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Development and Psychometric Evaluation of the Children's Yale-Brown Obsessive-Compulsive Scale Second Edition

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Objective: To develop and examine the psychometric properties of the Children's Yale-Brown Obsessive-Compulsive Scale Second Edition (CY-BOCS-II) in children and adolescents with obsessive-compulsive disorder (OCD).

Method: Youth with OCD (N = 102; age range 7–17 years), who were seeking treatment from 1 of 2 specialty OCD treatment centers, participated in the study. The CY-BOCS-II was administered at an initial assessment, and measures of OCD symptom severity, anxiety and depressive symptoms, behavioral and emotional problems, and global functioning were administered. Inter-rater and test-retest reliabilities were assessed on a subsample of participants (n = 50 and n = 31, respectively) approximately 1 week after intial assessment.

Results: The CY-BOCS-II demonstrated moderate-to-strong internal consistency (α = 0.75–0.88) and excellent inter-rater (intraclass correlation coefficient = 0.86–0.92) and test-retest (intraclass correlation coefficient = 0.95–0.98) reliabilities across all scales. Construct validity was supported by strong correlations with clinician-rated measures of OCD symptom severity and moderate correlations with measures of anxiety symptoms. Exploratory factor analysis showed a 2-factor structure, which was generally inconsistent with its adult counterpart, the Yale-Brown Obsessive-Compulsive Scale Second Edition.

Conclusion: Initial findings support the CY-BOCS-II as a reliable and valid measure of obsessive-compulsive symptoms in youth.

Key words: Children's Yale-Brown Obsessive-Compulsive Scale, obsessive-compulsive disorder, validity, assessment, treatment

J Am Acad Child Adolesc Psychiatry 2019;58(1):92–98. CG

The Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS)[1,2] is the most widely used measure of clinician-rated obsessive-compulsive symptom severity. It has been translated into numerous languages and its psychometric properties have been supported across many studies.[3] Despite its extensive use and established psychometric properties, there is a need for revision to reflect the improved phenomenologic understanding of obsessive-compulsive disorder (OCD) since the original development of the CY-BOCS more than 25 years ago.

First, avoidance is recognized as a central feature within OCD,[4] with the presence of avoidance associated with greater symptom severity in adults.[5] However, avoidance is not currently integrated into the symptom severity rating on the CY-BOCS and instead is captured by a single ancillary item.

Second, the original CY-BOCS total score ranges from 0 to 40 based on item responses ranging from 0 to 4, with ratings of 4 capturing a wide range of patients in the severe to extremely severe range. As a result, this original rating scheme can have difficulty differentiating individuals who present at the upper limits of severity from those who experience severity that is beyond the CY-BOCS ceiling. For example, an individual who dedicated 8 hours a day to compulsions would be clinically distinct from someone who spent every waking minute engaging in compulsions, but this would not be detected with the CY-BOCS, suggesting the need for a more sensitive rating scale, particularly in the upper range of severity.

Third, the resistance to obsessions item has demonstrated poor psychometric properties across numerous studies, suggesting limited utility in quantifying overall obsessive-compulsive severity.[1,6,7] Instead of resistance

against obsessions, duration between obsessions is believed to provide a better proxy for illness severity and is conceptually consistent with the cognitive behavioral principles that underlie the leading psychological treatment for OCD,[8] in which youth are encouraged to sit with the discomfort rather than attempt to distract themselves and resist the obsessions.

Fourth, the symptom checklist, although comprehensive, required updates. The original symptom checklist did not take into account avoidance, grouped symptoms by headings (which led to confusion), and contained awkward or ambiguous wording of some items. Thus, to increase the utility and precision of the measure, it is important to update the symptom checklist and provide practical examples to minimize rater confusion regarding more complicated symptoms.

With these considerations in mind, and in parallel with its adult counterpart (Y-BOCS-II),[9,10] we developed the CY-BOCS Second Edition (CY-BOCS-II). Although no data have been reported to date on the CY-BOCS-II, the Y-BOCS-II has been the subject of several investigations. The Y-BOCS-II Severity scale has established internal consistency ($\alpha = 0.86$–0.89) and test-retest reliability ($r = 0.81$). Convergent validity is strong, as evidenced by large correlations with other measures of OCD symptom severity[10,11] and related impairment.[11] Divergent validity has been established vis-à-vis nonsignificant correlations with symptoms of anxiety and impulsiveness and moderate correlations with symptoms of depression.[11] Exploratory factor analysis has supported a 2-factor structure consisting of obsessive items and compulsive items.[10]

In the present study, we examined the psychometric properties of the CY-BOCS-II. First, we examined the internal consistency, inter-rater reliability, and 1-week test-retest reliability of the CY-BOCS-II scores. Second, we examined the convergent validity of the CY-BOCS-II with clinician-rated and self-reported measures of obsessive-compulsive symptom severity. Third, we examined the divergent validity of the CY-BOCS-II with measures of parent- and child-rated measures of anxiety and depression and other relevant characteristics. Fourth, we examined the association of the CY-BOCS-II with other relevant clinical characteristics. Fifth, we examined the factor structure of the CY-BOCS-II.

METHOD

Participants

Participants in this study included 102 children (54% male) 7 to 17 years old, and their parents, who were seeking evaluation and potential treatment from 1 of 2 specialty OCD treatment centers. Some demographic data were missing for 6 youths. Youths were Caucasian (n = 88), African American (n = 1), Asian (n = 1), Middle Eastern (n = 2), or other (n = 5), with 5 parents not their child's disclosing race. Seven children were Hispanic. More than half the families reported a total household income higher than $100,000 (n = 53), with the remainder most frequently reporting $80,000 to $99,999 (n = 13) and $40,000 to $59,999 (n = 12). Individuals had a primary diagnosis of OCD, defined by criteria set forth in the *DSM-5,*[12] given by a licensed psychologist with extensive OCD assessment and diagnosis experience. After chart review and discussion regarding the clinical presentation of the patient, the OCD diagnosis was corroborated by a second psychologist.[13] Presence of comorbid disorders did not exclude patients from this study if their primary diagnosis remained OCD; however, patients presenting with schizophrenia, mental retardation, pervasive developmental disorers, or neurologic disorders were not eligible for participation.

Measures

Children's Yale-Brown Obsessive-Compulsive Scale–II. The CY-BOCS-II is a revised version of the original CY-BOCS,[1] which is a clinican-rated measure of obsessive-compulsive symptom severity in children. As discussed earlier, the CY-BOCS-II was developed to address emergent concerns about the original CY-BOCS measure regarding specific items and the sensitivity of the entire scale. In addition to revision of the CY-BOCS Severity scale, the symptom checklist was updated in the CY-BOCS-II. Development of the CY-BOCS-II involved several steps. First, items and formatting from the Y-BOCS-II were adapted by the investigators to be relevant for parents and children in OCD content and language. Second, the preliminary CY-BOCS-II was reviewed by child psychologists and psychiatrists with expertise in OCD for item content, wording, and formatting. Delphi procedures were used such that comments were integrated into a revised version that was re-reviewed by these individuals for additional comments, which were integrated. Third, the measure was pilot tested in a sample of children with OCD and their parents (not included in the present study) and clinicians who administered the measure. Feedback about content, wording, and practical administration was received and, if appropriate, integrated.

Clinical Global Impression–Severity. The Clinical Global Impression–Severity (CGI-S)[14] is a measure used to rate psychopathology severity on a 7-point scale. This measure is rated by a clinician, with a severity rating ranging from

0 (which indicates no illness) to 6 (indicating extremely severe symptoms). The CGI-S has proved responsive to treatment and is often used in psychotherapy and psychopharmacology trials.[15]

National Institute of Mental Helath Global Obsessive-Compulsive Scale. The National Institute of Mental Helath Global Obsessive-Compulsive Scale (NIMH-GOCS)[16] is a clinician-rated single-item measure used to assess OCD symptom severity and global functioning. Ratings are provided on a Likert scale ranging from 1 (indicating minimal symptoms) to 15 (indicating very severe symptoms). There is high test-retest reliability over a 2-week period with this measure ($rs = 0.87–0.98$),[17] good inter-rater reliability ($rs = 0.77–0.95$), and high correlations with the Y-BOCS ($r = 0.68$).[18]

Child Version of the Obsessive-Compulsive Inventory. The Child Version of the Obsessive-Compulsive Inventory (OCI-CV)[19] is a 21-item assessment used to measure obsessive-compulsive symptoms based on a 3-point rating scale, with ratings ranging from 0 (never) to 2 (always). This measure has strong retest reliability and internal consistency for subscale and total scores.[19,20]

Screen for Child Anxiety Related Disorders. The Screen for Child Anxiety Related Disorders (SCARED)[21] is a 41-item measure used to assess anxiety disorders in children across 4 areas: panic/somatic, separation anxiety, generalized anxiety, and social phobia. Each question is scored on a 3-point Likert-type scale and comes in 2 versions, the child self-report version (SCARED-C) and the parent-rated version (SCARED-P). The SCARED is a valid and reliable measurement tool with good internal consistency and moderate parent–child correlations.[22]

Short Mood and Feelings Questionnaire–Parent/Child Report. The Short Mood and Feelings Questionnaire–Parent/Child Report (SMFQ-P/C)[23] is a 13-item measure with high internal consistency used to assess depressive symptoms in children and adolescents. Each question is scored on a 3-point Likert-type scale, with responses ranging from 0 (not true) to 2 (true). This measure is a quick self-report tool completed by parents on behalf of their children.

Child Behavioral Checklist. The Child Behavioral Checklist (CBCL)[24] is a widely used parent-report measured used to assess behavioral and emotional problems in children. The assessment collects demographic data and scores for positive behaviors, school functioning, and social competence. The Internalizing and Externalizing subscales were of particular interest for this study. Each question is scored on a Likert-type scale, with scores ranging from 0 (not true) to 2 (very true).

Procedure

Parents in this study provided written informed consent, and children provided assent, as approved by the institutional review board at each clinic's institution. An initial assessment consisted of a semistructured interview conducted by an experienced psychiatrist or psychologist and the administration of the CY-BOCS-II immediately after this visit by a trained masters- or doctoral-level provider other than the evaluating clinician. The child and parent were each interviewed alone; final ratings were made by the clinician using clinical judgment. The clinician rated symptom severity on the CGI-S and NIMH-GOCS. Clinicians had experience in the administration of the CY-BOCS-II and received additional training, including attending an instructional meeting, observing a minimum of 5 clinical administrations of the CY-BOCS-II, and administering the assessment 3 times under direct observation. Administration of the measure was audio-recorded and later independently rated by a second observer for 50 participants (49%) to determine inter-rater reliability. After the collection of these clinican-rated measures, participants completed self-report measures. To examine test-retest reliability, the CY-BOCS-II was readministered in person to 31 participants (30.4%) roughly 1 week after their initial intake by the same clinician. The child had not participated in any new intervention during this interval. Inter-rater reliability was examined by review of audiotapes. Ongoing supervision by the first author was provided to clinicians. External incentives were not offered to any participants for participation in this study.

Analytic Plan

Descriptive statistics were calculated to examine the mean, SD, and range for all measures used in the present study. Frequency and severity of obsessive-compulsive symptoms were examined based on the CY-BOCS-II. Independent-sample t tests were conducted to determine potential sex differences on the questionnaires, and Pearson correlations were used to investigate potential associations between age and constructs of interest. Internal consistency was calculated separately for the CY-BOCS-II Obsession Severity, Compulsion Severity, and Total Severity scales using Cronbach α. Inter-rater reliability was calculated using the intraclass correlation coefficient (ICC) using a 2-way random effects model set for absolute agreement. Test-retest reliability was assessed

using the ICC through a 2-way mixed-effects model, measuring for absolute agreement. Construct validity was examined through Pearson correlations. Confirmatory factor analyses (CFAs) were conducted to examine the fit of 3 predetermined 2-factor structures; the first proposed model was split between the Obsession Severity scale items and the Compulsion Severity scale items, and the second proposed model was based on the Interference/Severity and Resistance/Control Factors.[7,25,26] A third model was a replication of the first proposed model, but it incorporated correlated residuals among parallel obsession and compulsion items based on recent CY-BOCS findings.[27] Fit was determined by multiple methods, including the χ^2 test, comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). To determine an adequate fit, a χ^2 value closer to 0, a CFI value of at least 0.95, an RMSEA value less than 0.08, and an SRMR value less than 0.08 were determined to have acceptable fit. SPSS 24[28] was used to conduct all analyses, except for the factor analyses, which were conducted using Mplus 7.[29]

TABLE 1 Descriptive Statistics for Study Measures

Measure	Mean	SD	Range
CY-BOCS-II Obsession Severity scale	15.01	4.41	3–24
CY-BOCS-II Compulsion Severity scale[a]	14.98	4.33	2–23
CY-BOCS-II Total Severity scale[a]	29.99	8.03	5–46
CGI-S	3.58	0.96	1–6
NIMH GOCS[b]	8.49	2.12	2–13
OCI-CV[c]	15.92	9.22	0–42
SCARED-C[c]	30.95	18.81	0–82
SCARED-P[e]	29.26	17.77	0–75
SMFQ-C[d]	9.88	6.54	0–26
SMFQ-P[f]	17.58	6.25	0–26
CBCL Internalizing[g]	19.25	10.33	1–50
CBCL Externalizing[e]	10.70	8.33	0–37

Note: N indicates 101 unless otherwise specified. CBCL = Child Behavior Checklist; CGI-S = Clinical Global Impression–Severity; CY-BOCS-II = Children's Yale-Brown Obsessive-Compulsive Scale–II; NIMH GOCS = National Institutes of Mental Health Global Obsessive-Compulsive Scale; OCI-CV = Obsessive-Compulsive Inventory–Child Version; SCARED-P/C = Screen for Child Anxiety Related Emotional Disorders–Parent/Child Report; SMFQ-P/C = Short Mood and Feelings Questionnaire–Parent/Child Report.

[a] *n = 100.*
[b] *n = 98.*
[c] *n = 86.*
[d] *n = 88.*
[e] *n = 95.*
[f] *n = 96.*
[g] *n = 87.*

RESULTS

Table 1 lists the descriptive statistics for all clinician-, parent-, and child-rated measures for the study. Table 2 lists CY-BOCS-II item frequencies and descriptive statistics. When considering potential sex differences on the various study measures, only the SCARED-C ($t_{84} = 1.28$, $p < .01$) and OCI-CV ($t_{84} = 0.000021$, $p < .05$) demonstrated statistically significantly higher scores for girls versus boys; all other measures had p values less than .05. For correlations between age and the study measures, the CY-BOCS-II Total ($r = 0.20$, $p = .049$), SMFQ-P ($r = 0.25$, $p < .05$), and CBCL Internalizing ($r = 0.22$, $p = .046$) scores exhibited small, positive, and statistically significant correlations; all other measures had p values less than .05.

Reliability

Internal Consistency. The internal consistencies of the Obsession Severity scale and Total Severity scale were good (Cronbrach $\alpha = 0.86$ and 0.88, respectively). The internal consistency of the Compulsion Severity scale was acceptable (Cronbach $\alpha = 0.75$).

Inter-rater Reliability. Inter-rater reliability (n = 50) was good to excellent across all scales. The inter-rater reliability for the Obsession Severity scale was good (ICC = 0.86, 95% CI 0.77–0.92). The inter-rater reliability for the Compulsion Severity scale was excellent (ICC = 0.92, 95% CI 0.86–0.95), as was the inter-rater reliability for the Total Severity scale (ICC = 0.91, 95% CI 0.84–0.95).

Test-Retest Reliability. The test-retest reliability (n = 31) of the Obsession Severity scale (ICC = 0.95, 95% CI 0.90–0.98), Compulsion Severity scale (ICC = 0.98, 95% CI 0.96–0.99), and Total Severity scale (ICC = 0.96, 95% CI 0.92–0.98) was excellent.

Construct Validity

When examining the correlations between the CY-BOCS-II Total Severity score and various OCD measures (Table 3), the CY-BOCS-II demonstrated large, positive correlations with the 2 clinician-rated measures (CGI-S and NIMH GOCS). A medium, positive correlation was found between the CY-BOCS-II and OCI-CV total scores.

When examining the correlation between the CY-BOCS-II Total Severity scale and divergent constructs (Table 3), the CY-BOCS-II exhibited small, positive correlations with parent-reported child anxiety and child externalizing symptoms. However, a small, negative

TABLE 2 Individual Children's Yale-Brown Obsessive-Compulsive Scale–II (CY-BOCS-II) Item Frequencies and Descriptive Statistics

				Frequency of Endorsement					
CY-BOCS-II Item	**Mean**	**SD**	**Range**	**0**	**1**	**2**	**3**	**4**	**5**
1. Time on obsessions	2.70	1.14	1–5	0	14	33	32	13	9
2. Obsession-free interval	3.19	0.97	1–5	0	4	17	46	24	10
3. Control over obsessions	3.55	1.09	0–5	1	6	6	28	43	17
4. Distress associated with obsessions	2.97	1.19	0–5	1	10	23	37	17	13
5. Interference from obsessions	2.59	1.12	0–5	1	19	25	34	19	3
6. Time on compulsions	2.52	1.15	1–5	0	22	28	34	10	7
7. Resistance against compulsions	3.00	1.56	0–5	9	14	5	32	20	20
8. Control over compulsions	3.50	1.10	0–5	1	7	4	34	38	17
9. Distress if compulsions prevented	3.27	1.10	1–5	0	7	13	44	20	17
10. Interference from compulsions	2.66	1.16	0–5	3	15	24	33	23	3

correlation was observed for child-reported depressive symptoms. Medium correlations were found between the CY-BOCS-II and child-reported anxiety, parent-reported child depressive symptoms, and child internalizing symptoms.

Factor Structure

Table 4 presents goodness-of-fit indices for the 3 CFAs that were conducted. All 3 models displayed poor fit, as determined by all goodness-of-fit indicators, although the SRMR values were barely above the proposed cutoff of less than 0.08 (0.08–0.09). Additional CFAs using categorical estimators were conducted to determine whether the model fit was affected by item response characteristics, but they failed to improve the overall fit.

Given the poor fit from the 2 proposed CFAs, an exploratory factor analysis was conducted using the default settings in Mplus 7 (eg, geomin rotation, maximum likelihood method for extracting factors). Ultimately, a 2-factor solution was determined based on retaining factors that had eigenvalues higher than 1 and parallel analysis. Table 5 presents the geomin-rotated factor loadings for the final 2-factor model. In the end, 1 factor contained the items measuring resistance and control over compulsions (2 items), with the remaining items loading onto another factor (8 items).

TABLE 3 Correlation Matrix Between Children's Yale-Brown Obsessive-Compulsive Scale–II (CY-BOCS-II) and Measures of Obsessive-Compulsive Disorder and Child Psychopathology

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CY-BOCS-II										
CGI-S	0.80***									
NIMH-GOCS	0.79***	0.90***								
OCI-CV	0.35**	0.27*	0.24*							
SCARED-C	0.34**	0.27*	0.19	0.69***						
SCARED-P	0.25*	0.29**	0.21	0.34**	0.68***					
SMFQ-C	−0.24*	0.14	0.15	0.35**	0.49***	0.35**				
SMFQ-P	0.36***	0.41***	0.37***	0.40***	0.49***	0.60***	0.45***			
CBCL-I	0.31**	0.28**	0.21	0.39***	0.61***	0.78***	0.46***	0.79***		
CBCL-E	0.24*	0.27**	0.21*	0.14	0.08	0.27**	0.06	0.39***	0.44***	

Note: *CBCL-I/E = Child Behavior Checklist–Internalizing/Externalizing; CGI-S = Clinical Global Impression-Severity; NIMH GOCS = National Institutes of Mental Health Global Obsessive-Compulsive Scale; OCI-CV = Obsessive-Compulsive Inventory–Child Version; SCARED-P/C = Screen for Child Anxiety Related Emotional Disorders–Parent/Child Report; SMFQ-P/C = Short Mood and Feelings Questionnaire–Parent/Child Report.*
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

TABLE 4 Goodness-of-Fit Indicators for Children's Yale-Brown Obsessive-Compulsive Scale–II (CY-BOCS-II) Confirmatory Factor Analysis (n = 100)

Model	χ^2	*df*	CFI	RMSEA	SRMR
Model 1[a]	123.13***	34	0.83	0.16	0.08
Model 2[b]	138.20***	34	0.80	0.18	0.09
Model 3	77.68***	27	0.90	0.14	0.08

Note: CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean residual.
[a]*Obsessions factor (items 1–5) and compulsions factor (items 6–10).*
[b]*Interference/severity factor (items 1–3, 6–8) and resistance/control factor (items 4, 5, 9, 10).*
***$p < .001$.

DISCUSSION

We report on the development and psychometric properties of the CY-BOCS-II. Overall, findings supported its use as a reliable and valid measure of obsessive-compulsive symptoms in youth. Reliability was measured by internal consistency, 1-week test-retest reliability, and inter-rater reliability, ranging from good to excellent. Mean scores on measures were slightly higher than in previous studies using the the CY-BOCS, which could be attributable to the expanded scoring range. Indeed, 9 children (9%) had scores higher than 40, which was the ceiling of the original CY-BOCS.

Construct validity also was supported. The measure was strongly associated with other clinician ratings of obsessive-compulsive symptom severity and with child self-reports of obsessive-compulsive symptom, frequency, and distress. Only modest relations were found with anxiety symptoms in general, which supports the ability of the CY-BOCS-II to measure OCD specifically, without being significantly influenced by co-occurring anxiety or depression. CY-BOCS-II scores were negatively correlated with child-reported depression severity, although modestly and positively related to parent-rated reports of child depressive symptoms. The inverse correlation with child-rated depression symptoms was somewhat surprising, given the long-established history supporting the linkage between OCD and depression in youth and adults.[30-32] However, this could reflect the independence of the measure from depression and/or be attributable to the method of assessing depression through self-report.

TABLE 5 Geomin Rotated Factor Loadings and Eigenvalues for the Children's Yale-Brown Obsessive-Compulsive Scale–II (CY-BOCS-II) Based on a 2-Factor Solution Through Exploratory Factor Analysis

CY-BOCS-II Item	Factor 1	Factor 2
1. Time on obsessions	**0.78**	−0.01
2. Obsession-free interval	**0.65**	−0.01
3. Control over obsessions	**0.61**	0.25
4. Distress associated with obsessions	**0.74**	0.11
5. Interference from obsessions	**0.76**	−0.02
6. Time on compulsions	**0.72**	−0.10
7. Resistance against compulsions	−0.01	**0.81**
8. Control over compulsions	0.32	**0.70**
9. Distress if compulsions prevented	**0.78**	0.13
10. Interference from compulsions	**0.74**	0.001
Eigenvalues	5.10	1.42

Note: The highest loadings for each item appear in boldface type.

The CY-BOCS-II factor structure was not consistent with its adult counterpart. Rather, a 2-factor structure was found, in which 8 items assessing interference and distress related to obsessions and compulsions, in addition to control against obsessions, loaded on 1 factor. The second factor included 2 items assessing resistance and control against compulsions. The resistance and control items have historically loaded on different factors; this could reflect difficulty by the affected individual and/or rater in assessing/conceptualizing these questions, resulting in divergent factor structures. Indeed, the exploratory factor analysis results might not fit into current theoretical models, likely because of the poor fit of items 7 and 8 (resistance and control), so these item properties should be examined in future research. In addition, removing the resistance against obsessions item might have altered the scale composition in such a manner that the factor structure now reflects obsessive-compulsive severity and compulsion resistance/control. On balance, it is worth noting that the CY-BOCS (and the Y-BOCS) factor structure has varied across studies,[33] which could reflect different sample characteristics.

The present study had several limitations. First, a structured diagnostic interview was not performed. However, clinical diagnostic interviews followed by consensus diagnostic procedures conducted by several experienced psychiatrists and psychologists in OCD were used to verify primary and co-occurring diagnoses. Second, the sample was fairly homogeneous for ethnicity-racial variables. Further investigations are warranted in diverse samples and in translations into languages other than English. Third, not all youths had retest or inter-rater administrations. Within these limitations, this is the first report on the development and psychometric properties of the CY-BOCS-II, with initial findings demonstrating promising results.

Accepted June 22, 2018.

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Funding for this study came, in part, to Dr. Wu, from the National Institute of Mental Health (NIMH; 2T32MH073517). The opinions expressed in this article are those of the authors and do not necessarily represent the official views of the NIMH.

Drs. Wu and McGuire served as the statistical experts for this research.

The contributions of Nicole McBride, MPH, Nikki Myers, BA, and Teresa Goff, BA, of the University of South Florida, are gratefully acknowledged.

Disclosure: Dr. Storch has received research support from the National Institutes of Health (NIH), the Red Cross, the Greater Houston Community Foundation, the Rebuild Texas Foundation, Mental Health America—Houston, and the Texas Education Coordinating Board. He has served as a consultant for Levo Pharmaceuticals. He has received book royalties from Elsevier, Lawrence Erlbaum, Springer, Jessica Kingsley, and the American Psychological Association. Dr. McGuire has received research support from the Tourette Association of America, the American Academy of Neurology, and the American Brain Foundation. He has served as a consultant for Bracket has received book royalties from Elsevier. Dr. Wu has received grant or research support from the NIMH. Dr. McIngvale has received funding from the Red Cross. Dr. Goodman has received research support from the NIH, Biohaven, and the Simons Foundation. He has served as a consultant for Biohaven. Drs. Hamblin, Schneider, Rufino, Rasmussen, and Price and Ms. Cepeda report no biomedical financial interests or potential conflicts of interest.

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0890-8567/$36.00/©2018 American Academy of Child and Adolescent Psychiatry

https://doi.org/10.1016/j.jaac.2018.05.029

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