6–12.8)	20.2 (7.8)	5.9 (1.8–19.1)
Social phobia	0.0		19.2 (11.7)	21.0 (5.0–88.7)
GAD <sup>b</sup>	7.6 (4.4)	6.4 (1.4–27.9)	11.2 (7.8)	6.2 (1.4–28.0)
Mood disorders				
Any mood disorder	15.9 (7.6)	4.6 (1.6–13.5)	36.4 (13.7)	5.6 (2.0–15.9)
MDD <sup>c</sup>	15.9 (7.6)	4.9 (1.7–14.5)	22.1 (10.9)	2.9 (0.9–9.4)
Dysthymia	0.0		4.5 (0.2)	4.6 (0.6–35.7)
Bipolar I disorder	0.0		0.0	
Bipolar II disorder	0.0		9.8 (9.4)	142.0 (NC <sup>e</sup> )
Substance-related disorders				
Alcohol abuse	29.3 (10.0)	2.8 (1.0–8.0) <sup>d</sup>	11.5 (11.0)	2.3 (0.3–20.0)
Alcohol dependence	5.3 (5.4)	3.1 (0.4–24.8)	0.0	
Drug abuse	0.0		0.0	
Drug dependence	0.0		0.0	
Suicidal ideation	21.6 (8.8)	2.8 (1.1–7.5)	24.1 (11.1)	2.5 (0.7–8.3)

Note. Subjects whose number of attacks was unknown were deleted ( $n=12$ ).

<sup>a</sup> Age-adjusted odds ratio. Lifetime prevalence of narrow IED was used as a dependent variable. References are those without relevant mental disorders or suicidal ideation.

<sup>b</sup> General anxiety disorder.

<sup>c</sup> Major depressive disorder.

<sup>d</sup>  $P=0.051$ .

<sup>e</sup> Not calculated due to small sample size.

**Table 7**

Comparisons of age of onset between mental disorders and IED in subjects having both mental disorders and IED.

N <sup>a</sup>	IED	Comorbid disorder		p <sup>b</sup>	N <sup>a</sup>	Narrow IED	Comorbid disorder		p <sup>b</sup>
	Age of onset, year (SE)	Type of comorbid disorder	Age of onset, year (SE)			Age of onset, year (SE)	Type of comorbid disorder	Age of onset, year (SE)	
7	16.9 (4.2)	Specific phobia	4.9 (0.5)	0.026	6	19.3 (4.5)	Specific phobia	5.1 (0.6)	0.027
4	18.1 (6.4)	Social phobia	14.0 (2.3)	0.63	3	23.0 (7.4)	Social phobia	14.5 (3.5)	0.49
8	21.5 (6.6)	GAD <sup>c</sup>	37.5 (2.6)	0.17	5	26.8 (8.5)	GAD <sup>c</sup>	34.6 (7.2)	0.39
13	21.7 (3.9)	MDD <sup>d</sup>	30.6 (4.1)	0.07	9	24.6 (3.0)	MDD <sup>d</sup>	32.0 (5.3)	0.18
4	20.5 (9.6)	Dysthymia	31.3 (7.1)	0.23	1	15.0 (—) <sup>e</sup>	Dysthymia	23.0 (—) <sup>e</sup>	— <sup>e</sup>
10	23.1 (4.1)	Alcohol abuse	25.8 (2.4)	0.16	8	22.0 (3.6)	Alcohol abuse	24.7 (1.6)	0.08

<sup>a</sup> Number of comorbid cases.<sup>b</sup> Paired *t*-test for average age differences of onset between IED and each comorbid disorder.<sup>c</sup> General anxiety disorder.<sup>d</sup> Major depressive disorder.<sup>e</sup> Not calculated.

#### 4. Discussion

Due to insufficient antecedent evidence regarding the population-based prevalence of IED, the present results regarding such prevalence are difficult to compare with the previous data. However, both the lifetime and 12-month prevalence of IED observed in the present survey were obviously lower than those in the United States (Coccaro et al., 2004; Kessler et al., 2006; Ortega et al., 2008) or in South Africa (Fincham et al., 2009). As mentioned above, Japanese are less likely to openly express their emotions compared with Westerners. In addition, Japanese are generally more likely than Westerners to share a stigmatization toward mental disorders (Griffiths et al., 2006), and to suppress their emotions accordingly. This cultural reluctance to express emotion may also have affected responses to the structured interviews conducted in the present survey. Ortega et al. (2008) also suggested that the different prevalence of IED among sub-ethnic Latino groups might reflect differences in response styles rather than any disabling psychopathology. However, we could not include a measure that would reflect the suppression of anger because the present study was conducted as a part of a widespread prevalence survey of various mental disorders including IED. Thus, the possibility of a Japanese tendency to suppress their emotions still remains speculative.

Nevertheless, it should be noted that the total amount of property damages of subjects with narrow lifetime IED and the number of cases in which they sought medical attention were rather fewer despite the fact that they had more anger attacks than those in the 'broad only' category. This suggested that each anger attack of subjects within the narrow criteria was relatively trivial, and that those people in such criteria might exaggeratedly regard their trivial emotional reactions as "anger attacks." No role impairment in home and work of those with 12-month IED supports this supposition.

As for demographic factors, both a lifetime and 12-month prevalence of IED tended to be higher in men than in women. This is not surprising given that men are generally more impulsive than women. The strong association between younger age and a lifetime prevalence of IED may be somewhat affected by recall bias, since young people are more readily able to recall their behavioral problems. On the other hand, employment and a good educational background were associated with a somewhat increased risk of IED, which suggested that job-related stress among the educated classes might be one of the environmental triggers of impulsivity. These findings are consistent with those in South Africa (Fincham et al., 2009).

Regarding the comorbidity of mood and anxiety disorders with IED, such disorders were shown to be associated with an increased risk of a lifetime prevalence of IED, which was consistent with the previous studies (Kessler et al., 2006; Amara et al., 2007; Ortega et al.,

2008; Fincham et al., 2009). Specific phobia, which had younger age of onset than that for IED, might be a possible risk factor for the later onset of IED. On the other hand, IED seems a precursor of MDD and alcohol abuse.

The habitual use of tranquilizers, psychostimulants, and analgesics (except for medical treatment), has been statistically significantly associated with an increased risk of lifetime prevalence of IED. Those drugs are relatively common and easy to obtain. In general, patients with IED, after calming down, often regret their sudden explosive outbursts. Indeed, 52% of our subjects usually or invariably regretted their behavior after such outbursts, which might lead them to a depressive or anxious state. Therefore, they are apt to use such drugs as a natural element in the course of such stressful events. Because the habitual use of these drugs increases the risk of drug dependence, they may sometimes use the drugs for other than the primary medical purpose. On the other hand, no comorbid conditions were observed between drug abuse or dependence, and IED in our sample.

However, substance-related disorders have actually been reported as significantly associated with an increased prevalence of IED (Kessler et al., 2006; Ortega et al., 2008; Fincham et al., 2009). The above-mentioned commonly used drugs that are relatively easy to obtain are likely to be the causes of bad habits from recreational use to harmful dependence, even if the use of those drugs did not reach the diagnostic threshold for substance-related disorders.

The comorbidity of any mood or anxiety disorder may mediate these interactions between substance-use and IED. The present results have demonstrated that those disorders, especially extreme anxiety, were more frequently observed or more strongly associated with IED in women than in men. It has also been reported that the association between suicide and substance-related disorders is stronger in women (Yoshimasu et al., 2008). As mentioned above, these findings suggest that women with both IED and mood or anxiety disorders should be regarded as a particularly high-risk group for suicide. Consequently, special vigilance must be used to forestall suicide or suicidal attempts, especially because women tend to frequently use harmful substances as the means of taking their lives (Bostwick and Rundell, 1999).

Furthermore, the experience of alcohol-related problems as well as their possibility has been significantly associated with a lifetime prevalence of IED. Though subjects with lifetime IED in our sample did not present the symptoms of alcohol abuse or dependence at the time when an interview was conducted, these results indicate that patients with IED may actually be prone to cause serious accidents when drinking. Alcohol-related disorders have also been associated with depression or suicidal risks (Kölves et al., 2006; Sher, 2008; Watts, 2008). Thus, the vicious interaction between drinking or substance abuse and impulsivity leading people to suicidal acts should itself be regarded as a serious suicidal risk. This hypothesis deserves close

attention, especially because subjects in the present study with lifetime IED have in fact showed an especially high prevalence of suicidal ideation. In this sense, IED patients with harmful drinking habits or substance abuse might well comprise a high-risk group for suicide. Indeed, another US epidemiological study suggested that patients having both IED and MDD or drug dependence should receive rigorous assessment for their self-aggression (McCloskey et al., 2008).

In summary, the present study showed that the prevalence of IED was relatively low in Japanese compared with Western populations, and that IED was associated with mood and anxiety disorders as well as suicidal ideation. In addition, common substance use and drinking-related problems were associated with an increase in the prevalence of IED. Considering the impulsivity caused by IED and its relation to suicidal ideation, those having IED as well as such mental and behavioral problems should be regarded as one of the highest suicide-risk groups, and must be given the benefit of an appropriate interventional approach specifically designed for suicide prevention.

#### Acknowledgements

World Mental Health Japan (WMH-J) is supported by a Grant for Research on Psychiatric and Neurological Diseases and Mental Health (H13-SHOGAI-023, H14-TOKUBETSU-026, H16-KOKORO-013) from the Japanese Ministry of Health, Labour, and Welfare. We would like to thank the staff members, field coordinators, and interviewers of the WMH Japan 2002–2006 Survey, which was carried out in conjunction with the World Health Organization World Mental Health (WMH) Survey Initiative. We are also grateful to the WMH staff for their generous assistance with the instrumentation, fieldwork, and data analysis. These activities were supported by the US National Institute of Mental Health (R01MH070884), the John D. and Catherine T. MacArthur Foundation, the Pfizer Foundation, the US Public Health Service (R13-MH066849, R01-MH069864, and R01 DA016558), the Fogarty International Center (FIRCA R01-TW006481), the Pan American Health Organization, Eli Lilly and Company, Ortho-McNeil Pharmaceutical, Inc., GlaxoSmithKline, and Bristol-Myers Squibb. A complete list of WMH publications can be found at <http://www.hcp.med.harvard.edu/wmh/>.

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#### References

- Amara, G., Richa, S., Baylé, F.J., 2007. Intermittent explosive disorder: current status. *Encephale* 33, 339–345.
- American Psychiatric Association, 1994. *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. American Psychiatric Association, Washington, D.C.
- American Psychiatric Association, 2000. *Diagnostic and statistical manual of mental disorders*, 4th ed., text revision. American Psychiatric Association, Washington, D.C.
- Bostwick, J.M., Rundell, J.R., 1999. Suicidality. In: Rundell, J.R., Wise, M.G. (Eds.), *Essentials of Consultation-Liaison Psychiatry*. American Psychiatric Press, Washington, D.C., pp. 39–52.
- Coccaro, E.F., 2000. Intermittent explosive disorder. *Current Psychiatry Reports* 2, 67–71.
- Coccaro, E.F., Kavoussi, R.J., Berman, M.E., Lish, J.D., 1998. Intermittent explosive disorder-revised: development, reliability, and validity of research criteria. *Comprehensive Psychiatry* 39, 368–376.
- Coccaro, E.F., Schmidt, C.A., Samuels, J.F., Nestadt, G., 2004. Lifetime and 1-month prevalence rates of intermittent explosive disorder in a community sample. *The Journal of Clinical Psychiatry* 65, 820–824.
- Fincham, D., Grimsrud, A., Corrigan, J., Williams, D.R., Seedat, S., Stein, D.J., Myer, L., 2009. Intermittent explosive disorder in South Africa: prevalence, correlates and the role of traumatic exposures. *Psychopathology* 42, 92–98.
- Griffiths, K.M., Nakane, Y., Christensen, H., Yoshioka, K., Jorm, A.F., Nakane, H., 2006. Stigma in response to mental disorders: a comparison of Australia and Japan. *BMC Psychiatry* 6, 21.
- Kaplan, H.I., Sadock, B.J., 1998. Impulse-control disorders not elsewhere classified. In: Kaplan, H.I., Sadock, B.J. (Eds.), *Synopsis of Psychiatry*, 8th ed. Lippincott Williams & Wilkins, Baltimore, pp. 761–763.
- 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 Neuroscience* 59, 441–452.
- Kessler, R.C., Coccaro, E.F., Fava, M., Jaeger, S., Jin, R., Walters, E., 2006. The prevalence and correlates of DSM-IV intermittent explosive disorder in the National Comorbidity Survey Replication. *Archives of General Psychiatry* 63, 669–678.
- Kessler, R.C., Üstün, T.B., 2008. The World Health Organization Composite International Diagnostic Interview. In: Kessler, R.C., Üstün, T.B. (Eds.), *The WHO World Mental Health Surveys*. Cambridge University Press, New York, pp. 58–90.
- Kölves, K., Várník, A., Toody, L.M., Wasserman, D., 2006. The role of alcohol in suicide: a case-control psychological autopsy study. *Psychological Medicine* 36, 923–930.
- Lejoyeux, M., Feuché, N., Loi, S., Solomon, J., Adés, J., 1999. Study of impulse-control disorders among alcohol-dependent patients. *The Journal of Clinical Psychiatry* 60, 302–305.
- Leon, A.C., Olsson, M., Portera, L., Farber, L., Sheehan, D.V., 1997. Assessing psychiatry impairment in primary care with the Sheehan Disability Scale. *International Journal of Psychiatry in Medicine* 27, 93–105.
- McCloskey, M.S., Ben-Zeev, D., Lee, R., Coccaro, E.F., 2008. Prevalence of suicidal and self-injurious behavior among subjects with intermittent explosive disorder. *Psychiatry Research* 158, 248–250.
- National comorbidity survey, 2005. Available at: <http://www.hcp.med.harvard.edu/ncs/diagnosis.php2005>.
- Olvera, R.L., 2002. Intermittent explosive disorder: epidemiology, diagnosis and treatment. *CNS Drugs* 16, 517–526.
- Ortega, A.N., Canino, G., Alegria, M., 2008. Lifetime and 12-month intermittent explosive disorder in Latinos. *The American Journal of Orthopsychiatry* 78, 133–139.
- Sheehan, D.V., Lecrubier, Y., Sheehan, K.H., Amorim, P., Janavs, J., Weiller, E., Hergueta, T., Baker, R., Dunbar, G.C., 1998. 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. *The Journal of Clinical Psychiatry* 59 (suppl 20), 22–33.
- Sher, L., 2008. Depression and suicidal behavior in alcohol abusing adolescents: possible role of selenium deficiency. *Minerva Pediatrica* 60, 201–209.
- Watts, M., 2008. Understanding the coexistence of alcohol misuse and depression. *The British Journal of Nursing* 17, 696–699.
- WHO World Mental Health Survey Consortium, 2004. Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization World Mental Health Surveys. *JAMA* 291, 2581–2590.
- World Health Organization, 1993. *The ICD-10 Classification of Mental and Behavioral Disorders: Diagnostic Criteria for Research*. World Health Organization, Geneva.
- Yoshimasu, K., Kiyohara, C., Miyashita, K., The stress research group of Japanese Society for Hygiene, 2008. Suicidal risk factors and completed suicide: meta-analyses based on psychological autopsy studies. *Environmental Health and Preventive Medicine* 13, 243–256.

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