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Prevalence and psychiatric comorbidities of intermittent explosive disorders in Metropolitan São Paulo, Brazil

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Abstract

Purpose To estimate the prevalence of intermittent explosive disorder (IED) in comorbidity with other psychiatric disorders and to describe the temporal sequencing of disorders in the São Paulo Metropolitan Area, Brazil.

Methods Data from the São Paulo Megacity Mental Health Survey, a population-based study of 5037 adult individuals, were analyzed. The World Health Organization Composite International Diagnostic Interview (CID 3.0) was used to assess lifetime DSM-IV disorders, including IED, with a response rate of 81.3%.

Results The majority (76.8%) of respondents with IED meet the criteria for at least one other psychiatric disorder, with a prevalence almost twice as high as that observed in individuals without IED. The prevalence of any anxiety, mood, impulse control or substance use disorders in respondents with IED was more than two times higher compared to those without IED, with prevalence ratios ranging from 2.1 (95% CI 1.74–2.48) to 2.9 (95% CI 2.12–4.06). The diagnosis of IED occurred earlier than most of the other mental disorders, except for those with usual onset in early childhood, as Specific and Social Phobias and Attention Deficit Disorder.

Conclusion Considering that IED is a highly comorbid disorder and has an earlier onset than most other mental comorbidities in the Brazilian general population, these results may be useful in guiding governmental mental health actions.

Keywords Aggression · Disruptive disorder · Impulse control · Comorbidity · Mental disorders

Introduction

Intermittent explosive disorder (IED) is characterized by episodes of unpremeditated aggression, which are disproportionate to the stressor event and are not better explained by another mental disorder, a general medical condition or the effect of psychotropic substances or medication. The Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) includes episodes of aggressive acts and/or destruction of property as a core diagnostic criteria of IED, while in the 5th edition (DSM-5), additional features were included, such as episodes of impulsive verbal aggression and significant psychological distress and/or social impairment associated to the aggressive behavior [1, 2]. This disorder has been described since the first edition of DSM, in 1956, with the core symptom of disproportionate reaction to environmental pressures and named as "Passive–Aggressive Personality". In DSM-II (1968), IED was classified as "Explosive Personality" and, finally, in 1980, the DSM-III Work Group proposed the current name IED and it was included in the "Impulse Control Disorders" section [3]. Population-based studies on lifetime prevalence of IED revealed that it is a relatively common disorder, occurring in 4.9% of the Brazilian population, in 5.4% of the American population, in 2.1% of the Japanese population and in 1.7% of the population from Iraq [4–7]. Previous studies demonstrated that IED starts at a young age, usually before or during adolescence, is more frequent among males, is associated with other psychiatric disorders, has a persistent

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course, results in high financial damage, and is frequently associated with psychosocial impairment [5, 7–9].

In previous studies of comorbibity, IED co-occurs with a variety of other mental disorders, such as mood, anxiety and substance use disorders [9, 10]. Findings from a cross-national group of population-based studies showed that the single most common co-morbid disorder was alcohol abuse, followed by depression, and the most common class of co-morbid disorders was anxiety disorders, affecting more than 50% of individuals with IED [9].

Until now, few studies describing the pattern of psychiatric comorbidities with IED have been conducted and, to our knowledge, there are no Brazilian reports on the patterns of mental comorbidities with IED in population-based samples. To contribute to filling this gap, the aims of the present study are to estimate the prevalence of psychiatric comorbidities with IED and to identify the temporal sequence between IED and other mental disorders in a representative sample of adult residents in the São Paulo Metropolitan Area, State of São Paulo, Brazil.

Methods

Study overview

Data used in the present study come from the São Paulo Megacity Mental Health Survey (SPMC) [20], the Brazilian component of the World Health Organization (WHO) World Mental Health Surveys (WMHS) initiative involving 30 countries worldwide [11, 12]. The SPMC is a population-based cross-sectional survey of psychiatric morbidity, assessing a probabilistic sample of household residents of the São Paulo Metropolitan Area, aged 18 years and over. Respondents were selected from a stratified multistage clustered area probability sample of households, covering 39 municipalities, without replacement. Data were collected between May 2005 and April 2007 by non-clinical trained interviewers, using the WMHS version of the WHO Composite International Diagnostic Interview (CIDI 3.0), which was translated and adapted into the Brazilian-Portuguese language. The global response rate was 81.3%. Detailed methodological information is described elsewhere [11–13]. Respondents were interviewed after written informed consent and the SPMC was approved by the Ethical and Research Committee of the School of Medicine, University of São Paulo (Process 792/03) [11].

Psychiatric assessment and diagnosis

The CIDI 3.0 is a fully structured questionnaire that operationalizes diagnosis according to the DSM-IV diagnostic criteria. Part I contains diagnostic sections for the assessment of core psychiatric disorders, including anxiety disorders (panic, agoraphobia, specific phobia, social phobia, generalized anxiety and separation anxiety), mood disorders (major depression, dysthymia, bipolar I and II), impulse control disorders (IED, oppositional-defiant, conduct, and attention-deficit/hyperactivity), substance use disorders (alcohol and drug abuse and dependence), and suicidality (ideation, plan and attempts). Part II comprises supplemental diagnostic modules, including post-traumatic stress and obsessive–compulsive disorders, and non-clinical sections. All respondents who fulfilled diagnostic criteria for any mental disorder assessed in Part I and 25% of those who were negative received also Part II sections. A total of 5037 individuals responded to Part I sections, of which 2942 also received Part II [11, 13]. The diagnosis of IED was considered without using the DSM-IV diagnostic hierarchical rules, which would include a manic episode, conduct disorder, and attention-deficit/hyperactivity disorder, as the ages of onset of each disorder would allow to identify if they occurred simultaneously only in the first episode.

Statistical analysis

Statistical analysis was performed using Data Analysis and Statistical Software (STATA version 13.0). All analyses were conducted with survey (SVY) routine, which adjusts the estimates for complex sampling design, using weights to adjust for the probability of selection in each stage, to non-response, and to the general population structure regarding age and sex, according to the year 2000 population census. All statistical tests were two sided with significance set at 0.05. The prevalence of each psychiatric disorder was calculated among those with and without IED and their respective 95% confidence intervals were estimated. All comorbid mental disorders were assessed separately and grouped into classes (anxiety, mood, substance use disorders, and impulse control disorders). The temporal sequence of IED was assessed through the difference between the age of onset of IED and of each mental disorder assessed. Respondents were categorized into three groups: the comorbid mental disorder preceding IED, the concurrent onset (same year) of IED, and other mental disorders or IED preceding the onset of the comorbid psychiatric disorder.

Results

A total of 5037 respondents were interviewed. Lifetime prevalence estimates of DSM-IV IED with and without hierarchy are 4.9% (95% CI 4.34–5.51) and 5.3% (95% CI 4.77–5.92), respectively. Lifetime and 12-month prevalence of IED have already been reported elsewhere [6, 14].

Sociodemographic characteristics of respondents with and without IED are presented in Table 1. No significant differential distributions between groups were observed. Most of the individuals with IED were female (57.5%), married (55.7%), currently employed (60.5%), and the mean age was 35.1 years. About half of respondents completed secondary school and there is a tendency towards a low-income distribution.

In Table 2, the prevalence estimates of mental disorders in respondents with and without IED are described. The majority (76.8%) of respondents with IED meet criteria for at least one other psychiatric disorder, with a prevalence almost twice as high as that observed in individuals without IED. All prevalence rates of mental disorders were estimated individually and grouped according to the class of disorders.

The prevalence of any anxiety disorder in respondents with IED was more than two times higher than among those without IED, with the prevalence ratios ranging from 2.2 for specific phobia to 4.6 for panic disorder, and all were statistically significant, except for agoraphobia without panic. Among the mood disorder group, the prevalence ratio was 2.3. Individuals with IED were five times more likely to present bipolar disorder and more than two times more likely to present major depressive disorder (Table 2).

In the substance use group, the prevalence ratio was 2.4. The single most common comorbid disorder in this group was alcohol abuse, affecting 20.3% of respondents with IED, in contrast to 8.8% of those without IED. Drug abuse was a disorder which is also frequent and presented a prevalence of more than three times higher in individuals with IED. Regarding the last group, the prevalence of any impulse control disorder was almost three times higher in respondents with IED than in those without IED. The prevalence of Conduct Disorder and Oppositional Defiant Disorder was almost five times higher in individuals with IED than without IED (Table 2).

The prevalence estimates of IED among respondents with other DSM-IV mental disorders are presented in Table 3. Almost 10% of all individuals with any other DSM-IV mental disorder also meet diagnostic criteria for IED. The prevalence ratios ranged from 11.1, in the group of anxiety disorders, to 15.1, in the impulse control disorders group. Regarding disorders separately, IED was particularly more prevalent in bipolar disorder I/II, conduct disorder and oppositional defiant disorder.

The temporal sequencing of IED and comorbid mental disorders are presented in Table 4. The diagnosis of IED occurred earlier than most anxiety disorders, except for

Table 1 Sociodemographic characteristics of respondents with and without IED (São Paulo Megacity; $n = 5037$)

	With IED %[mean] (95% CI)	Without IED %[mean] (95% CI)	*p* value
Age (mean)	35.1 (32.51–37.60)	39.1 (38.68–39.61)	> 0.05
Sex (%)			0.32
Female	57.5 (47.66–66.78)	52.4 (50.78–54.70)	
Male	42.5 (33.22–52.34)	47.3 (45.30–49.22)	
Education level (%)			0.41
Primary school	23.4 (16.95–31.40)	22.0 (20.44–23.59)	
Secondary school	25.4 (18.91–33.13)	23.5 (22.10–24.99)	
High school	39.1 (32.61–46.07)	37.1 (35.13–39.11)	
University	12.1 (7.57–18.78)	17.4 (15.78–19.18)	
Marital status (%)			0.39
Married/cohabitating	55.7 (49.85–61.4)	59.2 (57.01–61.27)	
Separated/widowed/divorced	18.7 (13.86–24.65)	15.3 (14.1–16.62)	
Never married	25.6 (19.47–32.94)	25.5 (23.5–27.66)	
Income (%)			0.18
Low income	28.4 (22.74–34.80)	22.1 (20.75–23.58)	
Low-average income	26.8 (21.41–33.03)	27.6 (26.45–28.79)	
High-average income	23.7 (18.25–30.17)	24.4 (22.82–25.97)	
High income	21.1 (15.49–28.07)	25.9 (24.42–27.45)	
Employment status (%)			0.19
Working	60.5 (51.98–68.48)	64.9 (62.43–67.26)	
Student	2.6 (0.91–7.09)	1.5 (0.89–2.54)	
Homemaker	13.7 (9.47–19.45)	13.2 (11.67–14.79)	
Retired	4.8 (1.84–12.07)	8.7 (7.63–9.89)	
Other	18.3 (11.75–27.47)	11.8 (9.76–14.09)	

Table 2 Prevalence of other DSM-IV mental disorders in respondents with IED in contrast to those without IED, and respective prevalence ratios (São Paulo Megacity; $n = 5037$)

	With IED		Without IED		Prevalence ratio
	N[a]	% (95% CI)[b]	N[a]	% (95% CI)[b]	PR (95% CI)
Social phobia	47	16.4 (11.21, 23.31)	209	5.0 (4.18, 5.85)	3.3 (2.15, 5.09)*
Specific phobia	76	25.6 (18.60, 34.05)	588	11.7 (10.36, 13.21)	2.2 (1.49, 3.18)*
Generalized anxiety disorder	37	15.2 (10.09, 22.36)	243	4.6 (3.79, 5.50)	3.3 (2.01, 5.51)*
Panic disorder	21	6.6 (3.63, 11.57)	78	1.4 (1.08, 1.88)	4.6 (2.38, 8.83)*
Agoraphobia	25	6.4 (3.49, 11.56)	130	2.7 (1.96, 3.65)	2.4 (1.13, 5.10)*
Agoraphobia without panic	20	5.2 (2.61, 9.94)	113	2.4 (1.73, 3.25)	2.2 (0.91, 5.17)
Obsessive–compulsive disorder[c]	51	20.5 (13.26, 30.27)	214	5.9 (4.90, 7.11)	3.5 (2.11, 5.67)*
Separation anxiety disorder	23	9.8 (5.82, 16.13)	142	3.1 (2.50, 3.80)	3.2 (1.86, 5.46)*
Adult separation Anxiety disorder	33	12.2 (7.72, 18.63)	241	4.9 (4.28, 5.56)	2.5 (1.55, 3.98)*
Posttraumatic stress disorder[c]	20	7.9 (3.85, 15.34)	140	2.9 (2.47, 3.38)	2.7 (1.28, 5.75)*
Any anxiety disorder	353	56.1 (48.37–63.47)	1369	27.0 (24.93–29.07)	2.1 (1.74, 2.48)*
Major depressive disorder	87	42.5 (36.10, 49.22)	848	16.9 (15.28; 18.74)	2.4 (1.89, 2.94)*
Dysthymia	15	4.2 (1.91, 8.77)	94	2.1 (1.42, 2.98)	2.0 (0.96, 4.23)
Bipolar disorder I/II	10	4.4 (1.69–10.88)	27	0.9 (0.62, 1.28)	4.9 (1.78, 13.60)*
Any mood disorder	112	41.5 (35.20–48.13)	944	18.1 (15.86–20.61)	2.3 (1.85, 2.83)*
Alcohol dependence	21	4.6 (2.96, 7.04)	155	3.2 (2.52, 4.05)	1.4 (0.85, 2.40)
Alcohol abuse	58	20.3 (16.04, 25.37)	397	8.8 (7.60, 10.07)	2.3 (1.86, 2.88)*
Drug dependence	9	2.5 (1.08, 5.74)	54	1.3 (0.83, 2.11)	1.9 (0.76, 4.71)
Drug abuse	20	7.7 (4.84, 11.93)	100	2.4 (1.78, 3.09)	3.3 (1.97, 5.38)*
Any substance use disorder	108	24.3 (19.55, 29.72)	528	10.2 (9.01, 11.56)	2.4 (1.94, 2.89)*
Attention deficit disorder	16	5.4 (2.30, 12.24)	69	1.5 (1.15, 1.95)	3.6 (1.44, 9.03)*
Conduct disorder	23	8.2 (4.66, 14.10)	75	1.7 (1.30, 2.28)	4.8 (2.51, 9.04)*
Oppositional defiant disorder	18	6.4 (2.77, 14.26)	64	1.3 (0.97, 1.86)	4.8 (1.85, 12.37)*
Pathological gambling[c]	7	2.1 (0.82, 5.19)	29	0.8 (0.45, 1.23)	2.8 (1.03, 7.45)*
Binge eating[c]	27	9.1 (5.33, 14.95)	167	4.4 (3.72, 5.30)	2.0 (1.11, 3.71)*
Any impulse control disorder	91	24.9 (18.29, 32.82)	403	8.5 (7.39, 9.64)	2.9 (2.12, 4.06)*
Any mental disorder	247	76.8 (71.16, 81.64)	2118	42.4 (39.32, 45.49)	1.8 (1.66, 1.97)*

*$p < 0.05$

[a]Unweighted absolute number

[b]Complex sample weighted proportions

[c]Part II sample ($n = 2942$)

specific and social phobias and for separation anxiety disorder. Regarding mood disorders, a higher proportion of onset after IED was observed, especially for major depressive disorder (68.5%). Among the substance use group, the onset of IED was earlier than the onset of all abuse and dependence disorders. However, the results involving drug dependence should be interpreted with caution due to the small number of cases. Regarding the impulse control disorders group, a larger proportion of pathological gambling and binge eating cases occurred after IED onset. Nevertheless, this result should also be interpreted with caution as the number of cases for those two disorders was very low. In contrast, in the impulse control disorders group, most cases were diagnosed before IED.

Discussion

In this study, we examined individuals with IED and studied the occurrence of comorbid mental disorders in a community-based sample, in comparison with individuals without IED. We also examined the temporal sequence of IED and other psychiatric disorders onset. The main findings of this study were (1) higher prevalence of most mental disorders in comorbidity with IED compared to the respective prevalences among individuals without IED; (2) regarding anxiety and impulse control disorders, IED most frequently preceded other psychiatric disorders, except for those that usually occur in childhood; (3) among mood and

Table 3 Prevalence of IED in other DSM-IV mental disorders (São Paulo Megacity; $n = 5037$)

	Prevalence ratio % (95% CI)
Social phobia	15.7 (10.75, 22.34)*
Specific phobia	10.9 (7.42, 15.82)*
Generalized anxiety disorder	15.8 (9.92, 24.19)*
Panic disorder	20.5 (11.98, 32.86)*
Agoraphobia	11.9 (6.09, 21.97)*
Agoraphobia without panic	10.9 (4.91, 22.41)*
Obsessive–compulsive disorder[a]	17.2 (11.40, 25.08)*
Separation anxiety disorder	15.2 (9.22, 24.03)*
Adult separation anxiety disorder	12.3 (7.86, 18.69)*
Posttraumatic stress disorder[a]	14.0 (7.3, 25.07)*
Anxiety disorders	11.1 (9.10–13.41)*
Major depressive disorder	12.4 (10.24, 14.87)*
Dysthymia	10.2 (5.09, 19.33)*
Bipolar disorder I/II	21.7 (8.78–44.42)*
Mood disorders	12.1 (9.88–14.65)*
Alcohol dependence	7.5 (4.50, 12.12)*
Alcohol abuse	11.5 (9.07, 14.55)*
Drug dependence	9.6 (3.70, 22.79)*
Drug abuse	15.5 (9.73, 23.78)*
Substance use disorders	11.8 (9.44, 14.62)*
Attention deficit disorder	16.9 (7.76, 32.89)*
Conduct disorder	21.1 (12.19, 34.09)*
Oppositional defiant disorder	21.2 (9.38, 41.20)*
Pathological dambling[a]	14.3 (4.80, 35.52)*
Binge eating[a]	10.9 (5.98, 18.95)*
Impulse control disorders	15.1 (11.13, 19.85)*
Any mental disorder	9.8 (8.48, 11.27)*

*$p < 0.05$

[a]Part II sample ($n = 2942$)

substance use disorders, IED most frequently preceded all disorders in these groups. Although IED has been reported to be more prevalent among men in previous studies [5, 9], we have not found such an association.

The prevalence of lifetime IED in this sample was high (4.9%), as reported elsewhere [6]. Overall, the diagnosis of any mental disorder was higher for those with IED compared to those without (76.8% vs 42.4%), revealing IED as a highly comorbid disorder in our sample. High rates of psychiatric comorbidity with IED have also been reported in a representative US sample from the *National Comorbidity Survey Replication,* where 81.8% of individuals with IED met criteria for at least one other mental disorder [5]. Similar results have been found in other population-based samples, such as in South Africa (60.5%) [10] and Iraq (61.2%) [4]. Even when regarding the opposite, that is, the occurrence of IED in other mental disorders, IED is a prevalent condition, especially in impulse control disorders and bipolar disorder, in part explained by the component of impulsivity, common to all of then [15]. The use of non-hierarchical diagnostic rules could also contribute to these findings, as IED-like symptoms may be present during a maniac episode or within the context of a conduct disorder.

At this point, it is important to consider that the instrument used for psychiatric assessment in our sample and in all population-based studies of the WMHS (CIDI 3.0) is fully structured and, although with satisfactory rates of diagnostic agreement [16], is not capable of capturing refined clinical distinctions, and may lead to over-estimation of comorbidity. Nevertheless, clinical exclusions were allowed for all diagnoses, with a question enquiring whether the symptoms were ever due to any clinical disease, or as a result of using alcohol or drugs.

Considering the prevalence of psychiatric disorders in individuals with and without IED, in our sample, the highest magnitude of associations was found for disruptive disorders, suggesting that impulsivity is an important component of IED, as well as an effective dysregulation [15]. A potential explanation for this association is based on reports on morphometric shape of the brain in individuals with IED, that have demonstrated deformities on the surface of the amygdala and hippocampus, affecting emotional regulation and impulsivity, due to projections to the medium prefrontal cortex [18]. Additionally, abnormalities in corticolimbic functioning, which are associated with the aggressive behavior, have been described in individuals with IED and in others, disruptive behavior disorders, such as conduct disorder [18].

We also observed that individuals with IED were twofold more likely to present any substance use disorder, with onset subsequent to the onset of IED in most cases. A representative US sample of adults and adolescents reported similar results, i.e. the onset of IED preceded most cases of any substance use disorder and the severity of substance use was greater when IED were comorbid [19]. In addition, IED was reported as a risk factor for substance use disorder in previous studies, but it was not relevant whether the diagnosis of IED was concurrent or previous to the substance use disorder [20].

Regarding the co-occurrence with anxiety disorders, we observed that the prevalence of any anxiety disorder in individuals with IED was more than two times higher than among those without IED. High prevalence of anxiety disorders in individuals with IED has been described and is in part explained by the fact that both disorders are associated with deficits in emotional regulation, especially in experiences of emotional intensity and lability [21, 22].

In relation to the temporal sequence of comorbid disorders, IED most frequently preceded all anxiety disorders, except in cases of separation anxiety disorder and social and

Table 4 Temporal sequence of IED and comorbid psychiatric disorders (São Paulo Megacity; $n = 5037$)

	N[a]	Comorbity preceded IED onset		Concurrent onset		Comorbity posterior to IED onset	
		%[b]	95% CI	%[b]	95% CI	%[b]	95% CI
Anxiety disorders							
Social phobia	47	77.9	57.75–90.08	4.8	1.28–16.52	17.3	7.02–36.66
Specific phobia	76	69.4	49.43–84.01	7.0	1.71–24.72	23.6	10.58–44.64
Generalized anxiety disorder	37	15.2	5.51–35.48	17.1	6.55–37.84	67.7	47–83.2
Panic disorder	21	21.3	1.61–81.74	26.2	2.27–84.43	52.5	9.87–91.77
Agoraphobia	25	31.1	10.17–64.18	26.0	5.27–68.85	43.0	11.19–81.86
Agoraphobia without panic	20	26.2	4.18–74.31	29.2	2.76–85.68	44.6	4.59–93.09
Separation anxiety disorder	23	92.6	40.41–99.57	7.4	0.43–59.59	–	–
Adult separation Anxiety disorder	33	12.1	3.43–34.86	9.0	1.87–34.18	78.9	55.77–91.68
Obsessive–compulsive disorder[c]	51	35.4	18.12–57.6	9.8	3.53–24.22	54.8	34.65–73.55
Posttraumatic stress disorder[c]	20	41.4	7.27–86.42	4.8	0.26–48.83	53.8	12.2–90.72
Mood disorders							
Major depressive disorder	105	21.1	12.04–34.22	10.5	6.21–17.04	68.5	54.22–79.96
Dysthymia	15	31.9	0–99.99	–	–	68.1	0.01–100
Bipolar disorder I/II	10	3.6	[d]	5.3	[d]	91.1	[d]
Substance use disorders							
Alcohol dependence	21	14.9	2.91–50.47	15.7	1.85–64.9	69.4	40.31–88.38
Alcohol abuse	58	20.9	9.24–40.77	10.0	2.03–37.11	69.1	56.08–79.68
Drug dependence	9	15.9	0–99.98	–	–	84.1	0.02–100
Drug abuse	20	31.2	8.33–69.4	0.6	0.05–8.21	68.1	30.32–91.31
Impulse control disorders							
Pathological gambling[c]	7	38.8	–[d]	–	–	61.2	–[d]
Binge eating[c]	27	18.9	1.21–81.66	6.7	0.61–45.68	74.3	21.62–96.82
Conduct disorder	23	61.2	19.26–91.25	3.5	0.15–47.21	35.3	7.81–77.83
Oppositional defiant disorder	18	85.8	–[d]	3.7	–[d]	10.5	–[d]
Attention deficit disorder	16	80.7	0.38–99.98	9.9	0–99.75	9.5	0–100

[a]Unweighted absolute number

[b]Complex sample weighted proportions

[c]Part II sample ($n = 2942$)

[d]It was not possible to estimate the confidence interval due to the low number of individuals in the category

specific phobias. Among mood and substance use disorders, IED occurred earlier in most cases of all disorders assessed. IED onset also preceded more frequent the onset of impulse control disorders, except in cases of attention deficit disorder, oppositional defiant disorder, and conduct disorder, which typically have childhood onsets. Such findings are consistent with previous studies that have revealed an early age of onset of IED, such as the mean age of 17 years, from a cross-national population-based study also from WMHS, and the median age of onset found in our sample, 16 years [6, 9].

Similar results were reported in a representative sample of US adolescents demonstrating that IED was an early-onset disorder when compared to most of the other disorders assessed, particularly anxiety and substance use disorders [23]. Another group found that IED most frequently preceded other mental disorders, especially major depression, generalized anxiety disorder, panic disorder and substance use disorders [5]. This raises the possibility that IED may be a risk factor or a risk marker for other subsequent mental disorders [5]. In this context, the treatment for anger attacks, even at young ages, may be an important opportunity to prevent the onset of later disorders [23].

Another issue of importance is the hypothesis that IED may be more prevalent in cultures with higher rates of violence. Although previous population-based studies have not found higher rates of IED in countries with war and high rates of violence, an association between IED and trauma exposure has been reported [4, 10]. However, it is possible that prevalence rates may be underestimated. In Iraq, for instance, the study was conducted in a highly violent period, which increased non-response rates in the areas experiencing the highest rates of violence [4]. Thus, prospective further studies evaluating this association are needed.

It is noteworthy mentioning that the DSM-5 included another disorder with aggressive and anger-related behavior, the disruptive mood dysregulation disorder (DMDD). It is characterized by recurrent temper outbursts grossly out of proportion in intensity, onset before 10 years of age, and persistent anger between impulsive outbursts [1]. Given the diagnostic similarity, except for persistent anger, it is important to assume that some cases of IED in our sample could also meet the criteria for DMDD that lasted until adulthood. Because it is a new disorder definition, the differential diagnosis with IED has not yet been systematically assessed. Nevertheless, among individuals with IED from a community sample, only 8% reported persistent anger and 3% met criteria for a retrospective DSM-5 DMDD diagnosis [24].

Our results should be analyzed considering the context of study limitations. First, the diagnoses were based on fully structured interviews based on self-reported retrospective information on signs and symptoms covering DSM-IV diagnostic criteria for mental disorders. Second, the cross-sectional design of the study does not allow to test causal relationships between IED and other mental disorders, although temporality could be fairly assessed through the investigation of ages at onset of specific clinical presentations. Notwithstanding these concerns, a strength of this study is the possibility of generalizing these results to the Brazilian population living in metropolitan conglomerates, given the representative sampling of community household adults. Moreover, to our knowledge, this is the first Brazilian population-based study examining IED and its comorbidity with other mental disorders.

In conclusion, IED is a relatively common disorder in Brazilians living in large metropolitan areas, and it is highly comorbid with other mental disorders, leading to greater psychosocial impairment and worse prognosis. Furthermore, the present study demonstrates that IED starts at a younger age than most other mental disorders, when occurring in comorbidity. These findings indicate that the early recognition of IED and the implementation of adequate treatment may prevent the onset of several other mental disorders and the negative outcomes related to them. Thus, the training of pediatric professionals in the early detection of IED could work as an effective screening. Further, it may also help to improve the management of comorbid mental disorders once IED symptoms are controlled. Prospective case identification and treatment data are needed to better clarify the nature of such comorbidity and to guide strategies for early recognition and development of treatment protocols. Apart from reducing the individual burden and societal costs, the early and adequate management of IED may also represent an important step to prevent harm and violence directed to others, especially within the context of family violence.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. American Psychiatric Association (2013) Diagnostic and statistical manual of mental disorders, 5th edn (DSM 5). American Psychiatric Association, Washington, DC
2. American Psychiatric Association (1994) Diagnostic and statistical manual of mental disorders, 4th edn (DSM IV). American Psychiatric Association, Washington, DC
3. Coccaro EF, Lee R, McCloskey MS (2014) Validity of the new A1 and A2 criteria for DSM-5 intermittent explosive disorder. Compr Psychiatry 55:260–267
4. Al-Hamsawi A et al (2014) The prevalence and correlates of intermittent explosive disorder in Iraq. Acta Psychiatr Scand 126(3):219–228
5. Kessler RC, Coccaro EF, 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. Arch Gen Psychiatry 63(6):669–678
6. Viana MC, Andrade LH (2012) Lifetime prevalence, age and gender distribution and age-of-onset of psychiatric disorders in the São Paulo Metropolitan area, Brazil: results from the São Paulo Megacity Mental Health Survey. Braz J Psychiatry 34(3):249–260
7. Yoshimasu K et al (2011) Epidemiological aspects of intermittent explosive disorder in Japan; prevalence and psychosocial comorbidity: findings from the World Mental Health Japan Survey 2002–2006. Psychiatry Res 186(2–3):384–389
8. Gelegen V, Tamam L (2018) Prevalence and clinical correlates of intermittent explosive disorder in Turkish psychiatric outpatients. Compr Psychiatry 83:64–70
9. Scott KM et al (2016) The cross-national epidemiology of DSM-IV intermittent explosive disorder. Psych Med 46(15):3161–3172
10. Fincham D, Grimsrud A, Corrigall J, Williams D, Seedat S, Stein DJ, Myer L (2009) Intermittent explosive disorder in South Africa: prevalence, correlates, and the role of traumatic exposures. Psychopatology 42(2):92–98
11. Viana MC, Teixeira MG, Beraldi F, Bassani IS, Andrade LH (2009) São Paulo Megacity Mental Health Survey—a population-based epidemiological study of psychiatric morbidity in the São Paulo Metropolitan area: aims, design and field implementation. Braz J Psychiatry 31(4):375–386
12. Kessler RC, Ustun TB (2004) The World Mental Health (WMH) Survey initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). Int J Methods Psychiatr Res 13(2):93–121
13. Viana MC, Viana-Moldes I, Teixeira M, Basani I, Andrade LH (2004) The World Mental Health Version of the Composite

International Diagnostic Interview (WMH-CIDI): translation and adaptation to Brazilian-Portuguese: the instrument used in the "São Paulo Megacity Mental Health Survey". Printed Version
14. Andrade LH et al (2012) Mental disorders in megacities: findings from the São Paulo Megacity Mental Health Survey. Brazil PLoS One 7(2):1–11
15. Coccaro EF (2012) Intermittent explosive disorder as a disorder of impulsive aggression for DSM-5. Am J Psychiatry 169(6):577–588
16. Haro JM et al (2006) Concordance of the composite international diagnostic interview version 3.0 (CIDI 3.0) with standardized clinical assessments in the WHO World Mental Health surveys. Int J Methods Psychiatr Res 15(4):167–180
17. Coccaro EF, Lee R, McCloskey M, Csernansky JG, Wang L (2015) Morphometric analysis of amygdala and hippocampus in impulsively aggressive and healthy control subjects. J Psychiatr Res 69:80–86
18. Coccaro EF, Sripada CS, Yanowitch RN, Phan KL (2011) Corticolimbic function in impulsive aggressive behavior. Biol Psychiatry 69:1153–1159
19. Coccaro EF, Fanning JR, Lee R (2017) Intermittent explosive disorder and substance use disorder: analyses of the National Comorbity Study—replication sample. J Clin Psychiatry 78(6):697–702
20. Coccaro EF, Fridberg DJ, Fanning JR, Grant JE, King AC, Lee R (2016) Substance use disorder: relationship with intermittent explosive disorder and aggression, anger and impulsivity. J Psychiatr Res 81:127–132
21. Fettich KC, McCloskey MS, Look AM, Coccaro EF (2015) Emotion regulation deficits in intermittent explosive disorder. Aggress Behav 41(1):25–33
22. Galbraith T, Carliner H, Keyes KM, McLaughlin KA, McCloskey MS, Heimberg RG (2018) The co-occurrence and correlates of anxiety disorders among adolescents with intermittent explosive disorder. Aggress Behav 44(6):581–590
23. McLaughlin KA, Green JG, Hwang I, Sampson NA, Zaslavsky AM, Kessler RC (2012) Intermittent explosive disorder in the National Comorbidity survey replication adolescent supplement. Arch Gen Psychiatry 69(11):1131–1139
24. Coccaro EF (2018) DSM-5 intermittent explosive disorder: relationship with disruptive mood dysregulation disorder. Compr Psychiatry 84:118–121