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Tic-Related Obsessive-Compulsive Disorder (OCD): Phenomenology and Treatment Outcome in the Pediatric OCD Treatment Study II

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Abstract

Objective—Prior research has shown that youth with co-occurring tic disorders and obsessive-compulsive disorder (OCD) may differ from those with non-tic-related OCD in terms of clinical characteristics and treatment responsiveness. A broad definition of “tic-related” was used to examine whether children with tics in the Pediatric OCD Treatment Study II differed from those without tics in terms of demographic and phenomenological characteristics and acute treatment outcome.

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Method—Participants were 124 youth aged 7-17 years with a primary diagnosis of OCD who were partial responders to an adequate serotonin reuptake inhibitor (SRI) trial. Participants were randomized to medication management, medication management plus instructions in cognitive behavioral therapy (CBT), or medication management plus full CBT. Tic status was based on the presence of motor and/or vocal tics on the Yale Global Tic Severity Scale.

Results—Tics were identified in 53% of the sample. Those with tic-related OCD did not differ from those with non-tic-related OCD in terms of age, family history of tics, OCD severity, OCD-related impairment, or comorbidity. Those with tics were responded equally in all treatment conditions.

Conclusion—Tic-related OCD was very prevalent using a broad definition of tic status. Results suggest that youth with this broad definition of tic-related OCD do not have increased OCD severity or inference, higher comorbidity rates or severity, or worsened functioning and support the use of CBT in this population. This highlights the importance of not making broad assumptions about OCD symptoms most likely to occur in an individual with comorbid tics. Clinical trial registration information--Treatment of Pediatric OCD for SRI Partial Responders; [http://clinicaltrials.gov/show/; NCT00074815](http://clinicaltrials.gov/show/NCT00074815).

Keywords

tic; obsessive compulsive disorder; tic-related OCD; treatment

Introduction

Obsessive-compulsive disorder (OCD) is clinically heterogeneous. A new diagnostic subtype for OCD in *DSM-5* is tic-related OCD, which occurs in individuals with a lifetime history of tic disorder.¹ This subtype is estimated to occur in 10-40% of OCD cases diagnosed in childhood.²

Tic-related OCD may differ from non-tic-related OCD across a number of demographic and phenomenological variables. Those with tic-related OCD may be more likely to be male^{3,4} and have an earlier age of OCD onset.^{4,5} Data also suggest that tic-related OCD is highly familial.⁶ In terms of co-occurring psychopathology, data are mixed. One study suggested that those with tic-related OCD exhibit more aggression problems than those with OCD alone.⁷ Another study found no such effect,⁸ and in that study, those with tic-related OCD were less likely than those with OCD alone to have problems with attention-deficit/hyperactivity disorder (ADHD).

Although those with tic-related OCD have been characterized as having different OCD symptoms,² data are mixed, especially in youth samples. Zohar et al.⁹ reported that obsessional content discriminated adolescents with tic-related OCD from adolescents with OCD, in that those with tic-related OCD endorsed more aggressive obsessions while others in the sample endorsed more sexual obsessions. In contrast, in a sample of children and adolescents,¹⁰ topography of compulsions, but not obsessions, discriminated those with tic-related OCD. Individuals with tic-related OCD were more likely to endorse ordering, hoarding, and washing/cleaning compulsions. In a third study examining OCD symptom

topography in youth, those with tic-related OCD were more likely to endorse contamination obsessions, sexual obsessions, and counting compulsions than the rest of the sample.¹¹

Thus, although tic-related OCD has been defined, in part, by differences in OCD symptom topography, data in youth samples are widely divergent. The reasons for these discrepancies are unclear and could potentially be attributable to method variance (e.g., categorization of tic-related OCD or OCD symptom subtypes¹²) or recruitment biases (e.g., secondary analyses of studies focused on OCD vs. tics). However, one consistent finding across the aforementioned and other⁸ studies is that those with tic-related OCD do not differ in terms of OCD symptom severity.

It also remains unclear if tics are associated with a differential response to OCD treatment. Some have argued that tic-related OCD necessitates adaptation of pharmacotherapy and cognitive-behavioral therapy (CBT) based on the premise that these individuals are harder to treat, more susceptible to premature termination, and more likely to be treatment refractory.¹³ For example, Mansueto and Keuler¹³ advocated for augmentation of serotonin reuptake inhibitor (SRI) treatment with low-dose neuroleptics or alpha 2 agonists and CBT modification to include longer sessions, more rote practice of skills, relaxation techniques, and substitution strategies. This question of differential treatment response has been examined in only a few studies. In the POTS trial, those with tics did not benefit from sertraline monotherapy (i.e., equivalent response between sertraline and placebo), whereas those without tics did benefit from sertraline monotherapy.¹⁴ In that same study, no difference was found in response to CBT or combined treatment. Two other studies suggest that youth with OCD and tics equally benefit from CBT alone.^{15,16} Medication trials have shown that tic-related OCD is associated with a lower response rate to paroxetine¹⁷ and fluvoxamine.¹⁸ Notably, some data suggest that those with tic-related OCD may be more likely than those without tic-related OCD to respond to neuroleptic augmentation of SRIs.¹⁹

This collective body of previous research has almost exclusively addressed the relationship between tics and OCD by defining tic status as meeting *DSM* criteria for a chronic tic disorder (persistent tic disorder, Tourette syndrome¹). Given the inconsistent findings in the aforementioned research, it is still unclear if the presence of tics in those with OCD has clinical utility in terms of distinct OCD phenomenology and treatment responsiveness.

The use of strict *DSM* diagnostic categories as the basis for psychiatric research has increasingly recognized limitations, such as the marked heterogeneity and co-morbidity of disorders and artificial demarcation between disorders with shared underlying genetic, neurological, and behavioral processes.²⁰ As a consequence, some have advocated for a dimensional approach that includes those who experience significant disorder symptoms but may not meet usual diagnostic criteria.²⁰ Empirical study of these alternative phenotypes may help us better understand etiology and phenomenology and improve treatment.

Previous research indicates that a far greater number of children with OCD have a lifetime history of tics (nearly 60%) than meet full *DSM* criteria for a chronic tic disorder.²¹ This high rate of co-occurrence is thought to be attributable to shared etiology involving dysfunction of the dopamine system and basal ganglia-thalamocortical circuits.^{2,22} Research

increasingly points to the importance of examining subtle or subthreshold motor dysfunction as a way of linking basal ganglia alterations to psychopathology.²³ These “motor phenotypes” have improved understanding of the phenomenology and longitudinal course of other disorders involving basal ganglia dysfunction, such as schizophrenia.²⁴ Applying a similarly broad “motor phenotype” approach may help yield a better understanding of the tic-OCD relationship. Indeed, a recent study that defined pediatric tic-related OCD more inclusively (co-occurrence with chronic tic disorders plus transient tic disorder and tic disorder not otherwise specified [NOS]) found greater error-related brain activity in non-tic-related than tic-related OCD.²⁵

The aims of the current study were to use a broad definition of “tic-related OCD” to examine whether children with tics in the Pediatric OCD Treatment Study II (POTS II)²⁶ differ from those with non-tic-related OCD in terms of demographic and phenomenological characteristics and acute treatment outcome. POTS II was a randomized controlled trial examining the efficacy of CBT augmentation strategies for youth who were partial responders to an optimal SRI dosage. Treatment conditions included medication management (MM), medication management plus CBT augmentation (MM+CBT), and medication management plus instructions in CBT (MM+iCBT). Primary outcomes indicated that those receiving MM+CBT had significantly greater OCD symptom reduction compared to MM alone ($ES = 0.85$) and that those receiving MM+iCBT did not show symptom reduction compared to MM alone ($ES = 0.16$). Importantly, results provided continued support for traditional CBT augmentation in a sample of partial responders and indicate limited support for an abbreviated version of CBT over medication management alone.

Tic-related OCD status was based on identification of tics on a clinician measure (Yale Global Tic Severity Scale [YGTSS]²⁷). Our approach was to see if the mere presence of tics—an easily observable indicator of a putative neurobiological marker—could be clinically informative. We hypothesized that those with tic-related OCD would differ from those without tic-related OCD in terms of age, gender, OCD symptomology, and comorbidity. It was also hypothesized that those with tic-related OCD would exhibit a poorer treatment response compared to those without tic-related OCD.

Method

Study Design

POTS II was a 12-week randomized controlled trial examining the efficacy of CBT augmentation strategies for youth with primary OCD who were partial responders to an optimal SRI dosage. The study rationale, design, methods, baseline sample characteristics, and primary outcomes have been reported elsewhere.^{26,28,29} POTS II participants were recruited from three sites (University of Pennsylvania [UPenn], Duke University, and Brown University) between 2004 and 2009 and randomized to one of three treatment strategies. In medication management only (MM; $n = 42$), participants received seven visits with a study psychiatrist. Visits focused on SRI maintenance, monitoring of clinical status and medication effects, and general encouragement to resist OCD. A second group received medication management as in MM plus CBT augmentation (MM+CBT; $n = 42$) occurring in 14 hourly visits over 12 weeks from a second provider (a study psychologist). The CBT

protocol was based on a published manual³⁰ and consisted of psychoeducation, cognitive training, and exposure with response prevention. The third group received medication management plus CBT augmentation from the same psychiatry provider who also provided instructions in CBT skills (MM+iCBT; n = 40) across seven 45-minute sessions. iCBT included psychoeducation, hierarchy development, and exposure homework but did not include in-session exposures and didactic parent sessions. Study assessments were conducted by independent evaluators (psychologists with PhD degrees), blind to treatment assignment of participants, who received training and supervision as described elsewhere.²⁸

The institutional review board at each site approved the study protocol, and all participants and at least one of their parents provided written informed consent. The Consolidated Standards of Reporting Trials diagram is reported in Franklin et al.²⁶

Participants

POTS II participants were 124 youth between the ages of 7-17 inclusive with a primary diagnosis of OCD according to *DSM-IV* criteria; clinically relevant residual OCD symptoms (score of 16 on the CY-BOCS); partial response to an adequate SRI trial; and current outpatient treatment. Participants were excluded if OCD was not their primary diagnosis and if they had a pervasive developmental disorder (PDD), did not have an adequate SRI trial, had an adequate CBT trial (>10 sessions), were pregnant, had pediatric autoimmune neuropsychiatric disorders associated with strep infection (PANDAS), or were taking more than one SRI concurrently. Eligibility was assessed using a multi-gate procedure.²⁶

For the current study, participants were classified as having either tic-related OCD (Tic +OCD) or OCD without tics based on clinician identification of tics on the YGTSS, which was administered by the independent evaluator. Clinicians first administered the tic checklist to inquire about current and lifetime presence of tics and then completed a summary item identifying the type of tics endorsed (no tics, motor tics only, vocal tics only, motor and vocal tics). Participants with motor, vocal, and both motor and vocal tics indicated on this YGTSS item were classified as having tic-related OCD. Criteria related to symptom duration and interference were not applied.

Measures

Demographics: Basic demographic information about child's gender, age, and family history of tics and OCD were collected via parental report.

Anxiety Disorders Interview Schedule for Children (ADIS-C/P)³¹: The ADIS-C/P is a psychometrically sound, structured diagnostic interview designed to assess *DSM-IV* childhood anxiety disorders and related mood and behavior disorders.

Yale Global Tic Severity Scale (YGTSS)²⁷: The YGTSS contains a checklist of simple and complex motor and vocal tics and a 5-item clinician-rated form of tic severity. Separate severity ratings are completed for motor and vocal tics; ratings are combined for a total tic severity score (range: 0-50). The YGTSS has demonstrated good convergent validity, discriminant validity, and inter-rater reliability.³²

Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS)³³: The CY-BOCS contains a checklist of obsessions and compulsions as well as a 10-item clinician-rated form of OCD symptom severity that incorporates clinical observation, parent, and child report. Adequate reliability, validity, and sensitivity to change have been demonstrated.³³

National Institutes of Mental Health – Global Obsessive Compulsive Scale (NIMH-GOCS)³⁴: This measure assesses OCD severity on a 1 (“minimal”) to 15 (“very severe”) scale based on symptom severity and functional impairment.

Clinical Global Impressions – Improvement Scale (CGI-I)³⁵: This form requires the clinician to classify the degree to which a patient has improved compared to an earlier point in time. Ratings range from 1 (“very much improved”) to 7 (“very much worse”). This scale has been used successfully in patients with OCD.³⁶

Children's OCD Impact Scale (COIS)³⁷: Parallel child- and parent-report forms assess the impact of OCD on psychosocial functioning. Subscales measure Social Impact (7 items), School Impact (6 items), and Home/Family Impact (7 items). One additional item allows for a global interference rating. The COIS has demonstrated good internal consistency and convergent validity.³⁷

Children's Depression Inventory (CDI)³⁸: The CDI is a 27-item child self-report measure of depressive symptomatology over the preceding two weeks and has shown adequate reliability and concurrent validity.³⁸ T scores are age- and gender-based; scores above 65 indicate clinically significant symptoms.

Multidimensional Anxiety Scale for Children (MASC)³⁹: Parallel child and parent-report measure emotional, cognitive, physical, and behavioral symptoms of anxiety with acceptable psychometric properties.³⁹ T scores greater than 65 indicate clinically significant symptoms.

Conners' Parent Rating Scale-Revised—Long Version (CPRS-R-L)⁴⁰: The CPRS-R-L is a psychometrically sound, 80-item parent-report measure of ADHD symptoms and oppositional behavior. T scores greater than 60 indicate clinically relevant symptoms.

Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire (PQ-LES-Q)⁴¹: The PQ-LES-Q is a 15-item child self-report scale assessing satisfaction with life across a variety of functional domains. Items are rated from 1 (very poor) to 5 (very good) and summed to generate a total score (higher scores indicate better quality of life). The PQ-LES-Q has demonstrated excellent internal consistency and sensitivity to change during treatment.

Analytic Plan—Potential group differences in terms of demographic variables, OCD symptomatology, and co-occurring psychopathology were examined using descriptive analyses and group comparisons (independent t-tests for continuous variables, Chi-square for categorical variables where all cells had $n \geq 10$, or Fischer's exact test for categorical variables where any cells had $n < 10$) of data collected during the pretreatment baseline evaluation. Treatment response was examined using several approaches. First, Chi-square

analysis was used to examine whether those with tic-related OCD were more likely to prematurely terminate treatment (including investigator-initiated withdrawals and study drops). Second, repeated measures analysis of variance (ANOVA) was used to compare mean CY-BOCS change from pre- to posttreatment for those with and without tic-related OCD within each treatment arm. Third, treatment response status was examined by comparing the rate of participants with and without tics who a) exhibited clinically significant change in CY-BOCS scores (reduction of at least 30%) and b) were classified as “much improved” or better at posttreatment (CGI-I score of 1 or 2). Statistical analyses were performed using SPSS 19 software (IBM).

Results

Tics

Tics were identified in 66 of 124 participants (53.2%). Of those with tics, 27 (40.9%) had motor tics only, 5 (7.6%) had vocal tics only, and 34 (51.5%) had both. Thirty five (53.0%) children with tics had a history of only simple tics, while 31 (47%) had past or current complex tics. Tic severity ratings based on the “worst ever” period of tics were available for 59 children and indicated moderate tic severity (mean YGTSS Total Severity score = 18.38, SD = 11.03, mean YGTSS Motor Severity score = 11.21, SD = 5.99, mean YGTSS Vocal Severity score = 7.10, SD = 6.83). Current tics (i.e., within the past week) were identified in 60 children. YGTSS scores for these 60 children indicated mild current tic severity (YGTSS Total Severity score = 10.3, SD = 8.86, YGTSS Motor Severity score = 6.68, SD = 5.21, YGTSS Vocal Severity score = 3.71, SD = 5.03).

Demographics

Participants did not differ by tic status with respect to age ($t = 0.19, p = .85$), sex ($\chi^2 = 2.21, p = .14$), or family history of tics ($\chi^2 = 0.14, p = .702$) or OCD ($\chi^2 = 0.51, p = .477$; see Table 1).

Baseline Psychopathology

Baseline characteristics are presented in Table 1.

OCD—Mean baseline CY-BOCS scores did not differ by tic status in terms of total severity ($t = 0.04, p = .96$), obsession severity ($t = 0.18, p = .86$), and compulsion severity ($t = 0.30, p = .76$). Rates of specific OCD symptoms endorsed on the CY-BOCS symptom checklist are presented in Figure 1. Those with OCD only were more likely to experience religious obsessions ($\chi^2 = 6.05, p = .014$), washing compulsions ($\chi^2 = 5.15, p = .025$), and ordering compulsions ($\chi^2 = 5.45, p = .020$). No differences were found for other obsession or compulsion categories. Groups did not differ on the NIMH-GOCS ($t = 0.25, p = .81$), COIS-C ($t = 0.91, p = .37$), COIS-P ($t = 0.23, p = .81$), and CGI-S ($t = 0.92, p = .36$).

Comorbidity—The number of ADIS-C/P comorbid psychiatric diagnoses ($\chi^2 = 0.35, p = .54$) and the frequency of specific disorder clusters did not differ by tic status (see Table 1). Comparisons of those with and without tics on dimensional measures of psychopathology revealed no significant differences in the severity of anxiety (MASC-C total: $t = 0.09, p = .$

93; MASC-P total: $t = 0.88, p = .37$), depression (CDI: $t = 0.44, p = .66$), and ADHD symptoms (CPRS ADHD index: $t = 0.26, p = .79$). Global functioning measures also did not differ by tic status (PQ-LES total: $t = 0.75, p = .45$; CGAS: $t = 0.36, p = .72$).

Treatment Response

The frequency of tic-related OCD was found to differ by site ($\chi^2 = 9.12, p = .01$), such that participants were less likely to have tic-related OCD at the University of Pennsylvania (see Table 1). There were no differences in the frequency of tic-related OCD by treatment group (MM: Tic+OCD $n = 25$, OCD $n = 17$; MM+iCBT: Tic+OCD $n = 20$, OCD $n = 20$; MM +CBT: Tic+OCD $n = 21$, OCD $n = 21$; $\chi^2 = 1.01, p = .60$).

Change in study status—Those with tic-related OCD were no more likely to prematurely terminate treatment ($n = 12$) than those without tics ($n = 11$; $\chi^2 = .013, p = .911$). Fischer's exact tests indicated that this equivalent rate of premature termination was consistent within each treatment condition (MM: Tic+OCD $n = 6$, OCD $n = 6, p = .498$; MM +iCBT: Tic+OCD $n = 3$, OCD $n = 3, p = .669$; MM+CBT: Tic+OCD $n = 3$, OCD $n = 2, p = .500$).

CY-BOCS change—Mean CY-BOCS scores for those with and without tics in each treatment condition are presented in Table 2. Repeated measures ANOVA indicated tic status was not associated with differential change on CY-BOCS scores at posttreatment in MM ($F[1, 36] = .015, p = .90$), MM+iCBT ($F[1, 31] = 1.73, p = .19$), or MM+CBT ($F[1, 37] = .006, p = .93$).

Responder status—Those with tic-related OCD were equally likely to experience clinically significant change on the CY-BOCS in all treatment conditions (Fischer's exact tests: MM: Tic+OCD $n = 7$, OCD $n = 5, p = .728$; MM+iCBT: Tic+OCD $n = 3$, OCD $n = 6, p = .259$; MM+CBT: Tic+OCD $n = 11$, OCD $n = 13, p = .749$).

Those with tic-related OCD were equally likely to be classified as “much improved” or better on the CGI-I (Tic+OCD $n = 22$, OCD $n = 22, \chi^2 = 3.05, p = .08$). Fischer's exact tests indicated that this equivalent rate of CGI-I classification was consistent within each treatment condition (MM: Tic+OCD $n = 6$, OCD $n = 4, p = .700$; MM+iCBT: Tic+OCD $n = 4$, OCD $n = 8, p = .157$; MM+CBT: Tic+OCD $n = 12$, OCD $n = 14, p = .550$).

Discussion

The current study used a broad definition of “tic-related OCD” to examine clinical characteristics and acute treatment outcome in youth with tics and OCD who participated in the POTS II trial. Overall, results suggest that those with tic-related OCD were generally no different from those with non-tic-related OCD in terms of demographic characteristics, OCD severity and phenomenology, comorbidity burden, and treatment outcome.

Tic status was classified based on current or lifetime presence of motor and/or vocal tics. Using this definition, tic-related OCD was very prevalent, occurring in 53% of the sample. This is higher than the rate of tic disorders in this sample using ADIS-C/P-defined *DSM-IV*

criteria (15.3%).²⁶ This finding is consistent with prior research suggesting that a high proportion of youth with OCD have a lifetime history of tics, and that definitions that rely on meeting full *DSM* criteria may underestimate tic co-occurrence.²² It is also possible that the high tic rate in this sample reflects a greater prevalence of tics among those with OCD who are SRI partial responders.

Distinct demographic characteristics were not found in the tic-related OCD group. Findings contrast previous research indicating a male preponderance of both tics and tic-related OCD,^{3,4} as well as research suggesting that those with tic-related OCD are more likely to have a first-degree relative with tics.⁸ Discrepancies may reflect the unique nature of this sample. For example, females with tics may be more likely to be SRI partial responders, or parents in this sample may have been less likely to reveal tic history via self-report.

Clinical characteristics generally did not differ in the tic-related OCD group. Consistent with prior research in youth samples,⁸ data indicate that those with tic-related OCD do not have increased OCD severity or interference, higher comorbidity rates or severity, or worsened global functioning. Some differences were found in OCD symptom topography, such that fewer participants in the tic-related OCD group had religious obsessions and washing and ordering compulsions. Whether these differences are clinically meaningful is unclear, especially when compared to prior data that reveal no consistent pattern of OCD content in those with tic-related OCD.⁹⁻¹¹ The convergence of findings seems to suggest that tic-related OCD is not indicative of particular OCD symptom profiles. Clinically, this highlights the importance of not making broad assumptions about the type of OCD symptoms most likely to occur in an individual with comorbid tics.

Tic-related OCD was not associated with differential treatment response. The tic-related OCD group was equally likely to respond in all treatment conditions and was no less likely to be treatment-refractory or terminate prematurely. In contrast to POTS I,¹⁴ tics did not moderate medication management alone, which may be attributable to this sample being youth who were already medication partial-responders, or to the more broad definition of tic-related OCD in the current study. The finding that those with tic-related OCD benefitted equally from CBT interventions is consistent with prior research¹⁴⁻¹⁶ and further supports the use of CBT for youth with tic-related OCD. This also suggests that the new *DSM-5* tic-related OCD specifier may assist clinicians in characterizing OCD but may have less utility in terms of psychotherapy treatment selection. However, the way CBT is delivered may still require clinician expertise in both OCD and tics to ensure appropriate matching of CBT technique to symptoms (e.g., exposures to target core obsessional fears, competing responses to target tics).

Findings contrast some recommendations that those with tic-related OCD need modified CBT.¹³ Our finding is not entirely unexpected given CBT theory, which underlies psychotherapy of both tics and OCD.^{42,43} This theory postulates that both tics and compulsions are maintained by negative reinforcement that occurs when the behavior alleviates the discomfort of private aversive experiences (premonitory urges or obsessions). CBT for OCD targets this process using exposures, which involve intentionally eliciting distress and resisting escape or avoidance behaviors (compulsions) so that natural

habituation can occur. Exposure therapy has been shown to lead to reductions in tics and premonitory urges,⁴⁴ and a similar mechanism is thought to underlie behavior therapy for tics.⁴³ Therefore, if a child with tic-related OCD is struggling with CBT, or if tic and OCD symptoms are difficult to differentiate, modifications that tap CBT change mechanisms may be beneficial. For example, modifications that bolster the likelihood of habituation (e.g., longer sessions, more rote exposure practice) or distress tolerance (e.g., mindfulness) may be more helpful than strategies that counteract habituation or emphasize escape from negative affect (e.g., relaxation).

The current study has several limitations. First, the sample composition may have introduced ascertainment biases (e.g., partial responders to SRIs may differ from responders in terms of OCD phenomenology, family characteristics, underlying neuropathology, etc.). Second, family history of tics and OCD were assessed via parent report rather than more comprehensive family assessments used in genetics studies,⁴⁵ which may not have accurately captured incidence rates. Third, POTS II focused on characterization and treatment of OCD specifically. It is possible that findings would differ in a sample of children presenting with primary tics who have co-occurring OCD, or in those who have another primary co-occurring disorder. It is also possible that characteristics that are unique to tic-related OCD were not measured, and that these factors may have an impact on treatment outcome (e.g., neurobiological functioning²⁵). Finally, youth with tics+OCD were less common at the UPenn site, which is likely attributable to that site's recruiting for a concurrent study on tics.

Recent shifts in the diagnostic classification of tic-related OCD, coupled with the push for more dimensional psychopathology research, suggest several avenues for future research. Comparing the clinical utility of different operational definitions of the tic-related OCD phenotype may be useful. It is possible that different variants of tic history, ranging from past mild transient tics to severe chronic tics, carry distinct implications for OCD clinical presentation, treatment outcome, and neurobiological and genetic underpinnings. It is also possible that other clinical features of the tic-OCD “gray area” drive clinical differences in tic-related OCD, rather than just absence or presence of tics (e.g., OCD symptoms not purely related to harm avoidance, such as sensory phenomena or incompleteness⁴⁶). Methodology incorporating dimensional measures tapping multiple levels of analysis may also help to better elucidate the relationship between tics and OCD. Although the current results support the use of CBT for tic-related OCD, improved understanding of the tic-OCD overlap may lead to beneficial treatment adaptations.

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References

1. Association AP. Diagnostic and statistical manual of mental disorders. 5th ed.. American Psychiatric Publishing; Arlington, VA: 2013.

2. Leckman JF, Denys D, Simpson HB, et al. Obsessive-compulsive disorder: a review of the diagnostic criteria and possible subtypes and dimensional specifiers for DSM-V. *Depress Anxiety*. 2010; 27:507–527. [PubMed: 20217853]
3. Leckman JF, Grice DE, Barr LC, et al. Tic-related vs. non-tic-related obsessive compulsive disorder. *Anxiety*. 1994; 1:208–215. [PubMed: 9160576]
4. Mataix-Cols D, Rauch SL, Manzo PA, Jenike MA, Baer L. Use of factor-analyzed symptom dimensions to predict outcome with serotonin reuptake inhibitors and placebo in the treatment of obsessive-compulsive disorder. *Am J Psychiatry*. 1999; 156:1409–1416. [PubMed: 10484953]
5. Diniz JB, Rosario-Campos MC, Hounie AG, et al. Chronic tics and Tourette syndrome in patients with obsessive-compulsive disorder. *J Psychiatr Res*. 2006; 40:487–493. [PubMed: 16289552]
6. do Rosario-Campos MC, Leckman JF, Curi M, et al. A family study of early-onset obsessive-compulsive disorder. *Am J Med Genet B Neuropsychiatr Genet*. 2005; 136B:92–97. [PubMed: 15892140]
7. Ivarsson T, Melin K, Wallin L. Categorical and dimensional aspects of co-morbidity in obsessive-compulsive disorder (OCD). *Eur Child Adolesc Psychiatry*. 2008; 17:20–31. [PubMed: 18004647]
8. Lewin AB, Chang S, McCracken J, McQueen M, Piacentini J. Comparison of clinical features among youth with tic disorders, obsessive-compulsive disorder (OCD), and both conditions. *Psychiatry Res*. 2010; 178:317–322. [PubMed: 20488548]
9. Zohar AH, Pauls DL, Ratzoni G, et al. Obsessive-compulsive disorder with and without tics in an epidemiological sample of adolescents. *Am J Psychiatry*. 1997; 154:274–276. [PubMed: 9016283]
10. Hanna GL, Piacentini J, Cantwell DP, Fischer DJ, Himle JA, Van Etten M. Obsessive-compulsive disorder with and without tics in a clinical sample of children and adolescents. *Depress Anxiety*. 2002; 16:59–63. [PubMed: 12219336]
11. Storch EA, Stigge-Kaufman D, Marien WE, et al. Obsessive-compulsive disorder in youth with and without a chronic tic disorder. *Depress Anxiety*. 2008; 25:761–767. [PubMed: 17345600]
12. McKay D, Abramowitz JS, Calamari JE, et al. A critical evaluation of obsessive-compulsive disorder subtypes: symptoms versus mechanisms. *Clin Psychol Rev*. 2004; 24:283–313. [PubMed: 15245833]
13. Mansueto CS, Keuler DJ. Tic or compulsion?: It's Tourettic OCD. *Behav Modif*. 2005; 29:784–799. [PubMed: 16046664]
14. March JS, Franklin M, Leonard H, et al. Tics moderate treatment outcome with sertraline but not cognitive-behavior therapy in pediatric obsessive-compulsive disorder. *Biol Psychiatry*. 2007; 61:344–347. [PubMed: 17241830]
15. Storch EA, Merlo LJ, Larson MJ, et al. Impact of comorbidity on cognitive-behavioral therapy response in pediatric obsessive-compulsive disorder. *J Am Acad Child Adolesc Psychiatry*. 2008; 47:583–592. [PubMed: 18356759]
16. Keeley ML, Storch EA, Merlo LJ, Geffken GR. Clinical predictors of response to cognitive-behavioral therapy for obsessive-compulsive disorder. *Clin Psychol Rev*. 2008; 28:118–130. [PubMed: 17531365]
17. Geller DA, Biederman J, Stewart SE, et al. Impact of comorbidity on treatment response to paroxetine in pediatric obsessive-compulsive disorder: Is the use of exclusion criteria empirically supported in randomized clinical trials? *J Child Adolesc Psychopharmacol*. 2003; 13:19–29.
18. McDougle CJ, Goodman WK, Leckman JF, Barr LC, Heninger GR, Price LH. The efficacy of fluvoxamine in obsessive-compulsive disorder: effects of comorbid chronic tic disorder. *J Clin Psychopharmacol*. 1993; 13:354–358. [PubMed: 8227493]
19. Bloch M, Landeros-Weisenberger A, Kelmendi B, Coric V, Bracken M, Leckman J. A systematic review: Antipsychotic augmentation with treatment refractory obsessive compulsive disorder. *Mol Psychiatry*. 2006; 11:622–632. [PubMed: 16585942]
20. Cuthbert BN, Insel TR. Toward the future of psychiatric diagnosis: the seven pillars of RDoC. *BMC medicine*. 2013; 11:126. [PubMed: 23672542]
21. Leonard HL, Lenane MC, Swedo SE, Rettew DC, Gershon ES, Rapoport JL. Tics and Tourette's Disorder: A 2- to 7-Year Follow Up of 54 Obsessive-Compulsive Children. *Am J Psychiatry*. 1992; 149:1244–1251. [PubMed: 1503140]

22. Leonard HL, Swedo SE, Lenane M, et al. A 2- to 7-year follow-up study of 54 obsessive-compulsive children and adolescents. *Arch Gen Psychiatry*. 1993; 50:429–439. [PubMed: 8498877]
23. Bakker PR, Wichers M, van Harten PN, Myin-Germeys I, Delespaul P, van Os J. Novel directions for psychiatric diagnosis: from psychopathology to motor function to monitoring technology. *Epidemiol Psychiatric Sci*. 2013; 22:289–295.
24. Mittal VA, Walker EF. Movement abnormalities predict conversion to Axis I psychosis among prodromal adolescents. *J Abnorm Psychol*. 2007; 116:796–803. [PubMed: 18020725]
25. Hanna GL, Carrasco M, Harbin SM, et al. Error-related negativity and tic history in pediatric obsessive-compulsive disorder. *J Am Acad Child Adolesc Psychiatry*. 2012; 51:902–910. [PubMed: 22917203]
26. Franklin ME, Sapyta J, Freeman JB, et al. Cognitive behavior therapy augmentation of pharmacotherapy in pediatric obsessive-compulsive disorder: The Pediatric OCD Treatment Study II (POTS II) randomized controlled trial. *JAMA*. 2011; 306:1224–1232. [PubMed: 21934055]
27. Leckman JF, Riddle MA, Hardin MT, et al. The Yale global tic severity scale: Initial testing of a clinician-rated scale of tic severity. *J Am Acad Child Adolesc Psychiatry*. 1989; 28:566–573. [PubMed: 2768151]
28. Freeman J, Choate-Summers M, Garcia A, et al. The Pediatric Obsessive-Compulsive Disorder Treatment Study II: rationale, design and methods. *Child Adolesc Psychiatry Ment Health*. 2009; 3:4. [PubMed: 19183470]
29. Freeman J, Sapyta J, Garcia A, et al. Still Struggling: characteristics of youth with OCD who are partial responders to medication treatment. *Child Psychiatry Hum Dev*. 2011; 42:424–441. [PubMed: 21484416]
30. March J.; Mulle, K. *OCD in Children and Adolescents: A Cognitive-Behavioral Treatment Manual*. Guilford Press; New York: 1998.
31. Silverman, WK.; Albano, AM. *Anxiety disorders interview schedule for DSM-IV*. Psychological Corporation; San Antonio: 1996.
32. Storch EA, Murphy TK, Geffken GR, et al. Reliability and validity of the Yale Global Tic Severity Scale. *Psychol Assess*. 2005; 17:486–491. [PubMed: 16393016]
33. Scahill L, Riddle MA, McSwiggan-Hardin M, et al. Children's Yale-Brown Obsessive-Compulsive Scale: Reliability and validity. *J Am Acad Child Adolesc Psychiatry*. 1997; 36:844–852. [PubMed: 9183141]
34. Murphy, DL.; Pickar, D.; Alterman, LS. Methods for the quantitative assessment of depressive and manic behavior.. In: Burdock, EL.; Sudilovsky, A.; Gershon, S., editors. *The Behavior of Psychiatric Patients*. Marcel Dekker, Inc.; New York: 1982. p. 355-392.
35. Guy, W. *The ECDEU Assessment Manual for Psychopharmacology-Revised*. Department of Health, Education, and Welfare (DHEW); Rockville, MD: 1976. The Clinical Global Impression scale..
36. Wilhelm S, Steketee G, Fama JM, Buhlmann U, Teachman BA, Golan E. Modular Cognitive Therapy for Obsessive-Compulsive Disorder: A Wait-List Controlled Trial. *J Cogn Psychother*. 2009; 23:294–305. [PubMed: 21072138]
37. Piacentini J, Bergman RL, Keller M, McCracken J. Functional impairment in children and adolescents with obsessive-compulsive disorder. *J Child Adolesc Psychopharmacol*. 2003; 13:S61–S69. [PubMed: 12880501]
38. Kovacs, M. *Children's Depression Inventory Manual*. Multi-Health Systems, Inc.; North Tonawanda, NY: 1992.
39. March JS, Parker J, Sullivan K, Stallings P, Conners K. The Multidimensional Anxiety Scale for Children (MASC): factor structure, reliability, and validity. *J Am Acad Child Adolesc Psychiatry*. 1997; 36:554–565. [PubMed: 9100431]
40. Conners, CK. *Conners' Rating Scales-Revised: Instruments for Use with Children and Adolescents*. Mutli-Health Systems; North Tonawanda, NY: 1997.
41. Endicott J, Nee J, Yang R, Wohlberg C. Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire (PQ-LES-Q): reliability and validity. *J Am Acad Child Adolesc Psychiatry*. 2006; 45:401–407. [PubMed: 16601644]

42. Foa EB, Kozak MJ. Emotional processing of fear: Exposure to corrective information. *Psychol Bull.* 1986; 99:20–35. [PubMed: 2871574]
43. Capriotti MR, Brandt BC, Turkel JE, Lee HJ, Woods DW. Negative reinforcement and premonitory urges in youth with Tourette syndrome: An experimental evaluation. *Behav Modif.* 2014; 38:276–296. [PubMed: 24752420]
44. Verdellen CW, Hoogduin CA, Kato BS, Keijsers GP, Cath DC, Hoijtink HB. Habituation of premonitory sensations during exposure and response prevention treatment in Tourette's syndrome. *Behav Modif.* 2008; 32:215–227. [PubMed: 18285507]
45. Grados MA, Walkup J, Walford S. Genetics of obsessive-compulsive disorders: new findings and challenges. *Brain Dev.* 2003; 25:S55–61. [PubMed: 14980374]
46. da Silva Prado H, do Rosario MC, Shavitt RG, Miguel EC. Sensory phenomena, 'just right', and 'not just right' experiences in OD patients: Looking for consensus. *CNS Spectrums.* 2007; 12:95–96. [PubMed: 17375447]

Figure 1.

Types of obsessive-compulsive symptoms endorsed on Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS) in Tic + OCD (obsessive-compulsive disorder) and OCD groups. * $p < .05$

Table 1

Baseline Characteristics

	Tic+OCD (<i>n</i> = 66)	OCD (<i>n</i> = 58)	<i>p</i>
Study center			
Brown University	31	17	$\chi^2 = 9.12, p = .01^{**}$
Duke University Medical Center	21	14	
University of Pennsylvania	14	27	
Age, mean (SD)	13.55 (2.78)	13.65 (2.77)	$t = 0.19, p = .85$
Sex, male (%)	35 (53.0%)	23 (39.6%)	$\chi^2 = 2.21, p = .14$
Weeks on SRI, mean (SD)	84.42 (81.68)	64.03 (SD = 60.93)	$t = 1.55, p = .12$
Family history of tics	7	8	Fishers exact $p = .457$
Family history of OCD	16	12	Fishers exact $p = .311$
OCD baseline severity			
CY-BOCS Total, mean (SD)	24.86 (4.29)	24.82 (4.80)	$t = 0.048, p = .96$
CY-BOCS obsession total, mean (SD)	11.89 (2.52)	11.98 (2.92)	$t = 0.18, p = .86$
CY-BOCS compulsion total, mean (SD)	12.96 (2.24)	12.84 (2.48)	$t = 0.30, p = .76$
NIMH-GOCS, mean (SD)	9.58 (1.63)	9.66 (1.94)	$t = 2.47, p = .81$
Clinical Global Impression Severity score, mean (SD)	4.85 (0.89)	5.00 (0.90)	$t = 0.92, p = .36$
COIS-Parent, mean (SD)	48.51 (8.90)	50.38 (11.43)	$t = 0.90, p = .37$
COIS-Child, mean (SD)	53.71 (11.88)	53.13 (13.29)	$t = 0.23, p = .82$
Baseline comorbidities			
Any (excluding tics)	41 (62.1%)	33 (56.8%)	$\chi^2 = 0.35, p = .55$
ADHD	14 (21.2%)	13 (22.4%)	$\chi^2 = 0.26, p = .87$
Anxiety/mood	30 (45.5%)	25 (43.1%)	$\chi^2 = 0.06, p = .79$
ODD	1 (0.01%)	1 (0.01%)	$\chi^2 = 0.008, p = .92$
Dimensional measures of comorbidity			
MASC-C Total	50.13 (12.55)	49.92 (12.88)	$t = 0.09, p = .93$
MASC-P Total	52.15 (20.08)	48.80 (17.45)	$t = 0.88, p = .37$
CPRS ADHD Index	65.40 (11.98)	64.74 (13.25)	$t = 0.26, p = .79$
CDI Total	52.53 (10.97)	51.50 (11.83)	$t = 0.44, p = .66$
CGAS	53.02 (9.38)	52.36 (11.06)	$t = 0.36, p = .72$
PQ-LES Total	50.62 (9.21)	52.06 (9.73)	$t = 0.75, p = .45$

Note: ADHD = attention-deficit/hyperactivity disorder; CDI = Children's Depression Inventory; CGAS = Children's Global Assessment Scale; COIS = Children's OCD Impact Scale; CPRS = Conners' Parent Rating Scale-Revised—Long Version; CY-BOCS = Children's Yale-Brown Obsessive Compulsive Scale; MASC-C = Multidimensional Anxiety Scale for Children, Child-Report; MASC-P = Multidimensional Anxiety Scale for Children, Parent-Report; NIMH-GOCS = National Institutes of Mental Health – Global Obsessive Compulsive Scale; OCD = obsessive-compulsive disorder; ODD = oppositional defiant disorder; PQ-LES = Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire; SRI = serotonin reuptake inhibitor.

Table 2

Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS) Scores at 12 Weeks by Treatment Group and Tic Disorder Status.

Treatment Group	<i>n</i>	Baseline Mean (SD)	Week 12 Mean (SD)
MM – Tic	17 (14 at 12 week)	23.2 (5.4)	19.5 (8.4)
MM + Tic	25 (24 at 12 week)	25.1 (4.8)	22.2 (7.0)
iCBT –Tic	19 (17 at 12 week)	26.4 (5.2)	19.2 (8.0)
iCBT + Tic	20 (17 at 12 week)	25.3 (3.7)	21.5 (6.5)
COMB – Tic	21 (20 at 12 week)	24.7 (3.5)	14.6 (9.1)
COMB + Tic	21 (19 at 12 week)	24.2 (4.3)	13.9 (7.8)

Note: CBT = cognitive-behavioral therapy; COMB = CBT and medication management treatment; iCBT = medication management plus instructions in CBT; MM = medication management only.