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ORIGINAL ARTICLE

Screening for Pediatric Obsessive–Compulsive Disorder Using the Obsessive–Compulsive Inventory-Child Version

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Abstract

The study assessed the ability of the Obsessive-Compulsive Inventory-Child Version (OCI-CV) to detect pediatric obsessive-compulsive disorder (OCD) using receiver operating characteristic analyses. The sample consisted of 114 cases with current OCD, 340 cases with other psychiatric disorders (OPD), and 301 healthy controls (HC) ages 7 to 18 years. All 755 participants were assessed with two semi-structured interviews and seven rating scales. In a comparison of current OCD cases and all other participants, the optimal OCI-CV cut-score was 11 with an area under the curve (AUC) of .88. In a comparison of current OCD cases and OPD cases, the optimal OCI-CV cut-score was 11 with an AUC of .82. In a comparison of current OCD cases and HC, the optimal OCI-CV cut-score was 10 with an AUC of .94. The results indicate that the OCI-CV provides an effective screen for pediatric OCD using empirically derived cut-scores.

Keywords Obsessive–compulsive disorder · Pediatric · Assessment · Psychopathology · OCI-CV

Introduction

Obsessive–compulsive disorder (OCD) is a heterogeneous psychiatric syndrome that is often associated in youth with marked distress and significant impairment in family, peer, and academic functioning [1, 2]. Although it affects 1% to 2% of children and adolescents, pediatric OCD remains frequently underdiagnosed and undertreated [3, 4]. In one of the largest epidemiological studies of adults, the median age at onset for OCD was 19 years with 21% of cases having onset by age 10 [5]. Even with treatment, longitudinal studies indicate that over 40% of pediatric OCD cases continue to meet criteria for the diagnosis in adulthood [1, 6, 7]. Both obsessive–compulsive (OC) symptoms and OCD diagnosis in childhood are associated with increased risk of other psychiatric disorders in adulthood [1, 7, 8]. Given these pressing clinical concerns, it is necessary to have self-report screening instruments for pediatric OCD that are brief and psychometrically sound, that assess multiple dimensions of the disorder, that have adequate diagnostic sensitivity and specificity in both community and clinical settings, and that facilitate treatment planning and monitoring [1, 9–11].

Currently, there are seven child self-report measures of OC symptoms that measure overall severity, consisting of the Leyton Obsessional Inventory-Child Version Survey Form (LOI-CV) [12], Children's Florida Obsessive–Compulsive Inventory (C-FOCI) [13], Children's Obsessional Compulsive Inventory (ChOCI) [14], Short OCD Screener (SOCS) [1, 15], Adolescent Obsessive–Compulsive Scale (AOCS) [16], Youth Obsessive–Compulsive Symptoms Scale (YOCSS) [17], and Obsessive–Compulsive Inventory-Child Version (OCI-CV) [18]. In addition, the second version of the Multidimensional Anxiety Scale for Children (MASC2) has an Obsessions and Compulsions Scale that provides a child self-report measure of OC symptom severity [19].

The OCI-CV was developed as a self-report measure for children ages 7–17 [18]. It is a 21-item survey based on the Obsessive–Compulsive Inventory-Revised (OCI-R) [20] for

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adults that assesses the frequency of OC symptoms over the past month. The measure contains six subscales that are summed to produce a total score, consisting of doubting/checking, hoarding, neutralizing, obsessing, washing, and ordering. The OCI-CV initially was found to have acceptable reliability, including good internal consistency ($\alpha = 0.81–0.88$) and good to adequate 2-week test–retest reliability ($r = 0.68–0.89$) for the total and subscale scores [9, 18]. A subsequent study found good internal consistency for the total, doubting/checking, hoarding, obsessing, washing, and ordering subscale scores ($\rho = 0.79–0.87$), but poor internal consistency for the neutralizing subscale score ($\rho = 0.50$) [9, 21]. Subsequent factor analyses with community and clinical samples have found a six-factor model similar to the one in the initial study [18, 21–26]. The convergent validity of the OCI-CV has been assessed as fair to poor using clinician-rated measures of OCD severity ($r = 0.23–0.31$) [9, 18, 21]. Stronger evidence for the convergent validity of the OCI-CV was achieved using other self-report measures of OCD severity ($r = 0.53–0.72$) [25]. The divergent validity of the OCI-CV total score has been assessed as good to fair using a parent-report measure of irritability ($r = -0.02$) and self-report measure of depression ($r = 0.47–0.48$) [9, 18, 21].

A study using receiver operating characteristic (ROC) analyses found that the OCI-CV obsessing subscale, but not the OCI-CV total score or other subscales, had adequate sensitivity and specificity for the detection of OCD [22, 27]. Although the data indicate the OCI-CV is satisfactory for assessing OC symptoms and dimensions in children and adolescents, no studies of the OCI-CV have assessed all participants with semi-structured interviews and determined an optimal cut-score for the OCI-CV total score, which is necessary for identifying youth likely to warrant a diagnosis of OCD [22–25]. Furthermore, studies of the OCI-CV have lacked a large comparison group with other psychiatric disorders (OPD), which is essential for examining the sensitivity and specificity of the OCI-CV in clinical settings.

To further examine the use of the OCI-CV as a screening instrument for pediatric OCD, the following study was conducted in 755 children and adolescents. The first aim was to assess sex and age differences in the OCI-CV total score and subscale scores. The second aim was to assess OCI-CV total score and subscale score correlations. The third aim was to determine the convergent and divergent validity of the OCI-CV using other measures of OCD, anxiety, depressive, externalizing, and autistic symptoms. The fourth aim was to evaluate the demographic and clinical differences between OCD cases, OPD cases, and healthy controls (HC). The fifth aim was to examine the sensitivity and specificity of cut-scores for the OCI-CV total score to predict current OCD using ROC analyses and identify cut-scores that may be useful in community and clinical settings. The sixth aim was to compare the performance of the six subscales in predicting current OCD using multiple logistic regression. The subscale analysis was done because previous studies have suggested that the OCI-R obsessing subscale may be more predictive of OCD than the OCI-R total score [25] and that hoarding may not be a core symptom of OCD [27, 28].

Methods

Participants and Procedure

Child and adolescent outpatients were recruited from the Department of Psychiatry at the University of Michigan and local clinics. Healthy controls (HC) were recruited from the surrounding community. Participants were recruited using flyers, paid advertisements, and UM Health Research Studies (https://www.UMHealthResearch.org). Participants or their parents gave written informed consent in accordance with the Declaration of Helsinki. The tasks and procedures were authorized by the University of Michigan Medical School Institutional Review Board. Participants were paid for completing clinical interviews and questionnaires. The final sample consisted of 755 children and adolescents (57.1% female) 7–18 years old ($M = 14.19$, $SD = 3.30$ years). The majority of participants were Caucasian (89.0%, $n = 672$), with the remaining participants identifying as Latino (4.6%), Native American (3.4%), Asian (0.8%), African-American (0.1%), other (0.4%), or no response (1.6%).

Of the 454 cases, 114 had a history of current OCD and 340 had a history of other OPD without OCD, including 164 with an anxiety disorder, 65 with major depressive disorder (MDD), 34 with a tic disorder, and 115 with attention-deficit hyperactivity disorder (ADHD). The OCD group did not include data from 44 cases whose OC symptoms no longer met criteria for the diagnosis of OCD. However, the OPD group included 27 cases with a history of OC symptoms that never met criteria for an OCD diagnosis. All 301 HC had no diagnosis of a specific axis I disorder, but one control had a history of OC symptoms that never met criteria for an OCD diagnosis. Participants were excluded if they had a history of intellectual disability, head injury with loss of consciousness, or a chronic neurological disorder other than tic disorders. The study was consistent with the National Institute of Mental Health Research Domain Criteria project in using dimensional measures that cut across diagnostic categories while minimizing exclusion criteria [29].

Measures

Participants were interviewed with the Schedule for Affective Disorders and Schizophrenia for School-Aged Children-Present and Lifetime version (K-SADS-PL) [30], and the

Schedule for Obsessive–Compulsive and Other Behavioral Syndromes (SOCOBS) [31]. If a participant had a history of either obsessions or compulsions, the Children's Yale-Brown Obsessive–Compulsive Disorder Scale (CY-BOCS) [32] was used to assess the current severity of OC symptoms. Parents completed the Child Behavior Checklist (CBCL) [33], Toronto Obsessive–Compulsive Scale (TOCS) [34], and the Social Communication Questionnaire (SCQ) [35] about their children. Participants completed the OCI-CV [18], LOI-CV Survey Form [12], the Multidimensional Anxiety Scale for Children I (MASC) [19], and the Children's Depression Inventory (CDI) [36]. Parent and self-report forms were completed online using electronic forms.

The Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version

The K-SADS-PL is a semi-structured clinical interview conducted with a parent and child that combines both dimensional and categorical assessments to diagnose current and lifetime psychiatric diagnoses in children 6–18 years old according to DSM-5 criteria [30]. The sections on OCD and tic disorders in the K-SADS-PL were replaced in the current study with the SOCOBS [31].

Schedule for Obsessive–Compulsive and Other Behavioral Syndromes

The pediatric version of the SOCOBS is a semi-structured clinician interview conducted with a parent and child to assess OCD, hoarding disorder, tic disorders, trichotillomania, and excoriation disorder according to DSM-5 criteria [32]. The SOCOBS assesses OC and tic behaviors in more detail than the K-SADS-PL, and includes a modified checklist from the CY-BOCS [32] that elicits information about the onset and offset of 75 OC symptoms.

Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS)

The CY-BOCS is the most commonly used instrument for assessing OCD symptomatology and severity in children and adolescents [32, 37]. It is a 10-item clinician-rated, semi-structured interview conducted with a parent and child that is designed to assess OCD symptom severity over the past week. It has established psychometric properties, including high internal consistency and good to excellent interrater agreement for subscale and total scores. The CY-BOCS was used to assess the convergent validity of the OCI-CV in 114 participants with OCD.

Child Behavior Checklist (CBCL)

The CBCL is a 113-item parent-report measure with strong psychometric properties that assesses behavioral symptoms and adaptive behaviors during the past six months in children and adolescents 6–18 years old [33]. It provides subscales assessing internalizing and externalizing symptoms that were used to compare the OCD, OPD, and control groups in this study. The CBCL has an 8-item OC scale (CBCL-OCS) that was used to assess the convergent validity of the OCI-CV in 741 participants [38–40].

Toronto Obsessive–Compulsive Scale

The Toronto Obsessive–Compulsive Scale (TOCS) is a 21-item parent-report questionnaire that covers a wide array of OC traits over the last six months with sound psychometric properties [34]. Research on the TOCS in a community sample indicates that OC traits are common and continuously distributed [34]. The TOCS was used to assess the convergent validity of the OCI-CV in 383 participants.

Leyton Obsessional Inventory-Child Version Survey Form

The LOI-CV Survey Form is a 20-item self-report measure that assesses OC symptom severity during the last two weeks in children and adolescents [13]. It demonstrated good internal consistency in a large sample of non-clinical adolescents [13]. However, other research indicated that its psychometric properties are inadequate for use as a screening instrument or in assessing symptom severity in pediatric OCD [41]. The LOI-CV Survey Form was used to assess the convergent validity of the OCI-CV in 752 participants.

Multidimensional Anxiety Scale for Children (1 and 2)

The MASC1 and MASC2 are self-report measures that assess anxiety symptom severity in children and adolescents 8–19 years old [19]. The MASC1 consists of 39 items, whereas the MASC2 consists of 50 items. The MASC1 total score was used to assess the convergent validity of the OCI-CV in 372 participants. The 10-item Obsessions and Compulsions Scale score in the MASC2 was used to assess the convergent validity of the OCI-CV in 380 participants.

Children's Depression Inventory

The CDI is a 28-item self-report measure that assesses depressive symptom severity during the last two weeks in children and adolescents 7–17 years old [36]. It has good psychometric properties with high reliability and

well-established validity using a variety of techniques [42]. Because some studies suggest that the CDI is limited in its ability to discriminate between youth with depression and other internalizing disorders [42–44], the CDI was considered more of a test of the convergent validity than of the discriminant validity of the OCI-CV in 746 participants.

Social Communication Questionnaire

The SCQ is a 40-item parent-report screening questionnaire that provides information about a history of ASD symptoms [35]. The SCQ has good discriminant validity with respect to the separation of ASD from non-ASD diagnoses in all individuals regardless of intellectual level. The SCQ was used to examine the discriminant validity of the OCI-CV.

Statistical Analyses

Sex differences in the OCI-CV total score and subscale scores were examined with Student's *t* tests. Differences in OCI-CV total score and subscale scores between children 7–11 and adolescents 12–18 years old were assessed with Student's *t* tests. Pearson correlation coefficients were computed among the OCI-CV total score and subscale scores. The convergent validity of the OCI-CV was examined using Pearson coefficients to compare its correlations with LOI-CV Survey Form, MASC1, MASC2-OCS, CDI, TOCS, and CBCL-OCS scores in all groups and its correlation with the 10-item CY-BOCS score in the OCD group. Cohen's effect size conventions were used to describe the magnitude of effects (small: $r \geq 0.1$; medium: $r \geq 0.3$; large: $r \geq 0.5$) [45]. The discriminant validity of the OCI-CV was assessed by comparing its Pearson correlations with the SCQ total score. Differences between OCD cases, OPD cases, and HC in demographic and questionnaire data were tested using analyses of variance (ANOVA). Diagnostic differences between the OCD and OPD cases were assessed with χ^2 tests.

To determine the extent to which the OCI-CV total scores and subscale scores can accurately predict OCD, ROC analyses were conducted to assess the sensitivity and specificity of the measure at different cut-scores. The ROC analysis uses the association between sensitivity and specificity to derive an area under the curve (AUC), which indicates the extent to which a measure distinguishes between case positive (i.e., OCD) and case negative (i.e., OPD or HC) in a given sample irrespective of the base rate. A value of 0.50 in the AUC indicates chance level with no discrimination, whereas a value of 1.0 indicates a perfect diagnostic tool. In general, an AUC of 0.7 to 0.8 is considered acceptable, 0.8 to 0.9 is considered excellent, and more than 0.9 is considered outstanding [46]. The Youden Index was used to identify cut-scores that give equal weight to sensitivity and specificity [47]. A multiple logistic regression analysis was conducted with all participants to examine the relation of the six OCI-CV subscales to current OCD diagnosis. A backward stepwise regression analysis was done to confirm that no other subscale had a significant association with OCD diagnosis beyond those implicated by multiple logistic regression. Analyses were performed with JMP Pro Version 14 software. All tests were two-tailed with $\alpha = 0.05$.

Results

Sex and Age Differences

There was no significant sex difference in the OCI-CV total score ($p = 0.36$). With the OCI-CV subscales, females had significantly higher scores than males on the ordering subscale ($t_{1,\,753} = 2.13$, $p = 0.03$). In comparisons of children (ages 7–11) and adolescents (ages 12–18), there was a trend for children to have higher OCI-CV total scores than adolescents ($t_{1,\,753} = 1.95$, $p = 0.052$). With the OCI-CV subscales, children had higher scores than adolescents on the obsessing ($t_{1,\,753} = 1.92$, $p = 0.04$), neutralizing ($t_{1,\,753} = 2.11$, $p = 0.04$), and hoarding subscales ($t_{1,\,753} = 3.87$, $p < 0.0001$).

Subscale Correlations

Pearson correlation coefficients were computed between the OCI-CV total score and subscale scores (see Table 1). Correlations for the total and subscale scores were large

Table 1 Correlations between subscales of the Obsessive Compulsive Inventory-Child Version

	Checking	Obsessing	Hoarding	Washing	Ordering	Neutralizing
Checking	–					
Obsessing	0.55****	–				
Hoarding	0.42****	0.31****	–			
Washing	0.48****	0.42****	0.25****	–		
Ordering	0.54****	0.42****	0.39****	0.35****	–	
Neutralizing	0.53****	0.45****	0.33****	0.40****	0.43****	–
Total score	0.84****	0.76****	0.62****	0.65****	0.72****	0.68****

****$p < .0001$

(r's = 0.62 to 0.84), indicating the subscales measure a broader construct of OCD symptoms [50]. Correlations between subscales ranged from small (e.g., washing and hoarding, $r = 0.25$) to large (e.g., obsessions and checking, $r = 0.55$) [50].

Convergent and Discriminant Validity

The convergent validity of the OCI-CV was supported by its strong correlations with two other self-report measures of OCD symptoms, the LOI-CV Survey Form and MASC2 Obsessions and Compulsions Scale (r's = 0.88 and 0.81, respectively) (see Table 2). The convergent validity of the OCI-CV was further supported by its large correlations with two parent-report measures of OCD symptoms, the TOCS and CBCL-OCS (r's = 0.49 and 0.53, respectively). Partial support for the convergent validity of the OCI-CV in OCD cases was provided by its small but significant correlations with the CY-BOCS total, obsession, and compulsion scores (r's = 0.21 to 0.26). The convergent validity of the OCI-CV was further supported by its large correlations with the MASC1 total score and CDI total score, two self-report measures of anxiety and depressive symptoms (r's = 0.65 and 0.62, respectively).

The OCI-CV had a moderate correlation with the CBCL Internalizing Problems scale, but a small correlation with the CBCL Externalizing Problems scale, providing evidence for the discriminant validity of the OCI-CV scale (r's = 0.46 and 0.28, respectively; $z = 4.03$, $p < 0.0001$). The convergent and discriminant validity of OCI-CV was buttressed by its broad range of correlations with the CBCL DSM-Oriented Scales, with the highest correlation for the Anxiety Problems scale and lowest correlation for the Conduct Problems scale (r's = 0.44 and 0.20, respectively; $z = 5.18$, $p < 0.0001$). Partial support for the discriminant validity of the OCI-CV was also demonstrated in its significant but small correlation with the SCQ ($r = 0.27$).

Table 2 Convergent and divergent validity of the OCI-CV

	OCI-CV total score
CY-BOCS	
Total	0.26**
Obsessions	0.22*
Compulsions	0.21*
LOI-CV survey form	0.88****
MASC2 Obsessions and Compulsions Scale	0.81****
Toronto Obsessive–Compulsive Scale	0.49****
Child Behavior Checklist	
Obsessive–Compulsive problems	0.53****
Total problems	0.45****
Internalizing problems	0.46****
Externalizing problems	0.28****
Affective problems	0.41****
Anxiety problems	0.44****
Somatic problems	0.34****
Attention deficit/hyperactivity problems	0.26****
Oppositional defiant problems	0.26****
Conduct problems	0.20****
MASC1 total score	0.65****
Children's Depression Inventory total *T* score	0.62****
Social communication questionnaire	0.27****

OCI-CV Obsessive Compulsive Inventory-Child Version, *CY-BOCS* Children's Yale-Brown Obsessive Compulsive Scale, *LOI-CV Survey Form* Leyton Obsessional Inventory-Child Version Survey Form, *MASC* Multidimensional Anxiety Scale for Children

*$p < .05$; **$p < .01$; ***$p < .001$; ****$p < .0001$

Descriptive Statistics for OCD Patients, OPD Patients, and HC

Table 3 summarizes the demographic and dimensional characteristics of the OCD cases, OPD cases, and HC. Compared to OPD cases and HC, OCD cases had significantly higher total scores on the OCI-CV, LOI-CV Survey Form, MASC1, MASC2 Obsessions and Compulsions Scale, and CDI (all p values < 0.0001). OCD cases had significantly higher scores than OPD cases and HC on the CBCL Internalizing Problems, Affective Problems, Anxiety Problems, and Somatic Problems scales (all p values < 0.0001). In contrast, on the CBCL Externalizing Problems, Attention-Deficit/Hyperactivity Problems, Oppositional Defiant Problems, and Conduct Problems scales, OCD cases had significantly higher scores than the HC (all p values < 0.0001), but not the OPD. OCD cases had significantly higher scores on the SCQ than the OPD cases ($p < 0.001$) and HC ($p < 0.0001$). Table 4 summarizes the diagnostic differences between the OCD and OPD cases. OCD cases had a significantly higher prevalence of anxiety disorders ($p = 0.009$), tic disorders ($p < 0.0001$), and trichotillomania ($p = 0.0006$) than the OPD cases, whereas the OPD cases had a significantly higher prevalence of ADHD ($p = 0.006$) and enuresis ($p = 0.03$) than the OCD cases. There was no significant difference between the OCD and OPD groups in the prevalence of hoarding disorder ($p = 0.68$).

ROC Analyses of the OCI-CV Total Score

The empirical ROC curve using the OCI-CV total score for current OCD cases and all other participants is depicted in Fig. 1. The optimal OCI-CV cut-score in that comparison was 11 (sensitivity = 77.2%, specificity = 81.8%, Youden index = 0.59, accuracy = 0.81) with an AUC of 0.88, resulting in the correct classification of 88/114 OCD cases and 524/641 non-OCD participants (see Table 5). The empirical

Table 3 Demographic and questionnaire data for patients with OCD, patients with OPD, and HC

Variable	Patients with OCD N = 114		Patients with OPD N = 340		Healthy controls N = 301		Comparisons of OCD, OPD, and HC Groups	
	M	(SD)	*M*	(SD)	*M*	(SD)	Test statistic	*p*
Age (years)	13.4	3.0**,†	14.1	3.3	14.6	3.3	$F_{2, 752} = 5.4$	.005
Sex (M/F)	44/70	156/184	124/177	$\chi_2^2 = 2.45$	0.29			
OCI-CV								
Total score	16.6	7.6****,††††	7.8	6.4****	3.6	3.8	$F_{2, 752} = 205.6$	< .0001
Checking	4.0	2.8****,††††	1.8	2.0****	0.8	1.2	$F_{2, 752} = 114.7$	< .0001
Obsessing	3.5	2.4****,††††	1.9	2.0****	0.6	1.1	$F_{2, 752} = 125.3$	< .0001
Hoarding	2.0	1.8****, †††	1.5	1.6****	0.9	1.1	$F_{2, 752} = 31.6$	< .0001
Washing	2.5	2.2****,††††	0.6	0.9 **	0.3	0.7	$F_{2, 752} = 170.1$	< .0001
Ordering	2.6	2.0****,††††	1.6	1.7****	0.9	1.3	$F_{2, 752} = 51.2$	< .0001
Neutralizing	1.6	1.6****,††††	0.5	1.0****	0.2	0.5	$F_{2, 752} = 92.1$	< .0001
LOI-CV Survey Form	22.1	12.4****,††††	8.4	8.0****	4.2	4.9	$F_{2, 749} = 215.4$	< .0001
Child behavior checklist								
Obsessive compulsive problems	6.7	3.6****,††††	2.6	2.4****	1.0	1.2	$F_{2, 739} = 256.0$	< .0001
Total problems	44.6	26.5****,††††	32.3	24.3****	9.8	10.1	$F_{2, 739} = 256.0$	< .0001
Internalizing problems	17.1	9.7****,††††	11.1	9.1****	3.4	4.0	$F_{2, 738} = 155.7$	< .0001
Externalizing problems	9.0	8.6****	8.3	8.5****	2.7	3.6	$F_{2, 738} = 60.3$	< .0001
Affective problems	5.6	4.2****,††††	4.2	4.0****	0.9	1.6	$F_{2, 738} = 118.5$	< .0001
Anxiety problems	5.3	3.2****,††††	2.9	2.7****	0.7	1.2	$F_{2, 738} = 175.3$	< .0001
Somatic problems	2.8	2.7****,††††	1.7	2.2****	0.7	1.3	$F_{2, 738} = 49.7$	< .0001
ADHD problems	4.3	3.8****	4.2	3.8****	2.1	2.3	$F_{2, 738} = 77.9$	< .0001
Oppositional defiant problems	3.0	2.6****	2.9	2.6****	1.1	1.6	$F_{2, 738} = 56.8$	< .0001
Conduct problems	2.1	3.3****	2.3	3.5****	0.6	1.3	$F_{2, 738} = 31.8$	< .0001
TOCS	12.5	14.4****,††††	− 27.0	25.0****	− 40.8	22.9	$F_{2, 380} = 63.3$	< .0001
MASC1 total score	57.4	19.7****,††††	44.9	16.6****	29.8 13.7		$F_{2, 369} = 85.7$	< .0001
MASC2 OC scale	15.5	7.4****,††††	7.2	5.8****	3.6	4.1	$F_{2, 377} = 63.0$	< .0001
CDI total T-score	56.4	12.9****,†††	51.9	13.0****	42.4	7.2	$F_{2, 743} = 89.6$	< .0001
SCQ	5.7	4.9****, †††	4.2	4.9****	2.1	2.3	$F_{2, 734} = 38.8$	< .0001

OCD obsessive–compulsive disorder, *OPD* other psychiatric disorders, *HC* healthy controls, *OCI-CV* Obsessive Compulsive Inventory-Child Version, *LOI-CV Survey Form* Leyton obsessional inventory-child version survey form, *TOCS* Toronto Obsessive Compulsive Scale, *MASC1* Multidimensional Anxiety Scale for Children 1, *MASC2 OC Scale* Multidimensional Anxiety Scale for Children 2 Obsessions and Compulsions Scale, *SCQ* Social Communication Questionnaire

*compared to healthy controls, $p < .05$; **compared to healthy controls, $p < .01$; ***Compared to healthy controls, $p < .001$; ****compared to healthy controls, $p < .0001$

†compared to patients with OPD, $p < .05$; ††compared to patients with OPD, $p < .01$; †††compared to patients with OPD, $p < .001$; ††††compared to patients with OPD, $p < .0001$

ROC curves using the OCI-CV total score for current OCD cases and OPD cases and for current OCD cases and HC are depicted in Fig. 2. The optimal OCI-CV cut-score in the comparison of OCD cases and OPD cases was 11 (sensitivity = 77.2%, specificity = 70.3%, Youden index = 0.48, accuracy = 0.72) with an AUC of 0.82, resulting in the correct classification of 88/114 OCD cases and 239/340 OPD cases. The optimal OCI-CV cut-score in the comparison of OCD cases and HC was 10 (sensitivity = 79.2%, specificity = 92.7%, Youden index = 0.72, accuracy = 0.89) with an AUC of 0.94, resulting in the correct classification of 91/114 OCD cases and 279/301 HC.

Multiple Logistic Regression Analyses of the OCI-CV Subscale Scores

A multiple logistic regression analysis was conducted in all participants to examine the relation of the OCI-CV subscale scores to current OCD diagnosis (see Fig. 3 and Table 6). OCD had significant associations with washing ($p < 0.0001$), neutralizing ($p = 0.0009$), checking ($p = 0.004$), and obsessing ($p = 0.007$) subscale scores.

Table 4 Diagnostic differences between patients with OCD and patients with OPD

Diagnoses	Patients with OCD N = 114		Patients with OPD N = 340		Comparisons of OCD and OPD groups	
	N	%	N	%	Test statistic	*p*
Anxiety disorders	71	62	164	48	$\chi_1^2 = 6.75$	0.009
Major depressive disorder	25	22	65	19	$\chi_1^2 = 0.40$	0.52
ADHD	23	20	115	34	$\chi_1^2 = 7.52$	0.006
Oppositional defiant disorder	5	4	28	8	$\chi_1^2 = 1.88$	0.17
Conduct disorder	0	0	1	0.3	$\chi_1^2 = 0.34$	0.56
Tic disorders	29	25	34	10	$\chi_1^2 = 17.03$	< .0001
Trichotillomania	9	8	5	1	$\chi_1^2 = 11.78$	0.0006
Excoriation disorder	9	8	16	5	$\chi_1^2 = 1.67$	0.20
Hoarding disorder	5	4	12	4	$\chi_1^2 = 0.17$	0.68
Enuresis	13	11	69	20	$\chi_1^2 = 4.56$	0.03
Encopresis	2	2	10	3	$\chi_1^2 = 0.47$	0.49
Alcohol abuse disorder	0	0	5	2	$\chi_1^2 = 1.70$	0.19
Substance abuse disorder	0	0	6	2	$\chi_1^2 = 2.04$	0.15

OCD obsessive–compulsive disorder; *OPD* other psychiatric disorders; *ADHD* attention-deficit/hyperactivity disorder

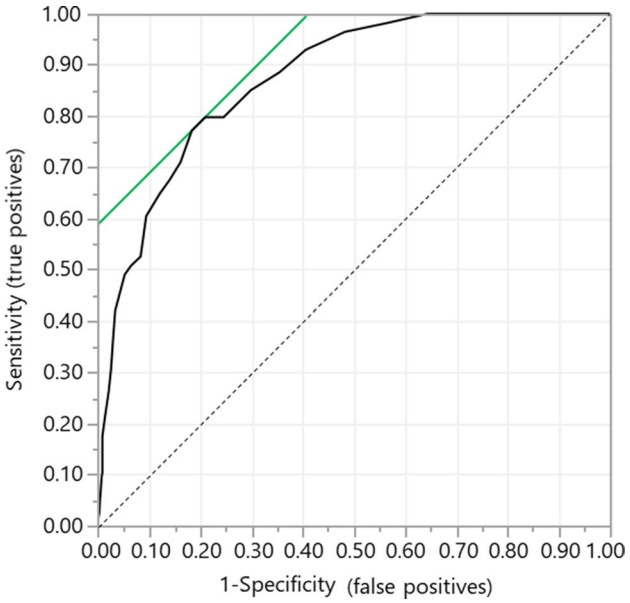

Fig. 1 Receiver operating characteristic curve analysis of the OCI-CV in patients with OCD and all other participants. *OCD* obsessive–compulsive disorder, *OCI-CV* Obsessive–Compulsive Inventory-Child Version

Backward stepwise logistic regression confirmed that no other variables had a significant effect on OCD diagnosis and yielded coefficients for predictors in the reduced model consistent with those in the full model (Table 6).

Table 5 Sensitivity, specificity, Youden Index, and accuracy for a range of cut-scores using the OCI-CV total score for discriminating patients with OCD from patients with OPD and HC

Cut-score	Sensitivity	Specificity	Youden Index	Accuracy
6	0.93	0.59	0.52	0.65
7	0.89	0.65	0.53	0.68
8	0.85	0.70	0.55	0.73
9	0.80	0.76	0.55	0.76
10	0.80	0.79	0.58	0.79
11	**0.77**	**0.82**	**0.59**	**0.81**
12	0.71	0.84	0.55	0.82
13	0.68	0.86	0.54	0.83
14	0.65	0.88	0.53	0.85
15	0.61	0.92	0.52	0.86

Accuracy (informativeness), percentage of children correctly classified. The best cut-score for maximizing the Youden Index is indicated in bold

OCI-CV Obsessive Compulsive Inventory-Child Version, *OCD* obsessive–compulsive disorder, *OPD* other psychiatric disorders, *HC* healthy controls

Discussion

The current study assessed the validity, sensitivity, and specificity of the OCI-CV as a screening instrument for pediatric OCD in a large sample of children and adolescents with a wide range of diagnoses and OC symptom severity. Similar to other studies, there was no sex difference in the OCI-CV total score [1]; however, females had

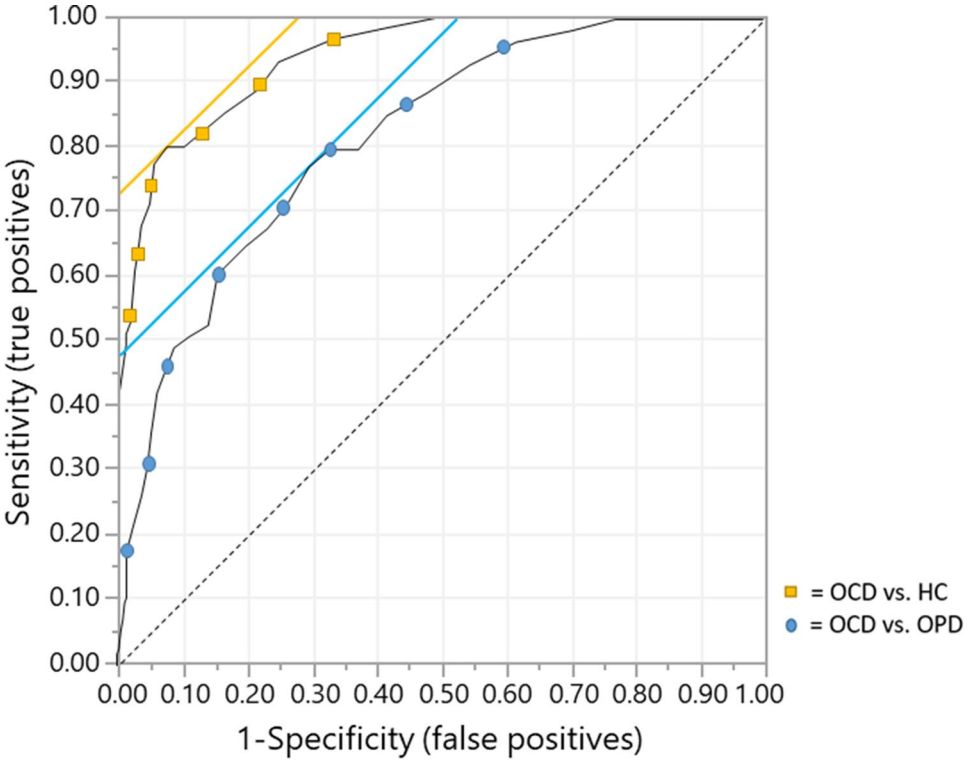

Fig. 2 Receiver operating characteristic curve analyses of the OCI-CV in patients with OCD and patients with OPD and in patients with OCD and HC. *OCD* obsessive–compulsive disorder, *OPD* other psychiatric disorders, *HC* healthy controls, *OCI-CV* obsessive compulsive inventory-child version

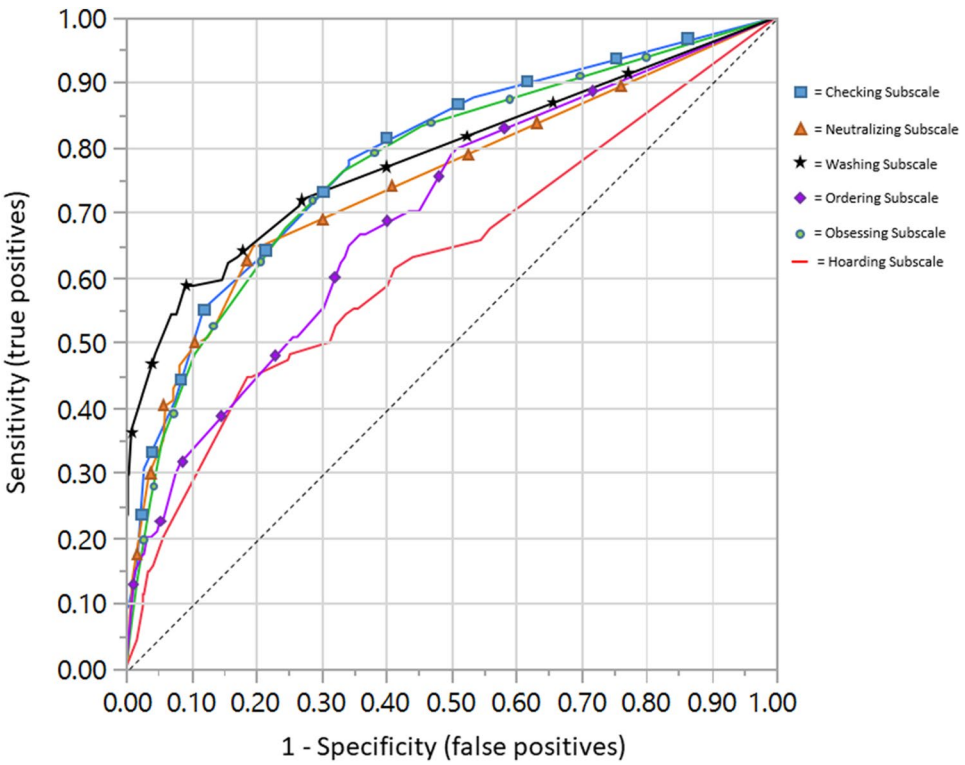

Fig. 3 Receiver operating characteristic curve analysis of the six OCI-CV subscales in patients with OCD and all other participants. *OCD* obsessive–compulsive disorder, *OCI-CV* obsessive compulsive inventory-child version

higher ordering subscale scores in our study. Children had higher scores than adolescents on the hoarding, obsessing, and neutralizing subscales. Similar findings were noted in an earlier study in which children ages 9–11 had higher washing, obsessing, neutralizing, and hoarding subscale scores than adolescents ages 12–17 [22]. Our study found

Table 6 Multiple logistic regression model for OCD as dependent variable and OCI-CV subscale scores as predictors

	Regression					Correlation	
	*R*2	*β*	*B* (SE)	χ^2	*p*	*r* (bivariate)	*r* (partial)
Full model							
	0.367			235.48	< .0001		
Checking		− 0.99	0.34	8.43	0.004	0.44	0.12
Obsessing		− 0.73	0.27	7.44	0.006	0.40	0.11
Hoarding		0.20	0.26	0.59	0.44	0.20	0.04
Washing		− 2.01	0.27	56.95	< 0.0001	0.55	0.39
Ordering		0.04	0.26	0.02	0.88	0.29	0.02
Neutralizing		− 1.14	0.35	10.89	0.0009	0.42	0.17
Reduced model after backward stepwise deletion of non-significant variables							
	0.336			234.81	< .0001		
Washing		− 2.00	0.26	57.00	< .0001	0.55	0.38
Neutralizing		− 1.09	0.34	10.50	0.001	0.42	0.16
Checking		− 0.92	0.32	8.23	0.004	0.44	0.11
Obsessing		− 0.72	0.27	7.35	0.007	0.40	0.10

OCD obsessive–compulsive disorder; *OCI-CV* Obsessive Compulsive Inventory-Child Version

large correlations between the OCI-CV total score and subscale scores, providing further evidence that the subscales index a broader construct of OCD symptoms [18] and weak to strong correlations between the OCI-CV subscale scores, indicating that they are related but not identical. Other studies have had similar findings, in which the OCI-CV subscales had moderately high correlations with the total score, but moderately low correlations with each other [20, 25].

In support of the convergent validity of the OCI-CV, we found very strong correlations between the OCI-CV total score and two other OCD self-report measures, the LOI-CV Survey Form and MASC2 Obsessions and Compulsions Scale [12, 19]. A previous study found the OCI-CV total score had very strong correlations with two other OCD self-report measures, the SOCS and C-FOCI [1, 13, 15, 25]. The convergent validity of the OCI-CV total score was also supported by its moderate to large correlations with two OCD parent-report measures of OCD, the TOCS and CBCL-OCS [33, 38–40]. The convergent validity of the OCI-CV total score was supported to a lesser extent by its small but significant correlations with CY-BOCS scores. This pattern was noted in earlier reports on the OCI-CV in which the correlations between the OCI-CV total scores and CY-BOCS scores were small to moderate in range [9, 18, 21]. Larger correlations may not have been observed because self-report and clinician-rated measures use different sources of information and assess different aspects of OCD symptom severity, with the CY-BOCS integrating somewhat inconsistent information from children and parents to provide estimates of time, interference, distress, resistance, and control [18, 21, 32]. The convergent validity of the OCI-CV total score was also supported by its large correlations with the MASC1 total score and CDI total score, two self-report measures of anxiety and depressive symptoms, respectively [19, 36]. Similarly, the original report on the OCI-CV found that other non-OCD self-report measures were more strongly correlated with the OCI-CV than was the CY-BOCS [20].

More direct support for the convergent and discriminant validity of the OCI-CV was provided by the stronger correlation of the OCI-CV total score with the CBCL Internalizing Problems score than with the CBCL Externalizing Problems score, as well as the stronger correlation of the OCI-CV with the CBCL anxiety problems score than with the CBCL Conduct Problems score [33]. The small but significant correlation between the OCI-CV and SCQ may partially reflect the conflation of OC symptoms with the restricted interests and repetitive behaviors measured by the SCQ [35]. To our knowledge, previous studies of the convergent and discriminant validity of the OCI-CV have not used the LOI-CV Survey Form, MASC2 Obsessive–Compulsive scale, CBCL, TOCS, and SCQ [12, 19, 33–35],

OCD cases had higher scores than the OPD cases and HC on the LOI-CV Survey Form, MASC1, MASC2 Obsessions and Compulsions scale, CDI, CBCL Internalizing Problems, Affective Problems, Anxiety Problems, Somatic Problems scales, and SCQ. In contrast, OCD cases had higher scores than the HC but not the OPD cases on the CBCL Externalizing Problems, Attention-Deficit/Hyperactivity Problems, Oppositional Defiant Problems, and Conduct Problems scales. Consistent with previous studies of comorbidity in pediatric OCD, OCD cases had a higher prevalence than the

OPD cases of anxiety disorders, tic disorders, and trichotillomania [48, 49].

In assessing the sensitivity and specificity of the OCI-CV with a ROC analysis to predict current OCD among all participants, the optimal cut-score was 11 with an AUC of 0.88. In a comparison of OCD cases and OPD cases, the optimal OCI-CV cut-score was also 11 with an AUC of 0.82, indicating that the OCI-CV with a cut-point of 11 is an effective screen for OCD in psychiatric clinics or other specialist clinics where OCD is common. In a comparison of OCD cases and HC, the optimal OCI-CV cut-score was 10 with an AUC of 0.94, indicating that the OCI-CV with a cut-score of 10 is an effective screen for OCD in primary care, community child health services, or educational psychology settings where OCD is less frequent. Our AUC result for the OCI-CV is better than the one reported for the OCI-R in differentiating between adult OCD cases and non-anxious controls (0.94 versus 0.70, respectively) and is identical to the one differentiating between adult OCD cases and anxious controls (0.82 versus 0.82, respectively) [20]. Furthermore, the specificity of 70% in our comparison of OCD cases and OPD cases is higher than the specificity of 52% for a similar comparison in a study of the SOCS [15]. Nonetheless, our OCI-CV cut-scores require replication in other samples.

A multiple logistic regression analysis determined that the washing, neutralizing, checking, and obsessing subscales, but not the hoarding and ordering subscales, were associated with a current OCD diagnosis, indicating that the last two subscales do not contribute to the prediction of pediatric OCD by the OCI-CV. In contrast to a study of the OCI-R study in adults, we found no evidence that the obsessing subscale is more strongly predictive of OCD than the OCI-CV total score [20]. We found no difference between the OCD and OPD groups in the prevalence of hoarding disorder. A previous study of the OCI-R found that the hoarding subscale did not discriminate between OCD cases and anxiety disorder cases, suggesting that hoarding is neither a symptom nor a manifestation of OCD [28]. Hoarding behaviors have been found to be increased in studies of individuals with either ASD [50] or ADHD [51]. It is unclear whether the OCI-CV ordering subscale may be correlated with behaviors associated with ASD or other disorders in our OPD group. It is also unclear whether the OCI-CV ordering items may reflect annoyance with having one's possessions or personal space violated as much as having an urge to arrange items in a particular order.

Our study has several limitations requiring further consideration. Because the sample was primarily Caucasian, the OCI-CV results require replication in other racial and ethnic groups. It is likely other studies will identify optimal cut-scores for the OCI-CV that are different from the cut-scores recommended in this study. Although the original study of the OCI-R identified an optimal cut-score of 21 for discriminating between OCD cases and non-anxious controls, subsequent studies have recommended cut-scores ranging between 14 to 36 for various populations [52]. Although our results indicate that the OCI-CV is an effective instrument for discriminating between OCD cases and HC and between OCD cases and OPC cases, additional interviews and measures are necessary for screening youth for OCD in a clinical setting laden with other severe psychiatric disorders, including ASD, ADHD, anxiety disorders, depressive disorders, tic disorders, hoarding disorder, and psychotic disorders [1, 6, 7, 27, 28, 48–52].

Summary

Pediatric OCD is a common, heterogeneous disorder often causing marked functional impairment in several domains that remains underdiagnosed and undertreated. Our study provides further evidence that the OCI-CV total score is highly correlated with its six subscale scores, and details new evidence for the convergent and discriminant validity of the OCI-CV by examining its correlations with several other rating scales. We examined the ability of the OCI-CV to detect pediatric OCD using ROC analyses and identified cut-scores that are likely to be useful in clinical and community settings. In comparing OCD cases and OPD cases, the optimal OCI-CV cut-score was 11 with an AUC of 0.82, indicating this cut-score provides an effective screen for OCD in psychiatric clinics or other specialty clinics where OCD is common. In comparing OCD cases and HC, the optimal OCI-CV cut-score was 10 with an AUC of 0.94, indicating this cut-score provides an effective screen for OCD in primary care, community child health services, or educational psychology settings where OCD is less frequent. A multiple logistic regression analysis with all participants found that a current OCD diagnosis had significant associations with washing, neutralizing, checking, and obsessing subscale scores, but not with ordering or hoarding subscale scores, suggesting that the last two subscales do not contribute to the prediction of pediatric OCD by the OCI-CV.

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References

1. Krebs G, Heyman I (2015) Obsessive-compulsive disorder in children and adolescents. Arch Dis Child 100:495–499
2. Piacentini J, Bergman RL, Keller M, McCracken J (2003) Functional impairment in children and adolescents with obsessive-compulsive disorder. J Child Adolesc Psychopharmacol 13(2, Supplement 1):61–69

3. Canals J, Hernandez-Martinez C, Cosi S, Voltas N (2012) The epidemiology of obsessive-compulsive disorder in Spanish school children. J Anxiety Disord 26:746–752
4. Dalsgaard S, Thorsteinsson E, Trabjerg BB, Schullenhner J, Plana-Ripoll O, Brikell I et al (2019) Incidence rates and cumulative incidences of the full spectrum of diagnosed mental disorders in childhood and adolescence. JAMA Psychiatry. https://doi.org/10.1001/jamapsychiatry.2019.3523
5. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE (2005) Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. Arch Gen Psychiatry 62:593–602
6. Stewart SE, Geller D, Jenike M, Pauls D, Shaw D, Mullin B et al (2004) Long-term outcome of pediatric obsessive-compulsive disorder: a meta-analysis and qualitative review of the literature. Acta Psychiatr Scand 11:4–13
7. Micali N, Heyman I, Perez M, Hilton K, Nakatani E, Turner C et al (2010) Long-term outcomes of obsessive-compulsive disorder: follow-up of 142 children and adolescents. Br J Psychiatry 197:128–134
8. Barzilay B, Patrick A, Calkins ME, Moore TM, Wolf DH, Benton TD et al (2019) Obsessive-compulsive symptomatology in community youth: typical development or a red flag for psychopathology? J Am Acad Child Adolesc Psychiatry 58:277–286
9. Rapp AM, Bergman RL, Piacentini J, McGuire JF (2016) Evidence-based assessment of obsessive-compulsive disorder. J Cent Nerv Syst Dis 8:13–29
10. Thorsen AL, Kvale G, Hansen B, van den Heuvel OA (2018) Symptom dimensions in obsessive-compulsive disorder as predictors of neurobiology and treatment response. Curr Treat Options Psychiatry 5:182–194
11. McGuire JF, Da G, Murphy TK, Small BJ, Unger A, Wilhelm S et al (2019) Defining treatment outcomes in pediatric obsessive-compulsive disorder using a self-report scale. Behav Ther 50:314–324
12. Berg CZ, Whitaker A, Davies M, Flament MF, Rapoport JL (1988) The survey form of the Leyton Obsessional Inventory—Child Version: norms from an epidemiological study. J Am Acad Child Adolesc Psychiatry 27:759–763
13. Storch EA, Khanna M, Merlo LJ, Loew BA, Franklin M, Reid JM et al (2009) Children's Florida obsessive compulsive inventory: psychometric properties and feasibility of a self-report measure of obsessive–compulsive symptoms in youth. Child Psychiatry Hum Dev 40:467–483
14. Shafran R, Frampton I, Heyman I, Reynolds M, Teachman B, Rachman S (2003) The preliminary development of a new self-report measure for OCD in young people. J Adolesc 26:137–142
15. Uher R, Heyman I, Mortimore C, Frampton I, Goodman R (2007) Screening young people for obsessive-compulsive disorder. Br J Psychiatry 191:353–354
16. Steinhausen H-C, Peloso M, Metzke CW (2009) Performance of the adolescent obsessive-compulsive scale in a community survey. J Anxiety Disord 23:218–222
17. De Caluwe E, De Clercq B (2014) Development and validation of the Youth Obsessive-Compulsive Symptoms Scale (YOCSS). Child Psychiatry Hum Dev 45:647–656
18. Foa EB, Coles M, Huppert JD, Pasupuleti RV, Franklin ME, March J (2010) Development and validation of a child version of the Obsessive Compulsive Inventory. Behav Ther 41:121–132
19. March JS, Parker JD, Sullivan K, Stallings P, Conners CK (1997) The Multidimensional Anxiety Scale for Children (MASC): factor structure, reliability, and validity. J Am Acad Child Adolesc Psychiatry 36:554–565
20. Foa EB, Huppert JD, Leiberg S, Langner R, Kichic R, Hajcak G et al (2002) The Obsessive Compulsive Inventory: development and validation of a short version. Psychol Assess 14:485–496
21. Jones AM, De Nadai AS, Arnold EB, McGuire JF, Lewin AB, Murphy TK et al (2013) Psychometric properties of the Obsessive Compulsive Inventory: Child Version in children and adolescents with obsessive-compulsive disorder. Child Psychiatry Hum Dev 44:137–151
22. Alcázar AIR, García BR, Iniesta-Sepúlveda M, Navas JLP, Rosa-Alcázar Á, Parada-Navas JL (2014) Obsessive Compulsive Inventory-Child Version (OCI-CV) in a Spanish community sample of children and adolescents. Psicothema 26(2):174–179
23. Martinez-Gonzalez AE, Rodriguez-Jimenez T, Piqueras JA, Vera-Villarroel P, Godoy A (2015) Psychometric properties of the Obsessive-Compulsive Inventory-Child Version (OCD-CV) in Chilean children and adolescents. PLoS ONE 10:e0136842
24. Rodriguez-Jimenez T, Godoy A, Piqueras JA, Gavino A, Martinez-Gonzalez AE, Foa EB (2015) Factor structure and measurement invariance of the Obsessive-Compulsive Inventory-Child Version (OCD-CV) in general population. Eur J Psychol Assess 33:97–103
25. Rodriguez-Jimenez T, Piqueras JA, Lazaro L, Moreno E, Ortiz AG, Godoy A (2016) Metric invariance, reliability, and validity of the Child Version of the Obsessive Compulsive Inventory (OCD-CV) in community and clinical samples. J Obsess Compul Related Disord 9:1–8
26. Pozza A, Barccacia B, Dettore D (2017) The Obsessive Compulsive Inventory-Child Version (OCI-CV): further evidence on confirmatory factor analytic structure, incremental and criterion validity in Italian community children and adolescents. Arch Psychiatr Nurs 31:291–295
27. Pertusa A, Frost RO, Fullana MA, Samuels JF, Steketee G, Tolin DF et al (2010) Refining the diagnostic boundaries of compulsive hoarding: a critical review. Clin Psychol Rev 30:371–386
28. Wheaton MG, Abramowitz JS, Fabrican LE, Berman NC, Franklin JC (2011) Is hoarding a symptom of obsessive-compulsive disorder? Int J Cogn Ther 4:225–238
29. Garvey M, Avenevoli S, Anderson K (2016) The National Institute of Mental Health Research Domain Criteria and clinical research in child and adolescent psychiatry. J Am Acad Child Adolesc Psychiatry 55:93–98
30. Kaufman J, Birmaher B, Brent D, Rao U, Flynn C, Moreci P et al (1997) Schedule for affective disorders and schizophrenia for school-age children-present and lifetime version (K-SADS-PL): initial reliability and validity data. J Am Acad Child Adolesc Psychiatry 36:980–988
31. Hanna GL (2013) Schedule for obsessive-compulsive and other behavioral syndromes (SOCOBS). University of Michigan, Ann Arbor
32. Scahill L, Riddle MA, McSwiggin-Hardin M, Ort SI, King RA, Goodman WK et al (1997) Children's Yale-Brown Obsessive Compulsive Scale: reliability and validity. J Am Acad Child Adolesc Psychiatry 36:844–852
33. Achenbach TM, Rescorla LA (2001) Manual for ASEBA school-age forms & profiles. University of Vermont Research Center for Children Youth and Families, Burlington
34. Park LS, Burton CL, Dupuis A, Shan J, Storch EA, Crosbie J et al (2016) The Toronto Obsessive-Compulsive Scale: psychometrics of a dimensional measure of obsessive-compulsive traits. J Am Acad Child Adolesc Psychiatry 55:310–318
35. Berument SK, Rutter M, Lord C, Pickles A, Bailey A (1999) Autism screening questionnaire: diagnostic validity. Br J Psychiatry 175:444–451
36. Kovacs M (1985) The children's depression inventory (CDI). Psychopharmacol Bull 21:995–998
37. Storch EA, Murphy TK, Geffken GR, Soto O, Sajid M, Allen P et al (2004) Psychometric evaluation of the Children's Yale-Brown Obsessive-Compulsive Scale. Psychiatry Res 129:91–98

38. Nelson EC, Hanna GL, Hudziak JJ, Botteron KN, Heath AC, Todd RD (2001) Obsessive-compulsive scale of the child behavior checklist: specificity, sensitivity, and predictive power. Pediatrics 108(1):e14–e14
39. Hudziak JJ, Althoff RR, Stanger C, van Beijsterveldt CE, Nelson EC, Hanna GL et al (2006) The Obsessive Compulsive Scale of the Child Behavior Checklist predicts obsessive-compulsive disorder: a receiver operating characteristic curve analysis. J Child Psychol Psychiatry 47:160–166
40. Geller DA, Doyle R, Shaw D, Mullin B, Coffey B, Petty C et al (2006) A quick and reliable screening measure for OCD in youth: reliability and validity of the obsessive compulsive scale of the Child Behavior Checklist. Compr Psychiatry 47:234–240
41. Storch EA, Park JM, Lewin AB, Morgan JR, Jones AM, Murphy TK (2011) The Leyton Obsession Inventory-Child Version Survey Form does not demonstrate adequate psychometric properties in American youth with pediatric obsessive-compulsive disorder. J Anxiety Disord 25:574–578
42. Saylor CF, Finch AJ, Spirito A, Bennett B (1984) The Children's Depression Inventory: a systematic evaluation of psychometric properties. J Consult Clin Psychol 52:955–998
43. Comer JS, Kendall PC (2005) High-end specificity of the Children's Depression Inventory in a sample of anxiety-disorder youth. Depress Anxiety 22:11–19
44. Kazdin AE (1987) Children's depression scale: validation with child psychiatric inpatients. J Child Psychol Psychiatry 28:29–41
45. Cohen J (1992) A power primer. Psychol Bull 112:155–159
46. Hosmer DW, Lemeshow S (2000) Applied logistic regression. Wiley, New York
47. Youden WJ (1950) Index for rating diagnostic tests. Cancer 3:32–35
48. Ivarrson T, Melin K, Wallin L (2008) Categorical and dimensional aspects of co-morbidity in obsessive-compulsive disorder (OCD). Eur Child Adolesc Psychiatry 17:20–31
49. Flessner CA, Berman N, Garcia A, Freeman JB, Leonard HL (2009) Symptom profiles in pediatric obsessive-compulsive disorder (OCD): the effects of comorbid grooming conditions. J Anxiety Disord 23:753–759
50. McDougle CJ, Kresch LE, Goodman WK, Naylor ST, Volkmar FR, Cohen DJ et al (1995) A case-controlled study of repetitive thoughts and behavior in adults with autistic disorder and obsessive-compulsive disorder. Am J Psychiatry 152:772–777
51. Hacker LE, Park JM, Timpano KR, Cavitt MA, Alvaro JL, Lewin AB et al (2016) Hoarding in children with ADHD. J Atten Disord 20:617–626
52. Wootton BM, Diefenbach GJ, Bragdon LB, Steketee G, Frost RO, Tolin DF (2015) A contemporary psychometric evaluation of the Obsessive Compulsive Inventory-Revised (OCD-R). Psychol Assess 27:874–882