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The cross-national epidemiology of DSM-IV intermittent explosive disorder

K. M. Scott[1]*, C. C. W. Lim[1], I. Hwang[2], T. Adamowski[3], A. Al-Hamzawi[4], E. Bromet[5], B. Bunting[6], M. P. Ferrand[7], S. Florescu[8], O. Gureje[9], H. Hinkov[10], C. Hu[11], E. Karam[12,13], S. Lee[14], J. Posada-Villa[15], D. Stein[16], H. Tachimori[17], M. C. Viana[18], M. Xavier[19] and R. C. Kessler[2]

[1] *Department of Psychological Medicine, University of Otago, PO Box 56, Dunedin 9054, New Zealand;* [2] *Department of Health Care Policy, Harvard University Medical School, 180 Longwood Avenue, Boston, MA 02115, USA;* [3] *Medical University of Wroclaw, L. Pasteur Str. 10, 50-367 Wroclaw, Poland;* [4] *Department of Psychiatry, College of Medicine, Qadisia University, Diwaniya 00964, Iraq;* [5] *Department of Psychiatry, State University of New York at Stony Brook, Putnam Hall – South Campus, Stony Brook, NY 11794-8790, USA;* [6] *University of Ulster, College Avenue, Londonderry BT48 7JL, UK;* [7] *Universidad Peruana Cayetano Heredia, Facultad de Salud Pública y Administración, Honorio Delgado, Lima, Peru;* [8] *Health Services and Research Evaluation Center, National School of Public Health Management and Professional Development, 31 Vaselor Street, Bucharest, 021253, Romania;* [9] *Department of Psychiatry, University College Hospital, PMB 5116, Ibadan, Nigeria;* [10] *National Center for Public Health Protection, 15 Acad. Ivan Ev. Geshov blvd, 1431 Sofia, Bulgaria;* [11] *Shenzhen Institute of Mental Health and Shenzhen Kangning Hospital, 13-15/F, Block B, No. 2019 Buxin Road, Luohu District, No. 1080 Cuizu Road, Luohu District, 518020, Guangdong Province, People's Republic of China;* [12] *St. George Hospital University Medical Center, Balamand University, Faculty of Medicine, Institute for Development, Research, Advocacy & Applied Care (IDRAAC), Medical Institute for Neuropsychological Disorders (MIND), Beirut, Lebanon;* [13] *Department of Psychiatry and Clinical Psychology, Institute for Development, Research Advocacy and Applied Care (IDRAAC), St. George Hospital University Medical Center, Beirut, Ashrafieh 166378, Lebanon;* [14] *Department of Psychiatry, The Chinese University of Hong Kong, Flat 7A, Block E, Staff Quarters, Prince of Wales Hospital, Shatin, Hong Kong SAR;* [15] *Universidad Colegio Mayor de Cundinamarca, Cra 7 No. 119-14 Cons. 511, Bogotá D.C., Colombia;* [16] *Department of Psychiatry and Mental Health, University of Cape Town, Private Bag X3, Rondebosch 7701, Cape Town, South Africa;* [17] *National Institute of Mental Health, National Center of Neurology and Psychiatry, 4-1-1 Ogawa-Higashi, Kodaira, Tokyo 187-8553, Japan;* [18] *Department of Social Medicine, Federal University of Espírito Santo (UFES), Rua Dr Eurico de Aguiar 888/705, Vitoria, ES 29055-280, Brazil;* [19] *Chronic Diseases Research Center (CEDOC) and Department of Mental Health, Faculdade de Ciências Médicas, Universidade Nova de Lisboa, Campo dos Mártires da Pátria, 130, 1169-056 Lisbon, Portugal*

Background. This is the first cross-national study of intermittent explosive disorder (IED).

Method. A total of 17 face-to-face cross-sectional household surveys of adults were conducted in 16 countries ($n = 88\,063$) as part of the World Mental Health Surveys initiative. The World Health Organization Composite International Diagnostic Interview (CIDI 3.0) assessed DSM-IV IED, using a conservative definition.

Results. Lifetime prevalence of IED ranged across countries from 0.1 to 2.7% with a weighted average of 0.8%; 0.4 and 0.3% met criteria for 12-month and 30-day prevalence, respectively. Sociodemographic correlates of lifetime risk of IED were being male, young, unemployed, divorced or separated, and having less education. The median age of onset of IED was 17 years with an interquartile range across countries of 13–23 years. The vast majority (81.7%) of those with lifetime IED met criteria for at least one other lifetime disorder; co-morbidity was highest with alcohol abuse and depression. Of those with 12-month IED, 39% reported severe impairment in at least one domain, most commonly social or relationship functioning. Prior traumatic experiences involving physical (non-combat) or sexual violence were associated with increased risk of IED onset.

Conclusions. Conservatively defined, IED is a low prevalence disorder but this belies the true societal costs of IED in terms of the effects of explosive anger attacks on families and relationships. IED is more common among males, the young, the socially disadvantaged and among those with prior exposure to violence, especially in childhood.

* Address for correspondence: K. M. Scott, Department of Psychological Medicine, University of Otago, PO Box 56, Dunedin 9054, New Zealand.

(Email: kate.scott@otago.ac.nz)

Introduction

Intermittent explosive disorder (IED) is characterized by impulsive, non-premeditated aggressive outbursts that are disproportionate to provocation (American Psychological Association, 2013). Although some form of IED has been included in the Diagnostic and Statistical Manual of Mental Disorders (DSM) for many years, problems with the earlier diagnostic

criteria precluded extensive research into this disorder (Coccaro *et al.* 1998; Coccaro, 2012). In DSM-IV, IED was defined as the occurrence of several episodes of failure to resist aggressive impulses, resulting in assaults or property destruction. To meet disorder criteria these episodes needed to be greatly out of proportion to any precipitating stressor and to not be better accounted for by another mental disorder. DSM-5 criteria are more specific about the number and type of aggressive outbursts, requiring at least three destructive (of property or involving physical injury to persons or animals) aggressive outbursts within a year, or a higher number of non-destructive aggressive outbursts.

Although there has been less research on the epidemiology of IED compared with other mental disorders, DSM-IV IED was assessed in national surveys in the USA (Kessler *et al.* 2006; McLaughlin *et al.* 2012) and in a small number of national and regional surveys in other countries (Fincham *et al.* 2009; Yoshimasu & Kawakami, 2011; Al-Hamzawi *et al.* 2012; Axinn *et al.* 2013; Rees *et al.* 2013). These studies have varied in assessment and diagnosis of IED, with some studies reporting very high prevalence estimates (Fincham *et al.* 2009; Rees *et al.* 2013). In this study from 17 of the World Mental Health (WMH) Surveys we report on the cross-national epidemiology of IED using a consistently applied, conservative diagnostic definition, examining prevalence, age of onset, type of aggressive outburst, sociodemographic correlates, co-morbidity, associated impairment and treatment. In the context of prior research that has linked prior trauma exposure with IED diagnosis (Fincham *et al.* 2009; Nickerson *et al.* 2012; Fanning *et al.* 2014), we also investigated associations between lifetime traumatic events and subsequent IED onset.

Method

Samples and procedures

This study uses data from all WMH surveys that measured IED (Appendix Table 1). A stratified multi-stage clustered area probability sampling strategy was used to select adult respondents (18 years+) in most WMH countries. In most countries, internal subsampling was used to reduce respondent burden and average interview time by dividing the interview into two parts. All respondents completed Part 1 which included the core diagnostic assessment of most mental disorders including IED. All Part 1 respondents who met lifetime criteria for any mental disorder and a probability sample of respondents without mental disorders were administered Part 2 which assessed the remaining disorders and other information related to survey aims (including exposure to traumatic events). Part 2 respondents were weighted by the inverse of their probability of selection for Part 2 of the interview to adjust for differential sampling. Additional weights were used to adjust for differential probabilities of selection within households, to adjust for non-response, and to match the samples to population sociodemographic distributions. All respondents provided written informed consent and measures taken to ensure data accuracy, cross-national consistency and protection of respondents are described in detail elsewhere (Kessler & Ustun, 2004; Kessler & Ustun, 2008).

Measures

IED

All surveys used the WMH survey version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI 3.0) (Kessler & Ustun, 2004), a fully structured, lay-administered face-to-face interview, to assess lifetime history of DSM-IV mental disorders including IED. DSM-IV criterion A for IED requires 'several discrete episodes of failure to resist aggressive impulses that result in serious assaultive acts or destruction of property'. This was operationalized in the CIDI by requiring the respondent to report at least three attacks in the same year of at least one of three types of anger attacks: (i) 'when all of a sudden you lost control and broke or smashed something worth more than a few dollars'; (ii) 'when all of a sudden you lost control and hit or tried to hurt someone'; and (iii) 'when all of a sudden you lost control and threatened to hit or hurt someone'. 12-Month diagnosis was assigned if those meeting lifetime criteria reported at least three attacks in the past 12 months, and 30-day diagnosis was assigned if those meeting 12-month criteria reported an anger attack in the past 30 days.

DSM-IV criterion B for IED requires that the aggressiveness is 'grossly out of proportion to any precipitating psychosocial stressor'. This criterion was operationalized in the CIDI by requiring the respondent to report either that they 'got a lot more angry than most people would have been in the same situation' or that the attacked occurred 'without good reason' or that the attack occurred 'in situations where most people would not have had an anger attack'.

DSM-IV criterion C for IED requires that the 'aggressive episodes are not better accounted for by another mental disorder and are not due to the direct physiological effects of a substance or a general medical condition'. This was assessed through a series of questions (for details, see Kessler *et al.* 2006) that ruled out IED diagnosis if anger attacks occurred exclusively when

respondents had been drinking or using drugs, when they were in a depressive or manic episode, or as a consequence of an organic cause such as epilepsy, head injury or use of medications.

This classification of IED is the 'narrow' definition of IED reported in the US National Comorbidity Survey Replication (NCS-R) (Kessler *et al.* 2006), but in the present study we have applied an additional impairment criterion that required respondents to report that their anger attacks caused at least some degree of interference with their work, social life or relationships. This makes the diagnosis of IED in this report more conservative than in earlier reports based on WMH Surveys data (Kessler *et al.* 2006, 2012; Yoshimasu & Kawakami, 2011; Al-Hamzawi *et al.* 2012).

DSM-IV v. DSM-5 criteria

DSM-5 criteria recognize two different patterns of aggressive outburst: high frequency/low intensity (criterion A1: non-destructive verbal or physical aggression occurring at least twice weekly for at least 3 months) or low frequency/high intensity (criterion A2: at least three destructive outbursts within a year-long period) (Coccaro *et al.* 2014*b*). The diagnostic algorithm used in the present study requires three aggressive outbursts within 1 year, but there was insufficient information on the lifetime frequency of specific types of aggressive outburst to confirm whether those meeting the DSM-IV criteria operationalized in this study would also meet DSM-5 criteria.

Impairment

Those meeting criteria for IED in the past 12-months were asked to rate the extent to which their symptoms interfered with his or her life and activities in the worst month of the past year using the Sheehan Disability Scales (Leon *et al.* 1997). These are 0–10 visual analogue scales that ask how much a focal disorder interfered with home management, work, social life and personal relationships using the response options none (0), mild (1–3), moderate (4–6), severe (7–10).

Traumatic events

Lifetime exposure to the events listed in Table 5 was assessed at the beginning of the CIDI post-traumatic stress disorder section (administered to the Part 2 subsamples). Additional questions were asked to determine the age of first occurrence and frequency of occurrence.

Statistical analysis

All analyses with the exception of Table 5 (traumatic events) and Table 4 (co-morbidity) used the Part 1 samples. Cross-tabulations were used to calculate prevalence, impairment, co-morbidity and treatment. Discrete-time survival analyses (Singer & Willett, 1993) with person-year as the unit of analysis were used to investigate time-lagged associations between traumatic events and first onset of IED. Logistic regression and survival analyses were used to examine sociodemographic correlates. Significance was calculated using Wald and McNemar's χ^2 tests. As the WMH data are both clustered and weighted, the design-based Taylor series linearization (Shah, 1998) implemented in version 11 of the SUDAAN software system (Research Triangle Institute, 1999) was used to estimate standard errors and evaluate the statistical significance of coefficients. Statistical significance was consistently evaluated using two-sided tests, with $p < 0.05$ considered significant.

Results

Cross-national prevalence of IED

The lifetime prevalence of IED varied significantly across countries ranging from a low of 0.1% in Nigeria to a high of 2.7% in the USA (Table 1). In all countries combined, lifetime IED prevalence averaged 0.8%, with 0.4% and 0.3% meeting criteria for 12-month and 30-day prevalence, respectively. The proportion meeting 12-month criteria among lifetime cases (12-month/lifetime), which can be taken as a proxy indicator of recurrence of disorder, was 53.6%. The proportion with 30-day prevalence among 12-month cases (30-day/12-month: 61.9%) suggests that episodes of IED can be moderately enduring. Although lifetime prevalence of IED was significantly higher in high-income countries (predominantly through the effect of the higher prevalence in the USA), the proxy indictors of recurrence and duration of episodes were highest in low-income countries, and lowest in high-income countries.

Median age of onset of IED was 17 years in the total sample (16 years in high-income countries and 18 years in lower- and 19 years in middle-income countries, respectively), with an interquartile range (IQR) across countries of 13–23 years, indicating that IED is generally an early-onset disorder (Appendix Table 2).

Type of anger attacks – 12-month IED

Respondents with 12-month IED were asked to think about the week during the past 12 months when they had their most violent attack and to report type and number of attacks during that week (Table 2). The case number in the first column indicates the number reporting at least one of each kind of attack; respondents could report more than one type of attack. The

Table 1. *Prevalence of DSM-IV IED[a] in the World Mental Health surveys*

Country	Lifetime prevalence	12-month prevalence	30-day prevalence	12-month prevalence of IED among lifetime cases	30-day prevalence of IED among 12-month cases	Sample size used, n
Low–lower middle-income countries	0.6 (0.1)	0.4 (0.0)	0.3 (0.0)	60.1 (3.8)	70.4 (5.0)	36 498
Colombia	1.2 (0.2)	0.5 (0.1)	0.4 (0.1)	41.9 (6.1)	75.7 (10.0)	4426
Iraq	0.4 (0.2)	0.4 (0.2)	0.3 (0.1)	93.9 (6.1)	86.6 (10.9)	4332
Nigeria	0.1 (0.0)	0.0 (0.0)	0.0 (0.0)	79.6 (20.7)	25.9 (27.2)	6752
Peru	0.6 (0.2)	0.2 (0.1)	0.2 (0.1)	37.7 (10.3)	72.1 (13.6)	3930
PRC China	0.5 (0.1)	0.3 (0.1)	0.2 (0.1)	52.8 (13.9)	71.5 (13.5)	5201
PRC Shen Zhen	0.7 (0.1)	0.6 (0.1)	0.4 (0.1)	83.9 (5.7)	63.7 (10.8)	7132
Ukraine	1.1 (0.2)	0.6 (0.1)	0.4 (0.1)	56.3 (7.9)	69.7 (9.9)	4725
Upper-middle-income countries	0.7 (0.1)	0.3 (0.1)	0.2 (0.0)	48.3 (5.6)	71.6 (6.7)	19 884
Brazil	0.7 (0.1)	0.4 (0.1)	0.2 (0.1)	53.0 (10.8)	49.5 (14.2)	5037
Bulgaria	0.2 (0.1)	0.2 (0.1)	0.1 (0.1)	68.8 (17.2)	84.6 (11.4)	5318
Lebanon	0.6 (0.1)	0.3 (0.1)	0.2 (0.1)	44.4 (12.6)	89.9 (10.9)	2857
Romania	0.5 (0.2)	0.3 (0.2)	0.3 (0.2)	66.0 (18.7)	93.1 (7.3)	2357
South Africa[b]	1.2 (0.3)	0.5 (0.2)	0.3 (0.1)	37.9 (9.6)	70.9 (9.0)	4315
High-income countries	1.1 (0.1)	0.6 (0.1)	0.3 (0.0)	51.4 (3.8)	52.2 (4.4)	31 681
Japan	0.4 (0.1)	0.2 (0.1)	0.1 (0.0)	66.6 (11.8)	39.5 (16.2)	4129
Northern Ireland	1.1 (0.2)	0.4 (0.1)	0.3 (0.1)	31.7 (7.5)	76.2 (12.2)	4340
Poland	0.2 (0.0)	0.1 (0.0)	0.0 (0.0)	49.4 (13.2)	36.0 (16.4)	10 081
Portugal	0.5 (0.1)	0.3 (0.1)	0.1 (0.1)	45.9 (11.7)	46.3 (24.0)	3849
USA	2.7 (0.2)	1.5 (0.2)	0.8 (0.1)	55.0 (4.8)	51.9 (5.0)	9282
All countries combined	0.8 (0.0)	0.4 (0.0)	0.3 (0.0)	53.6 (2.5)	61.9 (3.2)	88 063
WHO regions[c]						
Region of the Americas	1.6 (0.1)	0.8 (0.1)	0.5 (0.1)	51.7 (3.7)	55.4 (4.4)	22 675
African region	0.5 (0.1)	0.2 (0.1)	0.1 (0.1)	40.1 (9.1)	66.1 (9.8)	11 067
Western Pacific region	0.6 (0.1)	0.4 (0.1)	0.3 (0.1)	72.5 (6.0)	61.7 (8.1)	16 462
Eastern Mediterranean region	0.5 (0.1)	0.3 (0.1)	0.3 (0.1)	69.0 (9.8)	87.7 (8.2)	7189
Western European region	0.9 (0.1)	0.3 (0.1)	0.2 (0.1)	35.9 (6.3)	64.8 (13.0)	8189
Eastern European region	0.4 (0.0)	0.2 (0.0)	0.2 (0.0)	57.8 (6.1)	69.6 (7.0)	22 481
Comparison between countries	$\chi^2_{16} = 21.9$, $p < 0.001^*$	$\chi^2_{16} = 7.9$, $p < 0.001^*$	$\chi^2_{16} = 8.3$, $p < 0.001^*$	$\chi^2_{16} = 2.4$, $p = 0.002^*$	$\chi^2_{16} = 1.4$, $p = 0.153$	
Comparison between low-, middle- and high-income country groups	$\chi^2_2 = 19.1$, $p < 0.001^*$	$\chi^2_2 = 5.5$, $p = 0.044^*$	$\chi^2_2 = 0.9$, $p = 0.405$	$\chi^2_2 = 2.0$, $p = 0.133$	$\chi^2_2 = 4.3$, $p = 0.014^*$	
Comparison between WHO regions	$\chi^2_5 = 26.1$, $p < 0.001^*$	$\chi^2_5 = 8.3$, $p < 0.001^*$	$\chi^2_5 = 5.4$, $p < 0.001^*$	$\chi^2_5 = 4.1$, $p = 0.001^*$	$\chi^2_5 = 1.5$, $p = 0.186$	

Data are given as percentage (standard error).

DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, fourth edition; IED, intermittent explosive disorder; PRC, People's Republic of China; WHO, World Health Organization.

[a] The definition of IED in this study conforms to the 'narrow' definition used in prior reports from the World Mental Health Surveys but with the additional criterion of some degree of interference in functioning.

[b] The higher South African estimate in the paper by Fincham *et al.* (2009) was not calculated by the World Mental Health Data Coordination Centre and is incorrect: http://www.hcp.med.harvard.edu/wmh/ftpdir/Fincham_et_al_2009_erratum.pdf

[c] Region of the Americas (Colombia, Brazil, Peru, USA); African region (South Africa, Nigeria); Western Pacific region [PRC Shen Zhen, PRC China (Beijing and Shanghai), Japan]; Eastern Mediterranean region (Iraq, Lebanon); Western European region (Northern Ireland, Portugal); Eastern European region (Romania, Poland, Bulgaria, Ukraine).

* $p < 0.05$; two-sided test.

Table 2. *Type and number of anger attacks during the week of the past year containing the most violent attack, among those with 12-month intermittent explosive disorder* (n = 357)

		Number of attacks in the week	
Type of anger attack	*n*	Mean (S.E.)	Median (IQR)
Slam a door, kick a chair or throw clothes in anger	235	5.5 (0.6)	2 (1–5)
Break something in anger	170	3.2 (0.3)	1 (1–2)
Break several things in anger	104	2.7 (0.3)	1 (1–3)
Purposely set fire or destroy someone else's property	29	1.8 (0.4)	1 (1–2)
Purposely injure or torture an animal	16	2.1 (0.3)	1 (1–4)
Threaten someone	178	4.3 (0.5)	1 (1–3)
Hurt someone so badly that they needed medical attention	51	1.4 (0.1)	1 (1–2)
Hurt someone badly, but not enough to need medical attention	100	2.7 (0.3)	1 (1–3)

S.E., Standard error; IQR, interquartile range.

less destructive attacks were reported most frequently, with 235 reporting that they slammed a door, kicked a chair or threw clothes in anger, with a mean of 5.5 and a median of 2 such attacks per individual. At the other end of the violence spectrum 43% (151/357) reported that they hurt someone badly, with 14% (51/357) reporting that these attacks resulted in the need for medical attention for the victim. The discrepancy between the higher means and low medians within each type of attack indicates that a small group of individuals report high frequencies of attacks, and it is notable that some individuals reported more than one instance of arson, torturing an animal or hurting someone during the specified week.

Impairment of 12-month IED (Table 3)

In all countries combined, the proportion of those with 12-month IED who reported severe impairment in at least one domain was 38.9% in all countries combined, ranging (non-significantly) from 26.7% in middle-income countries to 36.5% in low-income countries and 44.7% in high-income countries. The highest levels of impairment were in the Ukraine, with 56.6% reporting severe impairment, followed by 50.1% of those with IED in the USA reporting severe impairment. By contrast, in Shenzhen, People's Republic of China (PRC) a considerably smaller proportion of those with IED (23.9%) reported severe impairment. In all countries

combined, severe impairment was more likely in the social and relationship domains than in the work and home domains, although this pattern was less evident in middle-income countries.

Impairment was increased by co-morbidity: the proportion reporting severe impairment was 43.5 (S.E. = 2.6) % among those with lifetime co-morbid disorders compared with 15.3 (S.E. = 1.8) % among those without lifetime co-morbidity (data not shown: available on request). Further results relating to co-morbidity are reported below.

Sociodemographic correlates

Statistically significant correlates of lifetime risk of IED in the total sample included being male, being young, being unemployed, being divorced or separated, and having less education (Appendix Table 3). There were no significant correlates of recurrence (12-month/lifetime). Being unemployed was positively associated with episode duration (30-day/12-month), and being never married was negatively associated with both episode duration and with current (30-day) prevalence of IED.

Lifetime co-morbidity with other DSM-IV disorders

Most respondents with lifetime IED (81.7%) met criteria for at least one other lifetime disorder (Table 4). The single most common co-morbid disorder was alcohol abuse (36.5%), closely followed by depression (35.2%). The most common class of co-morbid disorders was anxiety disorders (58.5%). The majority of those with 12-month IED (68.2%) also met criteria for a co-morbid disorder, most frequently an anxiety disorder. In terms of the temporal sequencing of disorders, lifetime IED preceded lifetime co-morbid mood disorders in 67.2% of cases, but only preceded co-morbid anxiety disorders in 26.7% of cases. IED onset also typically preceded substance use disorders onset (74.0% of lifetime cases), but did not precede most impulse control disorders.

Associations (odds ratios; ORs) of traumatic events with onset of IED (Table 5)

In bivariate survival models with each traumatic event as a single predictor, controlling for sociodemographic variables (age, gender, education, marital status, employment status) and country, most traumatic events were associated with subsequent first onset of IED, with the strongest associations between witnessing family violence as a child [OR 3.5, 95% confidence interval (CI) 2.8–4.4] and being physically abused as a child (OR 3.6, 95% CI 2.8–4.8). When all traumatic events were included in the one multivariate model,

Table 3. *Severity of role impairment (SDS) associated with 12-month IED, by country*

Country	Proportion with severe role impairment (SDS score: 7–10)					Number of 12-month IED cases
	Home	Work	Relationship	Social	Any[a]	
Low–lower middle-income countries[b,c]	20.5 (3.9)	15.7 (3.6)	22.8 (4.2)	24.6 (4.4)	36.5 (4.9)	131
Colombia[c,d,e]	7.3 (4.3)	19.0 (10.4)	32.2 (11.0)	44.0 (12.7)	46.1 (12.9)	23
Iraq	28.4 (15.8)	20.7 (12.5)	22.6 (14.0)	29.0 (15.3)	31.7 (15.9)	16
Nigeria	–	–	–	–	–	2
Peru	35.9 (11.9)	40.8 (14.0)	23.7 (12.5)	27.7 (14.3)	49.6 (12.5)	9
PRC China	–	–	–	–	–	14
PRC Shen Zhen[c,f]	13.6 (6.9)	1.7 (1.7)	10.0 (6.0)	18.9 (7.7)	23.9 (8.1)	41
Ukraine[b,g]	36.6 (9.0)	30.2 (9.3)	45.5 (10.3)	20.9 (9.1)	56.6 (11.0)	26
Upper–middle-income countries[e,f]	10.4 (4.1)	19.0 (7.1)	15.4 (5.1)	18.9 (6.0)	26.7 (7.8)	55
Brazil[f]	9.0 (6.4)	36.1 (15.2)	19.4 (10.1)	19.4 (10.1)	44.1 (15.8)	17
Bulgaria	–	–	–	–	–	7
Lebanon	–	–	–	–	–	9
Romania	–	–	–	–	–	6
South Africa	13.8 (8.4)	17.7 (9.6)	17.1 (9.2)	27.8 (14.1)	29.2 (14.4)	16
High-income countries[b,c,d,e]	19.2 (3.4)	13.5 (2.8)	30.2 (4.8)	27.6 (4.0)	44.7 (3.8)	171
Japan	–	–	–	–	–	11
Northern Ireland	19.1 (13.4)	9.3 (6.7)	15.1 (8.3)	8.0 (5.8)	26.4 (12.7)	13
Poland	–	–	–	–	–	9
Portugal	8.1 (7.7)	8.1 (7.7)	26.4 (15.6)	36.5 (15.9)	36.5 (15.9)	10
USA[b,c,d,e,f]	21.8 (4.0)	14.9 (3.5)	33.7 (6.1)	30.9 (4.9)	50.1 (4.4)	128
All countries combined[b,c,d,e]	18.3 (2.3)	15.1 (2.2)	25.1 (2.9)	25.1 (2.7)	38.9 (2.9)	357
WHO regions						
Region of the Americas[b,c,d,e]	19.5 (3.2)	18.6 (3.5)	31.6 (4.8)	31.1 (4.1)	49.0 (3.9)	177
African Region[c,e,g]	13.4 (8.1)	17.1 (9.2)	19.5 (9.7)	30.0 (14.3)	31.3 (14.5)	18
Western Pacific region[c,f]	12.0 (5.1)	3.4 (2.0)	9.4 (4.5)	14.9 (5.6)	23.9 (6.2)	66
Eastern Mediterranean region	24.8 (11.9)	15.5 (9.0)	23.3 (11.5)	27.7 (12.1)	29.5 (12.4)	25
Western European region	14.3 (8.4)	8.8 (5.0)	19.4 (8.3)	19.4 (8.6)	30.2 (10.2)	23
Eastern European region[b,g]	23.7 (6.4)	19.9 (6.1)	27.5 (7.5)	13.4 (5.4)	32.8 (8.0)	48
Comparison between countries[h]	$\chi^2_{16} = 1.3$, $p = 0.157$	$\chi^2_{16} = 1.4$, $p = 0.131$	$\chi^2_{16} = 1.6$, $p = 0.070$	$\chi^2_{16} = 1.3$, $p = 0.210$	$\chi^2_{16} = 1.8$, $p = 0.022*$	
Comparison between low-, middle- and high-income countries[h]	$\chi^2_2 = 1.6$, $p = 0.207$	$\chi^2_2 = 0.3$, $p = 0.734$	$\chi^2_2 = 1.9$, $p = 0.149$	$\chi^2_2 = 0.6$, $p = 0.530$	$\chi^2_2 = 2.2$, $p = 0.114$	
Comparison between WHO regions[h]	$\chi^2_5 = 0.7$, $p = 0.657$	$\chi^2_5 = 2.9$, $p = 0.013*$	$\chi^2_5 = 2.5$, $p = 0.028*$	$\chi^2_5 = 1.9$, $p = 0.098$	$\chi^2_5 = 2.8$, $p = 0.016*$	

Data are given as percentage (standard error). A dash was inserted where the number of 12-month cases is less than 5.

SDS, Sheehan Disability Scale; IED, intermittent explosive disorder; PRC, People's Republic of China; WHO, World Health Organization.

[a] Highest severity category across four SDS role domains.

McNemar's χ^2 test to determine if there is a significant difference ($p < 0.05$) for: [b]work *v.* relationship impairment; [c]work *v.* social impairment; [d]home *v.* relationship impairment; [e]home *v.* social impairment; [f]home *v.* work impairment; [g]relationship *v.* social impairment for each row entry. For example, subscript 'd' for Colombia indicates that the proportion with severe impairment associated with intermittent explosive disorder is significantly higher for relationship than home.

[h] χ^2 Test of homogeneity to determine if there is variation in impairment severity across countries.

* $p < 0.05$; two-sided test.

some dropped out of significance but physical abuse and witnessing violence as a child remained significantly associated with IED onset, as did non-combat war experience, intimate or sexual violence, and other (private) events. Combat experience was protective in the multivariate model (OR 0.3, 95% CI 0.1–0.7). Odds of IED onset increased substantially with the experience of an increasing number of different types of traumatic events, ranging from OR of 3.1 for one type of event to 8.0 for four or more types of events.

Table 4. *Co-morbidity of IED with other DSM-IV disorders*

	IED cases with co-morbid disorders		
	Lifetime co-morbidity[a]	12-month co-morbidity[b]	Temporal priority of IED[c]
Mood disorder			
Major depressive episode	35.2 (2.5)	25.2 (2.9)	68.1 (3.2)
Bipolar disorder	14.1 (1.6)	13.1 (2.2)	79.2 (6.3)
Any mood disorder	40.8 (2.6)	29.4 (3.0)	67.2 (3.3)
Anxiety disorder			
Panic disorder	9.5 (1.2)	8.3 (1.5)	54.9 (5.9)
Generalized anxiety disorder	20.8 (2.1)	19.1 (2.8)	62.6 (5.6)
Social phobia	23.1 (1.9)	18.8 (2.5)	28.1 (4.4)
Specific phobia	21.8 (1.8)	19.4 (2.4)	5.5 (1.9)
Agoraphobia	8.7 (1.2)	6.5 (1.5)	38.3 (7.1)
Post-traumatic stress disorder	15.5 (1.5)	11.0 (1.7)	54.9 (5.8)
Separation anxiety disorder	6.0 (1.0)	–	21.7 (9.6)
Adult separation anxiety disorder	15.6 (1.6)	4.9 (1.4)	74.3 (4.7)
Any anxiety disorder	58.5 (2.4)	49.4 (3.2)	26.7 (3.0)
Impulse-control disorder			
Attention-deficit disorder	12.0 (1.9)	11.2 (2.3)	14.1 (5.0)
Conduct disorder	16.6 (2.1)	3.4 (1.2)	44.9 (6.3)
Oppositional defiant disorder	16.5 (1.9)	4.3 (1.3)	24.5 (5.5)
Binge eating disorder with hierarchy	2.5 (0.7)	1.0 (0.5)	50.3 (13.6)
Bulimia with hierarchy	1.7 (0.6)	1.2 (0.7)	49.5 (16.9)
Any impulse-control disorder	30.9 (2.5)	16.6 (2.6)	27.1 (4.6)
Substance-use disorder			
Alcohol abuse	36.5 (2.3)	17.2 (2.4)	78.3 (3.3)
Alcohol dependence	17.2 (2.0)	10.0 (2.1)	92.4 (2.7)
Drug abuse	15.7 (1.8)	5.5 (1.5)	72.9 (5.4)
Drug dependence	8.0 (1.2)	3.1 (1.1)	94.3 (4.2)
Any substance-use disorder	39.6 (2.4)	20.6 (2.8)	74.0 (3.5)
Any mental disorder	81.7 (2.2)	68.2 (3.5)	28.8 (2.5)

Data are given as percentage (standard error).

IED, Intermittent explosive disorder; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, fourth edition.

[a] Percentage of respondents with lifetime IED who also meet lifetime criteria for at least one of the other DSM-IV disorders.

[b] Percentage of respondents with 12-month IED who also meet 12-month criteria for at least one of the other disorders.

[c] Percentage of respondents with either lifetime IED and at least one of the other disorders, whose age of onset of IED is reported to be younger than the age of onset of all co-morbid disorders under consideration.

Treatment of IED

Rates of treatment were low, with 25% of those with 12-month IED (of any severity) reporting treatment in the health care sector in the past 12 months in all countries combined (Appendix Table 4). Treatment rates varied significantly across country income groups, with 12% reporting treatment in low-income countries, with corresponding percentages of 28.4 and 33.5% in middle- and high-income countries, respectively.

Discussion

These results should be considered within the context of the study limitations. The retrospective assessment of mental disorders underestimates lifetime mental disorders (Takayanagi *et al.* 2014) and is likely to lead to inaccuracies in the age of onset timing (Simon & Von Korff, 1995); these limitations can also affect time-lagged associations and the estimates of temporal priority in the comorbidity analyses. In addition, although the clinical validity of many of the CIDI diagnoses in the WMH Surveys has been confirmed in clinical reappraisal interviews (Haro *et al.* 2006), this has not occurred with IED. Finally, these prevalence estimates are based on a conservative application of DSM-IV criteria and we are unable to judge whether DSM-5 estimates would be higher or lower than those we report here.

The average lifetime prevalence of DSM-IV IED across countries was 0.8%, making IED one of the

Table 5. *Associations between lifetime traumatic events and the subsequent onset of DSM-IV intermittent explosive disorder*[a]

Type of lifetime traumatic event	Bivariate model[b] OR (95% CI)	Multivariate type model[c] OR (95% CI)	Multivariate number model[d] OR (95% CI)
I. War events			
Combat experience	0.5 (0.2–1.3)	0.3 (0.1–0.7)*	–
Other war experience	2.3 (1.4–3.6)*	1.8 (1.1–2.8)*	–
II. Other interpersonal violence			
Physically abused as a child	3.6 (2.8–4.8)*	2.2 (1.6–3.1)*	–
Physically assaulted or threatened	1.6 (1.1–2.4)*	1.0 (0.6–1.6)	–
III. Intimate or sexual violence			
Physically abused or threatened by spouse or romantic partner	3.1 (2.1–4.6)*	1.7 (1.0–2.8)*	–
Sexually assaulted	2.9 (2.1–4.2)*	1.6 (1.0–2.4)*	–
IV. Accident			
Automobile accident	1.1 (0.7–1.8)	0.8 (0.5–1.3)	–
Other life-threatening accident	1.4 (1.0–2.1)	0.9 (0.6–1.5)	–
Natural disaster	1.2 (0.8–1.9)	0.8 (0.5–1.3)	–
Life-threatening illness	2.0 (1.2–3.3)*	1.5 (0.9–2.6)	–
V. Death			
Unexpected death of a loved one	1.7 (1.2–2.4)*	1.3 (0.9–1.8)	–
VI. Network events			
Other LTE to a loved one	1.5 (0.8–2.5)	0.8 (0.5–1.5)	–
Witnessed a traumatic injury or death	1.8 (1.2–2.7)*	1.3 (0.8–2.0)	–
Witnessed family violence as a child	3.5 (2.8–4.4)*	2.3 (1.8–3.0)*	–
VII. Other			
Other events	2.4 (1.6–3.7)*	1.5 (1.0–2.4)*	–
Joint significance of all types of traumatic events χ^2_{15}, p value	–	$\chi^2_{15} = 339.2$, $p < 0.001$*	–
VIII. Number of traumatic events			
Exactly one type	–	–	3.1 (2.4–4.0)*
Exactly two types	–	–	4.5 (3.1–6.5)*
Exactly three types	–	–	5.6 (3.7–8.7)*
Four or more types	–	–	8.0 (5.3–11.9)*
Joint significance of all number of traumatic events χ^2_4, p value	–	–	$\chi^2_4 = 130.4$, $p < 0.001$*

DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, fourth edition; OR, odds ratio; CI, confidence interval; LTE, lifetime traumatic event.

[a] Analysis for this table was performed on 14 out of 17 surveys due to restriction of data on lifetime traumatic events, and on the Part 2 subsamples in those surveys (n = 33 970).

[b] Bivariate models: each trauma type was estimated as a predictor of IED onset in a separate discrete time survival model controlling for age cohorts, gender, person-year, education, marriage, employment status and country.

[c] Model was estimated with dummy variables for all trauma types entered simultaneously as predictors of IED onset including the controls specified in (b).

[d] Model was estimated with dummy variables for number of traumas without any information about type of trauma as predictors of IED onset including the controls specified in (b).

* $p < 0.05$; two-sided test.

rarer mental disorders. Prevalence was found to vary considerably across countries, with lifetime prevalence of IED ranging from 0.1% (Nigeria) to 2.7% (USA). These prevalence estimates are lower than reported in prior publications from this dataset (Kessler *et al.* 2006, 2012; Yoshimasu & Kawakami, 2011; Al-Hamzawi *et al.* 2012) due to the application of a more conservative diagnostic algorithm that required that anger attacks cause some degree of interference in functioning. The cross-national variation is difficult to interpret as it may reflect a combination of variation in risk factors, in cultural factors that affect willingness to disclose mental health symptoms (Kessler & Ustun, 2008; Yoshimasu & Kawakami, 2011) and in methodological factors such as response rate and sampling. What can be concluded is that this study did not find support for the hypothesis that IED is more prevalent in countries characterized by war, terrorism and conflict (Fincham *et al.* 2009; Al-Hamzawi *et al.* 2012; Rees *et al.* 2013), given that we did not find IED prevalence

to be relatively elevated in countries marked by recent or current conflict (e.g. Lebanon, Iraq, South Africa, Northern Ireland).

Consistent with prior clinical and community studies lifetime risk of IED was higher among males, the young, the unemployed and those with lower educational attainment (Coccaro *et al.* 2005; Kessler *et al.* 2006, 2012; Ortega *et al.* 2008). We also observed that divorce or marital separation was associated with increased lifetime risk of IED, although the temporal sequence of that association is unclear. Also consistent with prior studies, IED was found to typically begin in adolescence, to have a high degree of co-morbidity with other mental disorders, and to usually onset at an earlier age than the co-morbid disorders (Coccaro *et al.* 2005; Kessler *et al.* 2006). In the context of the confirmed classification in DSM-5 of IED as an impulse control disorder it is interesting to note that we found that IED was as likely to be co-morbid with mood and anxiety disorders as with impulse control disorders; as noted by others this suggests that affective instability is an important component of IED (Kessler *et al.* 2006; Coccaro, 2012).

The information respondents provided on the type and frequency of anger attacks during the week of their most violent attack indicates that many anger attacks are non-destructive, although individuals engaging in these less destructive attacks might also have engaged in the more destructive attacks. Anger attacks that caused harm to others were also quite common, with 43% of those meeting 12-month criteria for IED reporting that they had hurt someone badly during their most violent anger attack. Moreover, a small proportion reported purposely torturing or injuring an animal, or arson. Our data do not allow us to determine whether some of these acts might have been premeditated rather than reactive. A recent study of a predominantly clinical population found that 5.9% of those meeting criteria for DSM-5 IED were also classified as 'highly likely' to meet criteria for psychopathic personality (Coccaro *et al.* 2014*a*).

A substantial minority (39%) of those with 12-month IED reported severe impairment in at least one domain and this was most typically the social or relationship domain. Some individuals with IED are therefore significantly disabled by their disorder; on the other hand, the majority reported only mild–moderate impairment. It may be that some of those with IED are not fully aware of, or may partly deny, the full ramifications of their aggressive outbursts either for themselves or for those on the receiving end of the outbursts. The intermittent nature of the aggressive outbursts may also be a factor that reduces the degree to which the disorder interferes with functioning.

The large sample size of the combined surveys allowed a comprehensive investigation of lifetime traumatic event predictors of the onset of IED, especially in terms of evaluating their independent associations. In time-lagged analyses we found that a wide range of traumatic events were associated with risk of subsequent IED in bivariate analyses, but some of these events lost significance in multivariate analysis, suggesting that their association with IED occurred through their association with other traumatic events. One of the independent predictors of IED in the multivariate model was childhood experience of physical abuse (but not physical assaults in general), consistent with the well-established intergenerational transmission of violence mediated by a range of neurobiological, emotional, cognitive and behavioral mechanisms (Van Goozen *et al.* 2007; Fanning *et al.* 2014). Witnessing of family violence was also associated with IED onset independent of the direct experience of child physical abuse; this is congruent with prior studies showing the witnessing of family violence to be a reliable, independent risk factor for youth involvement in violence (Yexley *et al.* 2002). We found prior experience of intimate partner violence and sexual assault to be independently associated with IED onset. While other studies have found IED to be associated with reports of intimate partner violence (O'Leary *et al.* 2008; Murray-Close *et al.* 2010) and it is intuitive that IED would increase risk of perpetration of intimate partner violence, further study using prospective data is required to confirm whether the experience of intimate partner violence is a risk factor for the onset of IED as our findings suggest. Finally, the experience of non-combat war experience was a risk factor for IED onset; by contrast, combat experience was protective. This latter finding may reflect military selection procedures.

In summary, IED using a conservative definition was found to be a relatively low prevalence disorder with an average of 0.8% (lifetime prevalence) in this group of 16 countries. IED is more likely to occur among males, the young and the socially disadvantaged. It is one of the earlier-onset disorders and is highly co-morbid with other disorders, especially mood and substance use disorders. Experience or witnessing of violence in early life as well as some experiences of violence in adulthood are predictively associated with lifetime risk of IED. This supports the view that at an individual level violence exposure is associated with perpetration of violence; however, we did not find that IED prevalence varied across countries in a pattern consistent with country-level conflict exposure. A substantial minority of respondents with IED reported severe functional impairment but this probably underestimates the true societal costs of

IED in terms of the effects of explosive anger attacks on families and relationships.

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Declaration of Interest

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All other authors have no conflicts of interest to declare.

Supplementary material

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