



Prevalence, comorbidities, and sociodemographic predictors of conduct disorder: the national epidemiology of Iranian children and adolescents psychiatric disorders (IRCAP)

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Abstract

The aim was to evaluate the lifetime prevalence of conduct disorder according to sociodemographic characteristics, determine the sociodemographic predictors of conduct disorder, and estimate the rates of comorbidities of psychiatric disorders in children and adolescents with conduct disorder by age and gender. The National Epidemiology of Iranian Children and Adolescents Psychiatric Disorders was a cross-sectional, general population-based study on 30,532 children and adolescents aged 6–18 years from all provinces of Iran, which was done using multistage cluster sampling. Iranian citizens aged 6–18 years who resided at least 1 year in each province were included, and children and adolescents with severe physical illnesses that prevented them to participate in the study were excluded. The sample weighting adjustment was used, since we had randomly selected the equal number of 1000 participants of each province from the urban and rural areas. Trained psychologists conducted diagnostic interviews with the adolescents and the children's parents using the Persian version of the Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime Version (K-SADS—PL). In this study, 54 children aged 6–9 years (0.58%, CI 0.47–0.77), 64 adolescents aged 10–14 years (0.57%, CI 0.47–0.77), and 117 adolescents aged 15–18 years (1.22%, CI 0.96–1.44) met the criteria of the lifetime conduct disorder. Conduct disorder was significantly more common in boys than in girls, and was significantly less prevalent among those participants whose fathers had no history of psychiatric hospitalization. Of the participants with conduct disorder, 83.4% met the criteria for at least one other psychiatric disorder. Conduct disorder had a high rate of comorbidity with oppositional defiant disorder (54.89%, CI 48.50–61.12), attention-deficit/hyperactivity disorder (32.34%, CI 26.68–38.56), tobacco use (20.43%, CI 15.77–26.04), and depressive disorders (18.30%, CI 13.88–23.74). Because of using the diagnostic instrument, we found a low total rate of prevalence for conduct disorder; however, higher rates of it were observed among boys and adolescents. Further studies are needed to explore the nature of comorbidities of conduct disorder and to consider them in a large clinical population.

Keywords Adolescents · Children · Conduct disorder · Comorbidity · Iran · Prevalence

Introduction

Characteristics of conduct disorder include aggression against people and animals, deceitfulness and theft, destroying properties, and serious violations of rules that have

lasted for at least 6 months among children and adolescents younger than 18 years [17]. The predictors of conduct disorder include low IQ, low school achievement, impulsiveness, lack of maternal closeness, parental conflict, disrupted families, history of harsh discipline, poor parental supervision, antisocial parents, low childhood socioeconomic status, and low family income [44, 46]. Conduct disorder is associated with violence, antisocial personality disorder, a range of substance use disorders, failing to complete high school, and early pregnancy [19].

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Conduct disorder has a considerable global burden, especially in males. It was found that 5.75 million children and adolescents lose years of healthy life due to the disability associated with conduct disorder [18]. In a comprehensive systematic review and meta-analysis of the prevalence of conduct disorder, Erskine et al. [17] reported the global prevalence rates of 3.6% and 1.5% for conduct disorder in males and females, respectively [17].

Iran is the 18th most populous country where children and adolescents constitute 31% of the total population [64] and conduct disorder is a common psychiatric disorder among the Iranian children and adolescents [6, 42, 43, 54, 61]. Previous studies reported different prevalence rates for conduct disorder among Iranian children and adolescents, which ranged from 0.34 to 32.9% [3, 6, 41–43, 54, 61]. However, there is no national population-based study to present an accurate rate of prevalence for conduct disorder in Iran [60]. Those previous studies that used screening tools, such as the Strengths and Difficulties Questionnaire (SDQ), reported much higher prevalence rates for conduct disorder as compared to the studies that used diagnostic tools [8, 16, 43, 53, 67]. For example, using SDQ, Mohammadi et al. [43] reported that 32.9% of children and adolescents were screened positive for conduct disorder in five provinces of Iran, which widely differed with the rate of 0.34% obtained using K-SADS-PL [41]. The variation in prevalence estimates showed that such diagnostic tools as K-SADS-PL should be used accurately to assess the prevalence of conduct disorder in a national epidemiological study.

The majority of studies showed that psychiatric comorbidities are prevalent among children and adolescents with conduct disorder [12, 28, 47, 53, 62]. There was at least 1 additional psychiatric disorder among 79% of adolescents with conduct disorder. The most common comorbidities of conduct disorder were ODD, ADHD, substance abuse disorders, depression, and anxiety disorders [36, 47, 53, 62]. Exploring co-occurring disorders can help predict the worst consequences of conduct disorder. Ghanizadeh [22] found that a higher score for physical aggression in the children and adolescents with conduct disorder was associated with ADHD severity [22]. Also, those who get hospitalized for conduct disorder may experience severe ADHD, substance abuse disorders, depression, and psychosis [20, 51].

Genetic factors play an essential role in the comorbidity of conduct disorder with ADHD and major depressive disorder among males. Moreover, environmental factors are important in developing comorbidities among females [9, 66]. Genetic factors largely contribute to the comorbidity of conduct disorder with substance abuse disorders in both genders [11]. Ilomaki et al. [28] observed no gender differences in the comorbidities of conduct disorder, except posttraumatic stress disorder, which was significantly more

common among females suffering from conduct disorder as compared to males [28].

Conduct disorder may be a causal risk factor for developing subsequent disorders. Conduct disorder symptoms can cause life stressors that increase the risk of depression and anxiety disorder. The National Comorbidity Survey Replication in the United States reported that the lifetime diagnosis of conduct disorder was associated with mental disorders, including bipolar disorder, major depressive disorder, dysthymia, panic disorder, generalized anxiety disorder, specific phobia, social phobia, posttraumatic stress disorder, obsessive-compulsive disorder, intermittent explosive disorder, ODD, ADHD, alcohol abuse or dependence, and drug abuse or dependence [47].

To provide the new information that are needed for the development of policies and rational planning of health-care resources to reduce the burden of conduct disorder, we conducted the national epidemiology of Iranian children and adolescents psychiatric disorders (IRCAP) in a large, nationally representative sample of Iranian children and adolescents aged 6–18 years. The aims of this study were to evaluate the lifetime prevalence of conduct disorder according to the sociodemographic characteristics, determine the sociodemographic predictors of conduct disorder, and estimate the rates of comorbidity of psychiatric disorders in children and adolescents with conduct disorder by age and gender. There are many studies that have reported the prevalence rates of conduct disorder mostly with small, school-based samples, using the screening tools and that did not include the lifetime estimates which reported high rates of conduct disorder. However, there are no general population-based studies with such a large and nationally representative sample to accurately assess the lifetime prevalence and comorbidities of conduct disorder according to age and gender using the diagnostic instrument of K-SADS-PL. Therefore, the results of this study can provide valuable information on conduct disorder for researchers, clinicians, and health-care policymakers.

Methods

Study design and setting

This was a cross-sectional, general population-based study. Data were collected from the national epidemiology of Iranian children and adolescents psychiatric disorders (IRCAP) study, which was a face to face household survey of 30,532 Persian-speaking children and adolescents aged 6–18 years. This study was executed in all provinces of Iran and lasted from 2016 to 2018. The response rate in this survey was 91.78%.

Participants

Iranian citizens, aged 6–18 years, who resided at least 1 year in each province were included in the study. We excluded children and adolescents with severe physical illnesses that prevented them from participation in the study.

The survey was administered based on multistage cluster sampling. 1000 children and adolescents were randomly selected from both urban and rural areas in each province of Iran. We randomly assigned 170 blocks according to the postal codes; one girl and one boy were chosen from each of the age groups of 6–9 years, 10–14 years, and 15–18 years, which gave us a total of 6 participants from each block.

We reported the prevalence of conduct disorder based on the sociodemographic factors by crude and weighted percentages. Although the population of children and adolescents is not equal in all provinces of Iran, we randomly selected the equal number of 1000 participants from each province. So, the population proportion of each province was weighted, and we used the sample weighting adjustment based on the population distribution of children and adolescents in each province according to the last national census [63] using the following formula:

$$W_{ij} = \left(\frac{1}{P_{ij} * 1000} \right) / 1000,$$

where W_{ij} : Weight for the individual in each province; P_{ij} : Probability of selecting the individual in his/her province.

A flow diagram illustrates the process of participant enrollment in the study (Fig. 1).

Variables

The diagnostic assessment was carried out by trained psychologists who interviewed the parents of children younger than 11 years and the adolescents aged 11–18 years using the Persian version of K-SADS–PL.

The following sociodemographic factors were collected: gender (boy, girl); age (6–9, 10–14, 15–18); type of settlement (urban, rural); father's and mother's education (illiterate, primary school, middle and high school, high school diploma, bachelor's degree, master's or higher degree); father's and mother's occupation (unemployed, laborer, farmer, businessman, retired, public sector employee, teacher, faculty member); father's and mother's history of psychiatric hospitalization.

The study was approved by the research ethics committee at the National Institute for Medical Research Development (Tehran, Iran) (reference number: IR.NIMAD.REC.1395.001). Full details of the method are available in the study protocol [40].

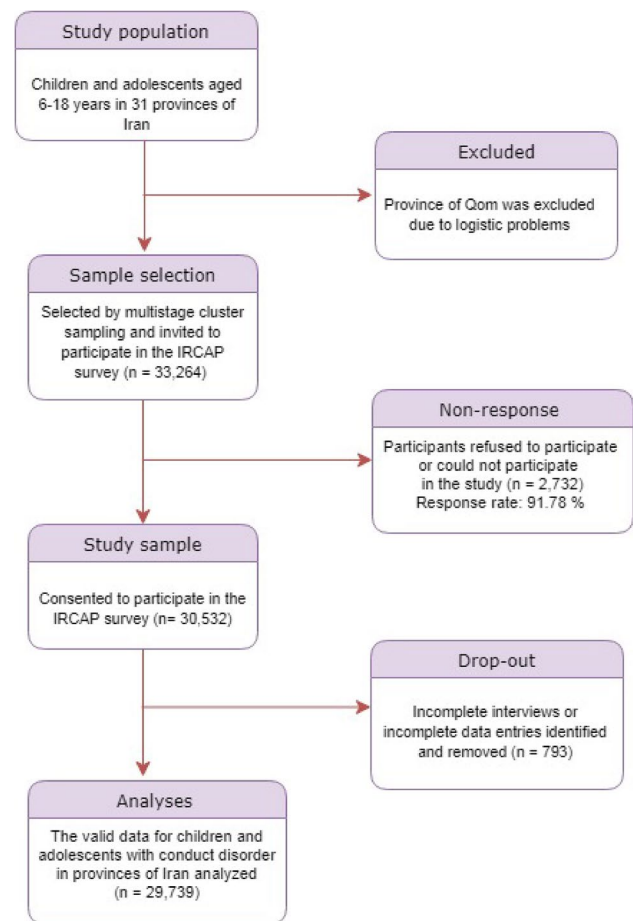


Fig. 1 Flow diagram of enrolling the participants in the study

Assessment

K-SADS–PL is a semi-structured psychiatric interview based on the DSM-IV criteria, including mood disorders, psychotic disorders, anxiety disorders, conduct disorder, ODD, ADHD, eating disorders, elimination disorders, and tic disorder. Ghanizadeh et al. [23] reported the validity of 0.92 and the reliability of 0.81 for the Persian version of K-SADS–PL for the diagnosis of conduct disorder. The specificity and sensitivity for psychiatric disorders modules of Persian version of K-SADS–PL were reported between 79.6 to 100, and 78.9 to 100, respectively [23].

Potential sources of bias

Although the population of children and adolescents is not equal in all provinces of Iran, we randomly selected the equal number of 1000 participants from all provinces, which generated the selection bias. Therefore, we used the sample weighting to handle this.

To avoid the recall bias, we trained psychologists to allocate enough time to interview the adolescents and parents of children to adequately recall the lifetime symptoms for each psychiatric disorder by the K-SADS–PL instrument which has a high specificity and sensitivity and an accurate criteria to diagnose the symptoms of mental disorders and minimize the measurement bias [23].

Statistical analysis

Data were analyzed using SPSS 20 and STATA 8. Results are presented in the form of frequency and percentages. The associations of conduct disorder with other psychiatric disorders and the sociodemographic predictors of conduct disorder were estimated using logistic regression analyses. The data were adjusted based on the weighting of population in each province and both crude and weighted prevalence rates were reported.

We used list-wise deletion method in handling the missing data, because the sample was large enough and the missing data was completely at random [4, 39]. Accordingly, we observed no significant difference between missing and valid data in the gender factor, which is an essential factor for conduct disorder.

Results

Of the 30,532 children and adolescents who participated in the survey, 29,739 individuals responded to the conduct disorder module (Fig. 1). No significant differences were observed in sociodemographic predictors of conduct disorder between respondents and non-respondents. Table 1 shows the sociodemographic characteristics of the sample. The total lifetime prevalence of conduct disorder was found to be 0.78%. Also, significant associations were observed between conduct disorder and father's occupation ($X^2 = 14.84$, $p < 0.05$), father's education ($X^2 = 11.77$, $p < 0.05$), and mother's education ($X^2 = 13.39$, $p < 0.05$). On the other hand, no associations were found between conduct disorder and mother's occupation ($X^2 = 13.39$, $p > 0.05$).

In the multivariate analysis, no significant differences were found in the sociodemographic characteristics of conduct disorder, except in gender, age, and father's history of psychiatric hospitalization (Table 2). Conduct disorder was significantly less prevalent among girls as compared to boys (OR 0.16, 95% CI 0.11–0.24, $p < 0.01$). Across the sample, 34 girls (0.28%, CI 0.22–0.39) and 201 boys (1.28%, CI 1.13–1.53) were diagnosed with conduct disorder. Conduct disorder was significantly more common among adolescents aged 15–18 years than among the referent age group (OR 2.22, 95% CI 1.58–3.15, $p < 0.01$) (Table 2). Figure 2 shows that the prevalence of the disorder increases with age among

boys but not among girls. Moreover, conduct disorder was significantly less prevalent among those whose fathers had no history of psychiatric hospitalization (OR 0.22, 95% CI 0.08–0.60, $p < 0.01$).

In the univariate analysis, rates of conduct disorder were significantly lower among those participants whose fathers had a high school diploma (OR 0.52, 95% CI 0.30–0.91, $p < 0.05$) as compared to participants whose fathers were illiterate. Also, those participants whose mothers had a high school diploma (OR 0.55, 95% CI 0.34–0.91, $p < 0.05$) or a bachelor's degree (OR 0.47, 95% CI 0.27–0.82, $p < 0.01$) experienced significantly lower rates of conduct disorder as compared to participants whose mothers were illiterate.

Of the participants with conduct disorder, 83.4% met the criteria for at least 1 other psychiatric disorder (Fig. 3). Conduct disorder is much more likely to co-occur with ODD (54.89%, CI 48.50–61.12), ADHD (32.34%, CI 26.68–38.56), tobacco use (20.43%, CI 15.77–26.04), and depressive disorders (18.30%, CI 13.88–23.74); however, it is much less likely to occur with bulimia nervosa (0.43%, CI 0.08–2.38), autism (0.43%, CI 0.08–2.38), and encopresis (0.85%, CI 0.23–3.05) (Table 3, Fig. 3). Moreover, higher prevalence rates of depressive disorders, mania, hypomania, and panic disorder were observed among girls who had conduct disorder as compared to boys. Separation anxiety disorder, ADHD, and enuresis were significantly less common among 15–18 year-old adolescents who had conduct disorder, but smoking was significantly more prevalent among them. Also, rates of ADHD, ODD, and enuresis were significantly lower among 10–14 year-old participants with conduct disorder as compared to 6–9 year-old participants with conduct disorder (Table 3).

Discussion

This study provided new information, using a large and nationally representative sample of Iranian children and adolescents aged 6–18 years. The aims were to evaluate the lifetime prevalence of conduct disorder according to sociodemographic characteristics, determine the sociodemographic predictors of conduct disorder, and estimate the rates of comorbidity of psychiatric disorders in children and adolescents with conduct disorder by age and gender.

Using various screening and diagnostic tools, several local studies reported different prevalence rates for conduct disorder, ranging from 0.34 to 32.9%, among Iranian children and adolescents [3, 6, 41–43, 54, 60]. The variation in prevalence estimates shows that such diagnostic tools as K-SADS–PL should be used accurately to assess the prevalence of conduct disorder in a national epidemiological study. Thus, this study provided a reliable national data set to accurately assess the lifetime prevalence and comorbidities

Table 1 Distribution of sociodemographic characteristics of the study participants

Sociodemographic characteristics	Total		With conduct disorder		
	<i>N</i>	%	<i>N</i>	Crude percent	Weighted percent (95% CI)
Gender					
Boy	14,567	48.98	201	1.38	1.28 (1.13–1.53)
Girl	15,172	51.02	34	0.22	0.28 (0.22–0.39)
Age					
6–9	10,121	34.03	54	0.53	0.58 (0.47–0.77)
10–14	10,414	35.02	64	0.61	0.57 (0.47–0.77)
15–18	9204	30.95	117	1.27	1.22 (0.96–1.44)
Types of settlement					
Urban	24,783	83.34	195	0.79	0.79 (0.67–0.94)
Rural	4956	16.66	40	0.81	0.58 (0.43–0.87)
Father's education ^a					
Illiterate	1290	4.34	16	1.24	1.26 (0.78–2.08)
Primary school	4623	15.55	41	0.89	0.82 (0.56–1.12)
Middle & high school	6393	21.5	63	0.99	0.98 (0.78–1.28)
High school diploma	8329	28.01	54	0.65	0.70 (0.54–0.90)
Bachelor's degree	6033	20.29	40	0.66	0.60 (0.43–0.83)
Master's or higher degree	1967	6.61	11	0.56	0.31 (0.14–0.67)
Missing	1104	3.71	10	0.91	1.30 (0.75–2.51)
Mother's education ^b					
Illiterate	1693	5.69	21	1.24	0.94 (0.54–1.46)
Primary school	5476	18.41	58	1.06	1.04 (0.78–1.35)
Middle & high school	5652	19.01	48	0.85	0.86 (0.68–1.18)
High school diploma	9574	32.19	66	0.69	0.70 (0.55–0.89)
Bachelor's degree	5554	19.01	33	0.59	0.56 (0.42–0.83)
Master's or higher degree	987	3.32	7	0.71	0.87 (0.48–1.72)
Missing	803	2.7	2	0.25	0.51 (0.18–1.51)
Father's occupation ^c					
Unemployed	987	3.32	14	1.42	0.97 (0.48–1.97)
Laborer	16,409	55.18	129	0.79	0.78 (0.68–0.94)
Farmer	981	3.3	10	1.02	0.81 (0.4–1.6)
Businessman	1054	3.54	10	0.95	1.35 (0.78–2.22)
Retired	1682	5.66	19	1.13	1.01 (0.61–1.6)
Public sector employee	6610	22.23	36	0.54	0.51 (0.43–0.74)
Teacher	802	2.7	4	0.5	0.42 (0.13–1.18)
Faculty member	172	0.58	2	1.16	1.09 (0.31–4.12)
Missing	1042	3.5	11	1.06	1.56 (0.89–2.87)
Mother's occupation ^d					
Laborer	968	3.25	10	1.03	1.15 (0.62–2.03)
Farmer	16	0.05	0	0	–
Businesswoman	220	0.74	4	1.82	1.62 (0.72–4.58)
Housewife	24,753	83.23	202	0.82	0.81 (0.68–0.91)
Retired	215	0.72	2	0.93	1.04 (0.29–3.31)
Public sector employee	1632	5.49	4	0.25	0.28 (0.13–0.74)
Teacher	1164	3.91	9	0.77	0.73 (0.38–1.51)
Faculty member	75	0.25	2	2.67	2.76 (0.71–9.24)
Missing	696	2.34	2	0.29	0.56 (0.21–1.83)
Father's history of psychiatric hospitalization					
Yes	109	0.37	4	3.67	2.19(0.32–7.11)
No	29,630	99.63	231	0.78	0.77(0.66–0.90)

Table 1 (continued)

Sociodemographic characteristics	Total		With conduct disorder		
	N	%	N	Crude percent	Weighted percent (95% CI)
Mother's history of psychiatric hospitalization					
Yes	90	0.3	2	2.22	1.27(0.21–6.03)
No	29,649	99.7	233	0.79	0.77(0.66–0.90)
Total	29,739	100	235	0.79	0.78 (0.68–0.91)

^a $\chi^2 = 11.77$, p value < 0.05^b $\chi^2 = 13.39$, p value < 0.05^c $\chi^2 = 14.84$, p value < 0.05^d $\chi^2 = 13.39$, p value > 0.05**Table 2** Sociodemographic predictors based on univariate and multivariate analysis ($N = 29,739$)

Sociodemographic predictors	Univariate analysis		Multivariate analysis	
	OR (95% CI)	P value	OR (95% CI)	P value
Gender				
Boy	1.00 Baseline			
Girl	0.16 (0.11–0.23)	0.001**	0.16 (0.11–0.24)	0.001**
Age				
6–9	1.00 Baseline			
10–14	1.15 (0.80–1.66)	0.45	1.16 (0.80–1.68)	0.44
15–18	2.40 (1.74–3.32)	0.001**	2.22 (1.58–3.11)	0.001**
Type of settlement				
Urban	1.00 Baseline			
Rural	1.03 (0.73–1.44)	0.89		
Father's education				
Illiterate	1.00 Baseline			
Primary school	0.71 (0.40–1.27)	0.26	0.71 (0.37–1.33)	0.29
Middle & high school	0.79 (0.46–1.38)	0.41	0.86 (0.45–1.63)	0.64
High school diploma	0.52 (0.30–0.91)	0.022*	0.58 (0.29–1.16)	0.13
Bachelor's degree	0.53 (0.30–0.95)	0.034	0.61 (0.29–1.27)	0.19
Master's or higher degree	0.45 (0.21–0.97)	0.041	0.52 (0.21–1.33)	0.17
Mother's education				
Illiterate	1.00 Baseline			
Primary school	0.85 (0.52–1.41)		1.22 (0.67–2.23)	0.51
Middle & high school	0.68 (0.41–1.14)	0.16	1.02 (0.53–1.94)	0.96
High school diploma	0.55 (0.34–0.91)	0.019*	0.98 (0.50–1.91)	0.95
Bachelor's degree	0.47 (0.27–0.82)	0.008*	0.89 (0.42–1.90)	0.77
Master's or higher degree	0.57 (0.24–1.34)	0.20	0.94 (0.32–2.76)	0.91
History of psychiatric hospitalization				
Father				
Yes	1.00 Baseline			
No	0.20 (0.07–0.56)	0.002**	0.22 (0.08–0.60)	0.003**
Mother				
Yes	1.00 Baseline			
No	0.34 (0.08–1.42)	0.14	0.41 (0.10–1.70)	0.22

OR Odds Ratio Adjusted, CI Confidence Interval; * $p \leq 0.05$; ** $p < 0.01$

of conduct disorder by age and gender among Iranian children and adolescents using the K-SADS-PL diagnostic instrument.

The 0.78% estimated total lifetime prevalence is consistent with the prevalence rate of conduct disorder reported by other studies that used the K-SADS-PL [1, 14, 41, 49,

Fig. 2 Rates of conduct disorder by age and gender

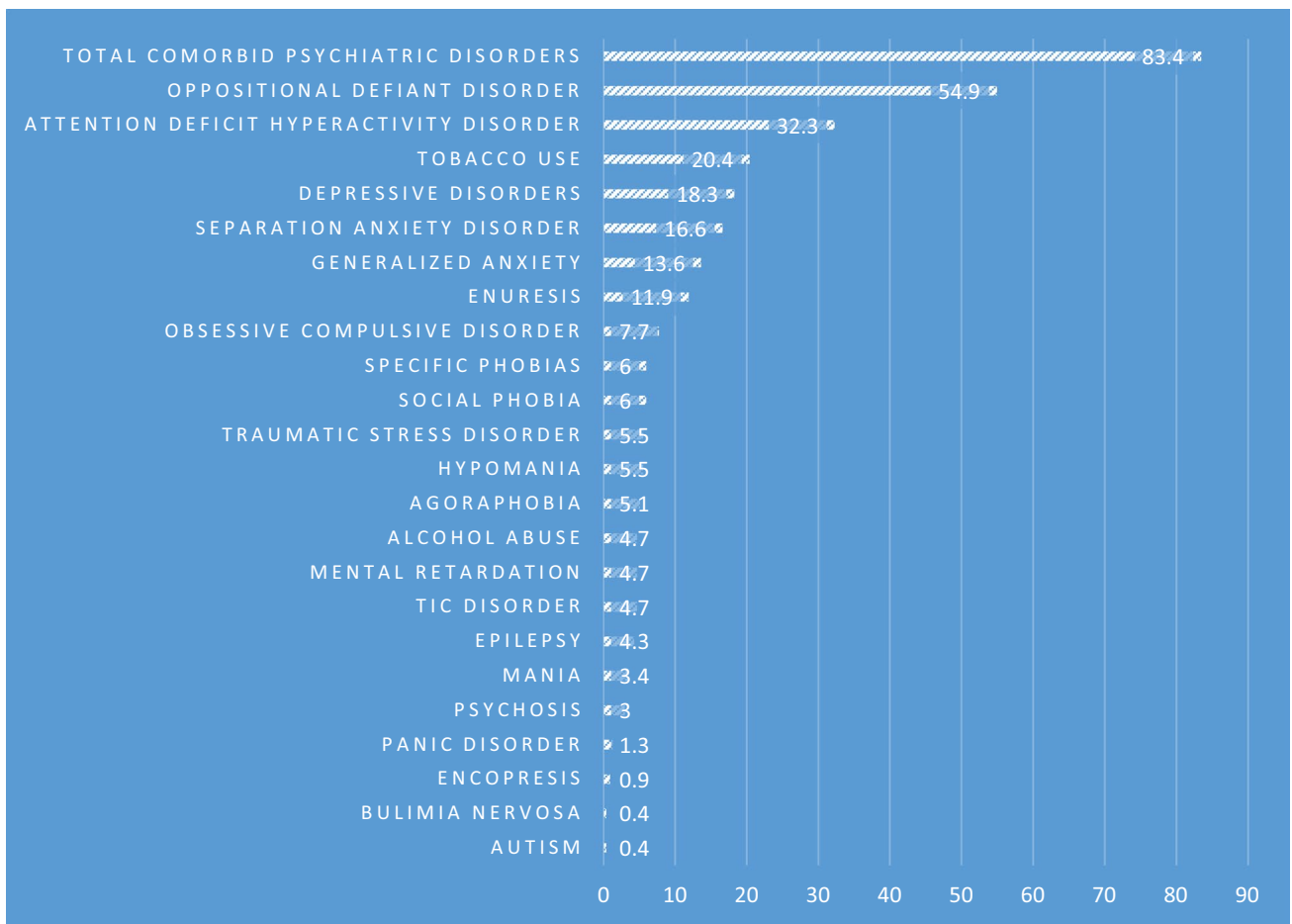
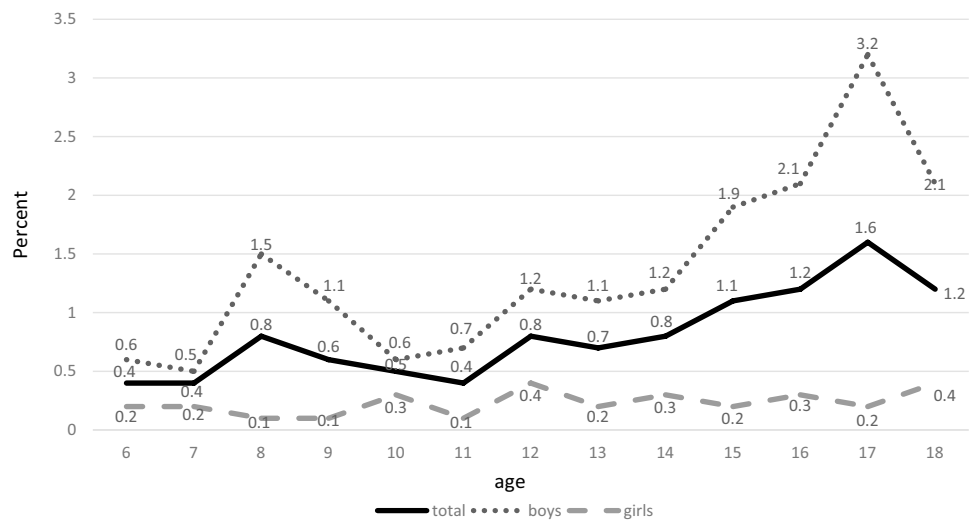


Fig. 3 Rates of comorbid disorders in conduct disorder

[52]. For example, Park et al. [49] executed a school population-based study in Busan, Korea, and found the prevalence rate of 0.3% for conduct disorder among a total of 34,758 students [49]. Also, Coughlan et al. [14] reported

the lifetime prevalence of 0.8% for conduct disorder among Irish adolescents using K-SADS-PL [14]. Another study found the prevalence of 0.6% among 6–16 years old students in several cities of Brazil [52]. However, the findings

Table 3 Rates of comorbidity of psychiatric disorders in children and adolescents with conduct disorder by age and gender ($N = 29,739$)

Psychiatric disorders	Total		Gender		Age, year					
	N (%)	(95% CI)	N (%)	(95% CI)	OR (95% CI)	N (%)	(95% CI)			
								OR (95% CI)		
Mood disorders	43(18.30)	(13.88–23.74)	Male	30(14.93)	(10.66–20.51)	1 baseline	6–9	7(12.96)	(6.42–24.42)	1 baseline
			Female	13(38.24)	(23.90–54.96)	3.49(1.57–7.76)**	10–14	15(23.44)	(14.75–35.14)	2.00 (0.75–5.38)
Mania	8(3.40)	(1.73–6.57)	Male	4(1.99)	(0.78–5.00)	1 baseline	15–18	21(17.95)	12.05–25.89	1.47 (0.58–3.71)
			Female	4(11.76)	(4.67–26.62)	6.47(1.53–27.25)*	6–9	1(1.85)	(0.33–9.77)	1 baseline
Hypomania	13(5.53)	(3.26–9.23)	Male	8(3.98)	(2.03–7.66)	1 baseline	10–14	2(3.13)	(0.86–10.70)	1.73 (0.15–19.7)
			Female	5(14.71)	(6.45–30.13)	4.09(1.25–13.38)*	15–18	5(4.27)	(1.84–9.61)	2.32 (0.26–20.37)
Total mood disorders	48(20.43)	(15.77–26.04)	Male	34(16.92)	(12.37–22.71)	1 baseline	6–9	2(3.70)	(1.02–12.53)	1 baseline
			Female	14(41.18)	(26.37–57.78)	3.38(1.54–7.40)**	10–14	2(3.13)	(0.86–10.70)	0.85 (0.12–6.25)
Psychosis	7(2.98)	(1.45–6.02)	Male	5(2.49)	(1.07–5.69)	1 baseline	15–18	9(7.69)	4.10–13.97	2.12 (0.44–10.19)
			Female	2(5.88)	(1.63–19.09)	2.66(0.49–14.36)	6–9	8(14.81)	7.70–26.59	1 baseline
Anxiety disorders	3(1.28)	(0.44–3.69)	Male	1(0.50)	(0.09–2.77)	1 baseline	10–14	2(3.70)	(1.02–12.53)	1.75 (0.67–4.55)
			Female	2(5.88)	(1.63–19.09)	12.37(1.10–140.40)*	15–18	3(4.69)	(1.61–12.90)	1.32 (0.21–8.21)
Separation anxiety disorder	39(16.66)	(12.39–21.89)	Male	32(15.92)	(11.51–21.61)	1 baseline	6–9	0	–	1 baseline
			Female	7(20.59)	(10.35–33.68)	1.34(0.54–3.35)	10–14	3(4.69)	(1.61–12.90)	0.81 (0.35–1.91)
Social phobia	14(5.96)	(3.58–9.75)	Male	13(6.47)	(3.82–10.75)	1 baseline	15–18	11(9.40)	5.33–16.05	0.29 (0.12–0.69)**
			Female	1(2.94)	(0.52–14.91)	0.44(0.06–3.48)	6–9	4(7.41)	(2.92–17.56)	1 baseline
Specific phobia	14(5.96)	(3.58–9.75)	Male	12(5.97)	(3.45–10.14)	1 baseline	10–14	2(3.13)	(0.86–10.70)	0.41 (0.07–2.32)
			Female	2(5.88)	(1.63–19.09)	0.95(0.21–4.48)	15–18	8(6.84)	3.51–12.92	0.89 (0.25–3.09)
Agoraphobia	12(5.11)	(2.95–8.72)	Male	11(5.47)	(3.08–9.53)	1 baseline	6–9	8(14.81)	(7.70–26.59)	1 baseline
			Female	1(2.94)	(0.52–14.91)	0.51(0.06–4.08)	10–14	4(6.25)	(2.46–15.00)	0.39 (0.11–1.36)
Generalized anxiety disorder	32(13.62)	(9.82–18.59)	Male	28(13.93)	(9.82–19.94)	1 baseline	15–18	2(1.71)	(0.47–6.02)	0.10 (0.02–0.47)
			Female	4(11.76)	(4.67–26.62)	0.82(0.27–2.52)	6–9	7(12.96)	(6.42–24.42)	1 baseline
						10–14	3(4.69)	(1.61–12.90)	0.33 (0.08–1.36)	
						15–18	2(1.71)	0.47–6.02	0.11 (0.02–0.56)	
						6–9	5(9.26)	(4.02–19.91)	1 baseline	
						10–14	13(20.31)	(12.27–31.71)	2.60 (0.86–7.87)	
						15–18	14(11.97)	(7.27–19.09)	1.30 (0.44–3.80)	

Table 3 (continued)

Psychiatric disorders	Total		Gender		Age, year					
	N(%)	(95% CI)	N(%)	(95% CI)	OR (95% CI)	N(%)	(95% CI)	OR (95% CI)		
Obsessive-compulsive Disorder	18(7.66)	(4.90–11.78)	Male	14(6.97)	(4.20–11.36)	1 baseline	6(11.11)	(5.19–22.19)	1 baseline	
			Female	4(11.76)	(4.67–26.62)	1.74(0.54–5.65)	5(7.81)	(3.38–17.02)	0.67 (0.19–2.34)	
							15–18	7(5.98)	(2.93–11.83)	0.49 (0.15–1.53)
PTSD	13(5.53)	(3.26–9.23)	Male	12(5.97)	(3.45–10.14)	1 baseline	6–9	4(7.41)	(2.92–17.56)	1 baseline
			Female	1(2.94)	(0.52–14.91)	0.58(0.07–4.62)	10–14	1(1.56)	(0.28–8.33)	0.20 (0.02–1.80)
							15–18	8(6.84)	(3.51–12.92)	0.93 (0.27–3.25)
Total anxiety disorders	84(35.74)	(29.89–42.05)	Male	71(35.32)	(29.04–42.15)	1 baseline	6–9	20(37.04)	(25.43–50.38)	1 baseline
			Female	13(38.24)	(2.39–54.96)	1.42(0.64–3.12)	10–14	25(39.06)	(28.05–51.31)	1.14 (0.53–2.44)
							15–18	39(33.33)	(25.44–42.28)	0.85 (0.43–1.69)
Behavioral disorders	76(32.34)	(26.68–38.56)	Male	66(32.84)	(26.72–39.60)	1 baseline	6–9	28(51.85)	(38.85–64.60)	1 baseline
			Female	10(29.41)	(16.83–46.17)	0.82(0.37–1.83)	10–14	17(26.56)	(17.29–38.48)	0.31 (0.14–0.69)**
							15–18	31(26.50)	(19.34–35.15)	0.29 (0.15–0.59)**
Oppositional defiant disorder	129(54.89)	(48.50–61.12)	Male	109(54.23)	(47.33–60.97)	1 baseline	6–9	36(66.67)	(53.36–77.76)	1 baseline
			Female	20(58.82)	(42.22–73.63)	1.16(0.54–2.46)	10–14	33(51.56)	(39.58–63.36)	0.46 (0.21–0.99)*
							15–18	60(51.28)	(42.33–60.15)	0.50 (0.25–1.02)
Tic disorder	11(4.68)	(2.63–8.18)	Male	10(4.98)	(2.73–8.92)	1 baseline	6–9	3(5.56)	(1.91–15.11)	1 baseline
			Female	1(2.94)	(0.52–14.91)	0.59(0.07–4.75)	10–14	4(6.25)	(2.46–15.00)	1.15 (0.24–5.38)
							15–18	4(3.42)	(1.34–8.46)	0.59 (0.13–2.76)
Total behavioral disorders	154(65.53)	(59.25–71.31)	Male	131(65.17)	(58.35–71.42)	1 baseline	6–9	42(77.78)	(65.06–86.81)	1 baseline
			Female	23(67.65)	(50.85–80.87)	1.12(0.51–2.42)	10–14	40(62.50)	(50.25–73.33)	0.48 (0.21–1.08)
							15–18	72(61.54)	52.49–69.85	0.46 (0.22–0.96)*
Neurodevelopmental disorders	1(0.43)	(0.08–2.38)	Male	1(0.50)	(0.09–2.77)	1 baseline	6–9	0		1 baseline
			Female	0		–	10–14	1(1.56)	(0.28–8.33)	–
							15–18	0		–
Mental retardation	11(4.68)	(2.63–8.18)	Male	10(4.98)	(2.73–8.92)	1 baseline	6–9	3(5.56)	(1.91–15.11)	1 baseline
			Female	1(2.94)	(0.52–14.91)	0.58(0.07–4.76)	10–14	3(4.69)	(1.61–12.9)	0.84 (0.16–4.32)
							15–18	5(4.27)	(1.84–9.61)	0.76 (0.17–3.30)
Epilepsy	10(4.26)	(2.33–7.66)	Male	9(4.48)	(2.37–8.29)	1 baseline	6–9	2(3.70)	(1.02–12.53)	1 baseline
			Female	1(2.94)	(0.52–14.91)	0.65(0.08–5.27)	10–14	3(4.69)	(1.61–12.90)	1.28 (0.21–7.95)
							15–18	5(4.27)	(1.84–9.61)	1.16 (0.22–6.18)
Total neurodevelopmental disorders	21(8.94)	(5.92–13.28)	Male	19(9.45)	(6.13–14.29)	1 baseline	6–9	5(9.26)	(4.02–19.91)	1 baseline
			Female	2(5.88)	(1.63–19.09)	0.59(0.13–2.65)	10–14	6(9.38)	(4.37–18.99)	1.01 (0.29–3.52)
							15–18	10(8.55)	(4.71–15.02)	0.91 (0.29–2.79)

Table 3 (continued)

Psychiatric disorders	Total		Gender		Age, year						
	N(%)	(95% CI)	N(%)	(95% CI)	OR (95% CI)	N(%)	(95% CI)	OR (95% CI)			
Substance abuse disorders	Smoking	48(20.43)	(15.77–26.04)	Male	40(19.90)	(14.97–25.96)	1 baseline	2(3.70)	(1.02–12.53)	1 baseline	
				Female	8(23.53)	(12.44–40.00)	1.24(0.52–2.94)	10–14	3(4.69)	(1.61–12.90)	1.28 (0.21–7.95)
								15–18	43(36.75)	(28.56–45.78)	15.10 (3.50–65.10)**
Alcohol abuse disorders		11(4.68)	(2.63–8.18)	Male	10(4.98)	(2.73–8.92)	1 baseline	6–9	0	–	1 baseline
				Female	1(2.94)	0.52–14.91	0.65(0.08–5.30)	10–14	0	–	–
								15–18	11(9.40)	(5.33–16.05)	–
Smoking or alcohol abuse disorders		53(22.55)	(17.67–28.31)	Male	45(22.39)	(17.18–28.64)	1 baseline	6–9	2(3.70)	(1.02–12.53)	1 baseline
				Female	8(23.53)	(12.44–40.00)	1.18(0.49–2.83)	10–14	3(4.69)	(1.61–12.90)	1.33 (0.21–8.32)
								15–18	48(41.03)	(32.54–50.09)	17.50 (4.04–75.30)**
Elimination Disorders	Enuresis	28(11.91)	(8.37–16.68)	Male	25(12.44)	(8.57–17.72)	1 baseline	6–9	13(24.07)	(14.64–36.94)	1 baseline
				Female	3(8.82)	(3.04–22.96)	0.66(0.19–2.31)	10–14	5(7.81)	(3.38–17.02)	0.26 (0.09–0.80)*
								15–18	10(8.55)	(4.71–15.02)	0.27 (0.11–0.67)**
Encopresis		2(0.85)	(0.23–3.05)	Male	1(0.50)	(0.09–2.77)	1 baseline	6–9	1(1.85)	(0.33–9.77)	1 baseline
				Female	1(2.94)	(0.52–14.91)	5.91(0.36–96.80)	10–14	0	–	–
								15–18	1(0.85)	(0.15–4.68)	–
Total elimination disorders		28(11.91)	(8.37–16.68)	Male	25(12.44)	(8.57–17.72)	1 baseline	6–9	13(24.07)	(14.64–36.94)	1 baseline
				Female	3(8.82)	(3.04–22.96)	0.65(0.19–2.30)	10–14	5(7.81)	(3.38–17.02)	0.25 (0.08–0.77)*
								15–18	10(8.55)	(4.71–15.02)	0.27 (0.11–0.66)**
Bulimia nervosa		1(0.43)	(0.08–2.38)	Male	1(0.50)	(0.09–2.77)	1 baseline	6–9	0	–	1 baseline
				Female	0	–	–	10–14	0	–	–
								15–18	1(0.85)	(0.15–4.68)	–

OR Odds Ratio Adjusted, CI Confidence Interval, * $p \leq 0.05$; ** $p < 0.01$

of the present study are lower than the estimates provided by previous studies conducted in other countries across the globe, particularly the lifetime prevalence estimates [17, 36, 47, 60]. For instance, Erskine et al. [17] included no lifetime estimate in their dataset, but reported a much higher prevalence for conduct disorder [17]. Also, previous studies that used screening tools such as SDQ reported much more prevalence rates of conduct disorder as compared to other studies that used diagnostic instruments [8, 16, 43, 53, 67]. Therefore, this general population-based study with such a large and nationally representative sample provided an accurate assessment of the lifetime prevalence and comorbidities of conduct disorder according to age and gender using the K-SADS-PL diagnostic instrument.

As expected, rates of conduct disorder were significantly higher in boys than in girls (girls, 0.3%; boys, 1.3%), which is consistent with findings of previous studies [17, 36, 37, 47, 60]. In line with prior reports, the results of our study showed that rates of conduct disorder increased with age, and that this disorder was significantly more common among teenagers [17, 36, 45]. As a result of social influences in adolescence, teenagers with conduct disorder may communicate with deviant peer groups with antisocial behaviors and experience more rejection from those peers without conduct disorder. Also, as physical strength and sexual maturity develop in adolescence, higher rates of conduct disorder may be observed by increase of age. Accordingly, more antisocial behaviors may be observed among adolescents with conduct disorder [5, 24, 36].

In this study, conduct disorder had a significantly lower rate of prevalence among those who had fathers with no history of psychiatric hospitalization. This finding is consistent with findings of previous studies that reported a higher prevalence of psychiatric disorders, such as substance use disorder, alcohol dependence, and antisocial behaviors, among fathers of individuals with conduct disorder [25–27, 31, 35, 50]. However, we found that psychiatric hospitalization of parents was a relatively rare event and not representative of parents experiencing mental disorders.

The rate of conduct disorder was significantly lower in participants who had fathers with a high school diploma and mothers with a high school diploma or a bachelor's degree. However, the mentioned associations dropped to non-significance in the multivariate model. These findings are in line with a previous study that reported an association between conduct disorder and lower education and occupation levels of fathers [2]. Nevertheless, Choi et al. did not find significant differences between parents of children with and without conduct disorder who had a university degree [12].

Of all psychiatric disorders, ODD and ADHD showed the greatest degrees of comorbidity with conduct disorder. This may be due to a strong similarity in the social and environmental antecedents of these disorders [22]. Most prior

studies reported a strong comorbidity and overlap among ODD, ADHD, and conduct disorder [13, 20, 36, 56, 62]. According to the DSM-IV, an individual with ODD cannot receive the diagnosis of conduct disorder; however, this criterion has been removed in the DSM-V. In this study, K-SADS-PL was used to diagnose conduct disorder and its comorbidities according to the DSM-IV criteria. Also, ODD was presented as a comorbidity of conduct disorder, since these are two distinct disorders. Moreover, several studies reported that the symptoms of ODD are not the precursors of conduct disorder symptoms. Thus, most children with ODD will not experience conduct disorder in the future [15, 22, 59].

In contrast to previous studies, a low comorbidity was found between conduct disorder and alcohol abuse or dependence [11, 20, 25, 30, 55]; this may be explained by a lack of legal availability of alcohol in Iran. Also, participants might have not declared their alcohol consumption, as this is both illegal and culturally inappropriate in Iran. However, a high comorbidity was observed between tobacco use and conduct disorder, which is in line with prior researches [7, 57]. Also, a great comorbidity was observed with depression, which is consistent with previous studies [10, 33, 34, 58, 65, 69]. Conduct disorder with comorbidity of internalizing psychopathology, such as depressive disorders, may lead to increased social problems with peers, impaired social adjustment, and fewer social skills [53].

In the present study, significantly higher prevalence rates of depressive disorders, mania, hypomania, and panic disorder were observed among girls with conduct disorder as compared to boys, which are confirmed by previous studies [21, 29, 38, 53, 68]. The higher frequency of comorbid disorders among girls with conduct disorder may be justified by higher developmental vulnerability of girls than boys [32]. For example, a strong co-occurrence of depressive disorders was found, particularly in girls with conduct disorder; as they had a 3.5-fold higher risk of experiencing depressive disorders compared to boys with conduct disorder.

Cognitive abilities increase in adolescence, and thus, comorbid separation anxiety disorder, ADHD, and enuresis are expected to significantly decrease among teenagers with conduct disorder, aged 15–18 years [17]. However, smoking was significantly more prevalent among teenagers with conduct disorder [17]. Also, rates of ADHD, ODD, and enuresis were significantly lower among 10–14 year-old participants with conduct disorder as compared to 6–9 year-old participants, which is consistent with previous findings [17, 36, 48]. Few studies have been estimated the comorbidities of conduct disorder based on gender and age. Moreover, it seems that conduct disorder may be an underlying factor in development of subsequent disorders. However, Co-occurrences may be due to common causes or antecedents.

Thus, future studies should be conducted to further explore the nature of the roots of conduct disorder.

Strengths and limitations

This was the first national epidemiological study on conduct disorder in Iran, which provided new information about the prevalence, comorbidities, and sociodemographic predictors of conduct disorder in this country. A national survey was conducted in this study, using multistage cluster sampling, and a small number of individuals with conduct disorder were detected in the general population. Thus, for future studies, it is recommended to use purposive sampling and consider comorbidities of conduct disorder in a large clinical population. Another limitation of this study was that psychiatric hospitalization of parents was a relatively rare event and not representative of parents experiencing mental disorders. Therefore, further studies are needed to present additional information on parental mental health. Also, this study failed to provide adequate justification for comorbidities of conduct disorder according to gender and age; since there were no prior studies on this topic.

Conclusions

This study provided a national data set to accurately assess the lifetime prevalence and comorbidities of conduct disorder among Iranian children and adolescents aged 6–18 years according to age and gender. Because of using the K-SADS–PL diagnostic instrument, we found a low total prevalence rate for conduct disorder. However, significantly higher rates of conduct disorder were observed among boys and adolescents aged 15–18 years. Participants who had fathers with no history of psychiatric hospitalization, participants whose fathers held a high school diploma, and participants who had mothers with a high school diploma or a bachelor's degree experienced significantly lower rates of conduct disorder. In addition, in this study, comorbidities of conduct disorder were reported according to age and gender. However, there are not adequate studies to confirm these findings, highlighting the need for further studies to explore the nature of comorbidities of conduct disorder.

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Compliance with ethical standards

Conflict of Interest None


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