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Comparison of clinical features among youth with tic disorders, obsessive-compulsive disorder (OCD), and both conditions

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Abstract

The comorbidity of Tic Disorders (TD) and Obsessive-Compulsive Disorder (OCD) has long been recognized in the clinical literature and appears to be bidirectional, affecting 20% to 60% of individuals with each disorder. Coffey et al. (1998) found that adults with TD+OCD had a more severe comorbidity profile than adults with OCD or TD alone. This exploratory study in children attempts to evaluate whether heightened diagnostic severity, increased comorbidity load, and lower functioning is more commonplace in youth with TD+OCD in comparison to either syndrome alone. Participants were 306 children (seeking clinical evaluation) with TD, OCD, or TD+OCD. Assessment consisted of a diagnostic battery (including structured diagnostic interviews and standardized parent-report inventories) to evaluate diagnostic severity, comorbid psychopathology, behavioral and emotional correlates, and general psychosocial functioning. Data from this study sample were not supportive of the premise that youth with both a tic disorder and OCD present with elevated diagnostic severity, higher risk-for or intensity-of comorbidity, increased likelihood of externalizing/internalizing symptomatology, or lower broad-based adaptive functioning. The OCD group had elevated rates of comorbid anxiety disorders and ADHD and ODD were more prevalent among youth in the TD group. The three groups also differed on key demographic variables. Our findings suggest that, in contrast to adults, TD+OCD in children and adolescents does not represent a more severe condition than either disorder alone on the basis of diagnostic comorbidity, symptom severity, or functional impairment.

Keywords

OCD; Obsessive Compulsive Disorder; Tourette's; Tics; comorbidity; child

1. Introduction

The comorbidity of tic disorders (TD) such as Tourette's Disorder and Chronic Motor Tic Disorder with Obsessive-Compulsive Disorder (OCD) has long been recognized in the

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clinical literature. The association appears to be bidirectional, with 20% to 60% of TD patients meeting criteria for OCD, and 20% to 38% of children with OCD reporting comorbid tics (Swedo et al. 1989; Riddle et al. 1990; Hanna 1995; Coffey et al. 2000; Eichstedt and Arnold 2001; Dickel et al., 2008; Ivarsson et al., 2008). Clinical correlates shared by OCD and TD include juvenile onset, a chronic fluctuating course, and familial occurrence (Coffey et al. 1998). Clinical presentations share characteristics including repetitive behaviors, intrusive thoughts and sensations, and deficits in behavioral inhibition. Moreover, both conditions are associated with neuroanatomical dysfunction in overlapping neurocortical systems including the basal ganglia, thalamus, and frontal lobes (Baxter et al. 1990; Coffey et al., 1998; Sheppard et al. 1999; de Mathis et al., 2008). The high rate of comorbidity between tic disorders and OCD have often made it difficult to clearly understand the unique and shared clinical features that exist between these related conditions.

Family studies have suggested that tic disorders and OCD represent variable expression of the same underlying risk factors. In general, research has supported a stronger familial component in child-onset cases of OCD in comparison with adult-onset cases; elevated rates of both OCD and tic disorders are found among the first-degree relatives of child-onset OCD probands (Riddle et al. 1990; Leonard et al. 1992). Additionally, research suggests that younger onset of OCD symptoms are associated with higher familial loading for OCD and TD symptoms in first degree relatives (Grados et al., 2001). Such evidence has led to suggestions that OCD is a heterogeneous condition, with a subset of cases being familial, early-onset, and likely related to tic disorders, others being familial but unrelated to tics, and yet another subgroup appearing to have no family history of either tics or OCD (Pauls et al. 1995). Furthermore, the clinical features observed in cases of TD+OCD may differ from those noted in patients with primary OCD without tics, with the comorbid condition representing a much more clinically heterogeneous subgroup (Como 1995; Miguel et al. 1997; Zohar et al. 1997).

Some adult studies have supported a clinical distinction among the three diagnostic groups, OCD, TD, and TD+OCD. Obsessive-Compulsive Disorder, when accompanied by a tic disorder, has been associated with higher rates of comorbid mood, anxiety, disruptive behavior, and substance use disorders than OCD or TD in the absence of the other (Comings 1994; Coffey et al. 1998; King et al.1999; Cath et al. 2001). Such studies have suggested that TD+OCD is a more severe phenotype than TD or OCD alone, and is often accompanied by multiple comorbidities (Coffey et al., 1998).

Unfortunately, similar studies comparing the psychiatric correlates of these three diagnostic groups (TD+OCD, TD, and OCD) in children and adolescents are less conclusive and more scant. Existing studies have primarily focused on comparing TD+OCD to either OCD or TD (e.g., Hanna et al., 2002; Ivarsson et al., 2008; Storch et al., 2008), and not both. Although extant studies comparing OCD and TD+OCD suggest no differences in the severity of either obsessions or compulsions between the two groups (Hanna et al., 2002; Storch et al., 2008), the types of obsessions and compulsions discriminating the two groups is inconsistent across previous studies (e.g., Zohar et al., 1997; Hanna et al., 2002; Storch et al., 2008). Generally, pediatric findings indicate that both disorders are not only highly comorbid with each other, but with a variety of other psychiatric conditions (Peterson et al., 2001; Lewin et al., 2005; Roessner et al., 2007; Grados et al 2008; Ivarsson et al., 2008). Research has shown that 85% of youngsters with OCD also meet diagnostic criteria for additional DSM-IV disorders including other anxiety disorders, depressive and behavioral disorders, and up to 50% experience multiple comorbid conditions (Geller 2006; Storch et al., 2008; Lewin and Piacentini, 2009). In fact, a recent study of 113 outpatients with primary OCD, conducted by Ivarsson et al. (2008), found that only one out of every five children with OCD presented in

the absence of a co-morbid diagnosis. Similarly, TD rarely exists in isolation, and has been related to a variety of problems including aggressiveness, impulsivity, mood, attentional problems, and anxiety disorders, and poor social skills (King et al., 1999; Gaze et al. 2006).

More evidence, however, needs to be brought forth to substantiate the relevant diagnostic and clinical distinctions between OCD, TD, and TD+OCD in children. In the extant (a) adult research (e.g., Coffey et al., 1998) and (b) child research (comparing TD+OCD to either OCD or TD; e.g., Hanna et al., 2002; Ivarsson et al., 2008; Storch et al., 2008), diagnostic severity, comorbidity, and global functioning provide preliminary markers to distinguish between-group differences. Although there are many factors that may contribute to presentation and prognosis of both tic disorders and OCD, information on diagnostic severity, patterns and strength of comorbidity, and patterns of emotional/behavioral correlates may help elucidate whether combined presentation (TD+OCD) suggests an intensified symptom presentation combined with an increased risk for other common comorbidities. An improved clinical picture of combined TD+OCD in contrast to both singular presentations could help guide future intervention research targeting these youth.

1.1 Study aims and hypothesis

Consequently, the purpose of this study was to extend the findings of Coffey et al. 1998 to children by examining severity and relevant clinical correlates in youngsters with OCD, TD, and TD+OCD. Specifically, this study examined severity differences at (1) a categorical, diagnostic level, (b) based on comorbidity, (c) examining dimensional behavioral/emotional symptoms, and (d) in terms of overall functioning. Whereas Coffey et al. (1998) reported on differences in common adult comorbidities (e.g., Bipolar Disorder, Panic Disorder, Substance Abuse, Major Depression) among these groups, we compared the three diagnostic groups on those psychiatric disorders most common in children along with relevant demographic and other psychiatric variables.

The authors hypothesized that, consistent with findings in adults by Coffey et al. (1998) and Tukel et al. (2002), the comorbid group would demonstrate elevated symptom severity, increased likelihood of additional comorbidities, higher incidence of clinically significant behavioral/emotional problems, and diminished overall functioning in comparison to youth with only a TD or only OCD.1

2. Methods

2.1 Participants

Participants were drawn from a consecutive series of children undergoing diagnostic evaluation at an urban university hospital based clinic specializing in the diagnosis and treatment of childhood anxiety, OCD, and tic disorders. From this pool, we selected those subjects (n = 306) meeting full *DSM-IV-TR* (American Psychiatric Association [APA], 2000) criteria for a diagnosis of OCD (n = *233*), Tourette's Disorder or Chronic Motor Tic Disorder (n = 40), or both OCD and TD (n = 33). It is noteworthy that the group sizes are unbalanced: 40 youth with TD-only, 206 youth with OCD-only and 33 youth with TD +OCD. Among participants with a Tic disorders diagnosis, 57 subjects met DSM-IV criteria for Tourette's Disorder, and 16 for Chronic Motor Tic Disorder. Youth with Transient and Vocal Tic Disorders were excluded in order to obtain a more homogenous sample. Self-identification of ethnicity was as follows for the entire sample: 77% White/Caucasian, along with 8.4% of the participants identifying as multiracial, 5.2% as Latino, 3.6% as Asian-American, 2% as Black/African-American, and 0.4% as Native American.

[1]Please note: Only OCD (or only TD) does not exclude the potential of other non-tic and non-OCD comorbidites.

2.2 Procedures

At the clinical intake, the Anxiety Disorder Interview Schedule for *DSM-IV*: Child and Parent versions (ADIS for *DSM-IV*: C/P; Silverman and Albano, 1996) was administered to each child and his or her parent(s), and supplemented with the Tic Disorder module from the Schedule for Affective Disorders and Schizophrenia for Children (KSADS, fifth revision; Orvaschel and Puig-Antich, 1994). The ADIS is a semi-structured interview that assesses the major anxiety, mood, and externalizing *DSM-IV* disorders experienced by school-age children and adolescents. The current version possesses good to excellent test-retest reliability for both symptom scales and diagnoses (Silverman et al., 2001).

The evaluation was conducted by a postdoctoral fellow or clinical psychologist. All diagnosticians were trained by the director or medical director of the clinic (JP or JM) according to procedures recommended by the ADIS manual (Silverman, 2001). Training involved attending a presentation on the administration of the interview, observing and coding a videotaped interview, co-rating multiple live interviews conducted by a trained diagnostician, and finally, assuming satisfactory completion of the earlier steps, conducting at least one interview using the structured interviews while under the live supervision of a trained diagnostician.

A single diagnostician administered the ADIS-C/P and Tic Module of the K-SADS, generally first to the parents and then to the child. While the parents were being interviewed, the child completed the self-report measures under the supervision of a trained research assistant. Following this, the diagnostician interviewed the child while the parent(s) completed questionnaires. In most cases, one primary parent brought the child in for the intake evaluation, although both biological parents and additional adult caregivers sometimes attended and provided information for a significant proportion of youngsters. A licensed clinical child psychologist supervised or conducted each intake evaluation. Prior to the start of the clinical evaluation, parents provided informed consent and youngsters' assent, for the use of their intake data for research purposes.

Diagnosticians reviewed symptom and interference reports from both the parent and child interviews. In the few cases where reports diverged, both respondents were re-interviewed together to clarify their impression; consensus was required for inclusion in this study. Final decisions about diagnoses were based upon the interviewer's clinical judgment as to whether the distress or interference that children and parents reported was clinically significant and attributable specifically to the symptom profile in question. For each assigned diagnosis, interviewers assigned diagnostic severity ratings (using the ADIS Clinician Severity Rating [CSR]) on a 0 (not all) to 8 (very, very much) scale, with 4 (somewhat) being considered the threshold severity required for diagnosis (*cf.* Silverman et al. 1996). In summary, these modules aimed to assure that participants meet DSM-IV-TR diagnostic criteria and presented with at least a moderate level of diagnostic severity. Breakdown of CSR ratings can be found in Table 1.

2.2.1 Reliability of diagnostic and severity ratings—Prior to conducting study evaluations, clinicians were evaluated for inter-rater reliability with taped and live evaluations as part of their certification process (see above). Moreover, for approximately two-thirds of cases, clinical interviewers presented the symptoms reported by the child and parent during the ADIS-IV interview, but not the assigned DSM-IV diagnoses, to a diagnostic review team led by licensed clinicians (JP, JM) experienced in the evaluation and treatment of child anxiety disorders. The review team then generated a consensus DSM-IV diagnostic profile including CSR scores and GAF. This procedure yielded high levels of diagnostic agreement between interviewer and consensus-generated diagnoses, with Kappas ranging from .82-.95 (a subset of findings is reported in Wood et al. 2002). Although not a

formal test of inter-rater reliability, these Kappa levels provide support for the accuracy of the severity ratings and diagnostic procedure used in this study.

2.3 Additional Measures

During the evaluation process, parents also completed a demographics questionnaire as well as the following standardized symptom rating scales for their child: *Child Behavior Checklist* (CBCL; Achenbach, 1994) is a 118-item scale completed by parents that assesses internalizing and externalizing behavioral problems and social and academic competence. The CBCL has been extensively tested and possesses excellent psychometrics and normative data for children in the study range. Broad-band Internalizing, Externalizing, and Total Competence, and narrow-band symptom scales were examined. Youth rated as being two or more standard deviations ($T \geq 70$) above the age and gender corrected means were considered to have clinically significant symptoms (T-scores have a mean of 50 and SD of 10) (Achenbach, 1994).

The *Global Axis of Functioning* (GAF; American Psychiatric Association, 2000) was also scored. Global Axis of Functioning is a numeric scale (0 through 100) used by mental health professionals to rate overall social, occupational and psychological functioning. The Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS; Scahill et al., 1997) is a commonly used measure to assess the presence and severity of obsessive and compulsive symptoms among youth with strong supporting reliability and validity data.2

Age of the child was defined as age at the study assessment. Age of tic or OCD onset was defined as age when the parents and/or child first noticed symptoms to be significant (i.e., time consuming, distressing, and impairing [for OCD]). The clinician administering the ADIS assessed, via the parent, assessed whether first-degree relatives had either (1) been formally diagnosed or (2) exhibited significant and impairing symptoms of OCD or TD.

2.4 Data Analysis

Statistical comparisons were carried out using SPSS 17.0. Clinician rated diagnostic severity is presented categorically for descriptive purposes ($CSR \geq 4$ was required for study inclusion). Group (TD, OCD, and TD+OCD) differences in demographic variables were conducted using analysis of variance (ANOVA), independent t-tests, and Chi-Square (for categorical comparisons). If the initial omnibus test suggested main effects for group differences, respective follow-up Boniferroni posthoc, t-test, or chi-square analyses were conducted in combination with qualitative examination of group means to isolate specific between-group variations. A similar methodology was applied to the identification of group differences in clinical severity, comorbidity, and symptomatic expression. Chi-square analysis was used to identify group differences in diagnosis and in the presence of clinically-significant behavioral/emotional symptoms (as rated on the CBCL; clinical significance defined as $T \geq 70$). The authors used ANOVA to identify group differences in GAF, CBCL subscale scores, and CY-BOCS scores. Data are presented as mean ± standard deviation (M ± SD), unless otherwise specified. Given the exploratory nature of this research, all tests are two-tailed, and statistical significance was defined at the 0.05 level to minimize Type II error.

[2]Unfortunately, the CY-BOCS did not become a component of the standard clinical intake battery until midway through data collection. Consequently, CY-BOCS data are available for 38% of the OCD group, 25% of the TD group, and 50% of the TD+OCD group. Individuals receiving the CYBOCS did not differ in terms or ADIS-CSR, demographic factors, CBCL scores, or other study variables.

3. Results

3.1 Differences in OCD and Tic Severity

Independent *t*-tests were computed to compare (1) tic severity (based on ADIS Clinician Severity Rating [CSR]) between TD and TD+OCD groups and (2) OCD severity (also using the ADIS CSR) between the OCD and TD+OCD groups. The data not support for our hypothesis that TD+OCD group would present with increased tic and OCD severity in comparison with subjects in the respective comparison groups. In fact, no significant differences in respective symptom severities (t = -1.4; df = 30; p = 0.16; and t = 1.1; df = 42;p = 0.26, respectively) were detected (see Table 2). A breakdown of severity ratings are presented in Table 1.

To evaluate whether youth with TD+OCD had more severe OCD symptoms based on the CY-BOCS, ANOVA was utilized. The authors found that youth with TD+OCD had significantly lower levels of both obsessions F (2,106) = 24.8; $p < 0.000$ (M = 8.8; SD = 5.8 for TD+OCD vs. M = 3.3; SD = 5.6 for TD) and compulsions, F (2,106) = 24.3; $p < 0.000$ (M = 11.9; SD = 3.6 for TD+OCD vs. M = 4.2; SD = 5.6 for TD) in comparison to youth with TD. Additionally, we found that youth with TD+OCD had significantly lower levels of obsessions (M = 8.8; SD = 5.8 for TD+OCD vs. M = 12.5; SD = 3.2 for OCD) but equivalent compulsions (M = 11.9; SD = 3.6 for TD+OCD vs. M = 4.2; SD = 5.6 for TD) in comparison to youth with OCD. Youth with TD had significantly lower levels of both obsessions and compulsions that youth with OCD. These data did not suggest that obsessive-compulsive symptoms are elevated in youth with TD+OCD.

3.2 Categorical Comorbidity Differences

In order to further examine whether TD+OCD represented a more severe clinical profile in comparison to the other study groups, the occurrence of comorbid psychopathology was assessed. However, increased prevalence of common comorbidities was not found in the combined TD+OCD group (see Table 3).

Nevertheless, as seen in Table 3, certain between-group differences in diagnostic comorbidity were found between the study groups. A significantly higher percentage of anxiety disorders (Generalized Anxiety Disorder, Social Phobia, Separation Anxiety Disorder, and Specific Phobia) were found in the OCD group: 40% of youth with OCD-only met criteria for a comorbid DSM-IV-TR anxiety disorder in comparison to both the TD (7.5%) and TD+OCD (18.2%) groups, χ^2= (2, 233) = 20.46, p = 0.000). Significant group differences were found for both Generalized Anxiety Disorder (GAD; χ^2= (2, 233) = 13.48, p = 0.001) and Separation Anxiety Disorder (SAD; χ^2= (2, 233) = 5.85, p = 0.05). Both GAD and SAD were more prevalent among youth with OCD. A trend towards significance was also noted in the social phobia group (χ^2= (2, 233) = 5.12, p = 0.06). No significant group differences were found for depressive disorders (Major Depressive Disorder/ Dysthymia).

On the other hand, youth in the TD group had significantly greater occurrences of both Attention Deficit Hyperactivity Disorder (ADHD) and Oppositional Defiant Disorder or Conduct Disorder (ODD/CD). Thirty-five percent of the TD group met diagnostic criteria for ADHD compared to 12.9% in the OCD group (χ^2 (2, 40) = 13.23, p = 0.001). No significant differences in the presence of ADHD were found between the TD and TD+OCD groups. The TD and TD+OCD groups had a higher percentage of ODD/CD than did the OCD group, 17.5 and 12.1% respectively (χ^2 (2, 40) = 7.65, p = 0.02).

3.3 Comorbidity Symptom Load

To further contrast severity differences across study groups, the authors examined whether comorbidity load (as opposed to specific diagnostic patterns discussed in section 3.2) was elevated in the TD+OCD group. Accordingly, the following data are presented in Table 2: the total number of comorbid conditions (based on DSM-IV-TR criteria, accessed via the ADIS), the summed severity of the disorders (combined CSR), and the average severity of comorbidity (mean CSR). The authors found that the number of additional comorbidities, cumulative severity, and average clinical severity in the combined group did not exceed that of the singular diagnosis groups. In fact, no group differences were identified with the exception of slightly higher severity of comorbid symptoms among youth with OCD-only compared to youth with TD-only.

3.4 Differences in Overall Functioning

Contrary to our expectation, no significant differences in clinician-rated global severity scores (GAF; see Table 4) were identified. Among youth with OCD only, the mean GAF = 53.4 (SD = 6.7, range = 30-71); among youth with TD only, M = 55.4 (SD = 10.4; range = 20-80); and in the combined TD + OCD group, M = 51.4 (SD = 5.1, range = 40-61).

3.5 Dimensional assessment of severity

Group differences were assessed dimensionally using symptom ratings from CBCL subscales. Parent ratings of behavioral and emotional problems for youth with TD+OCD did not exceed rating for the other groups. However, parents rated children in the TD group as having less internalizing symptoms and thought problems (based on CBCL T-Scores) compared to the other two groups. Similarly, children in the TD group were rated as having significantly fewer symptoms of anxiety/depression than youth in the OCD group. Data are presented in Table 4.

To further assess severity differences utilizing the CBCL, the authors examined whether study groups differed on the number of youth rated as having clinically-significant symptoms (defined as T-Score ≥ 70). Data are presented in Table 5. We found that youth in the TD-only group were significantly less likely to display (a) clinically significant internalizing symptoms and (b) thought problems in comparison to either of the other two groups. Youth with TD-only were less likely to have clinically significant anxiety/depression in comparison to youth with OCD-only. However, youth with TD-only were more likely to have clinically-significant attention problems in comparison to the combined TD+OCD group.

3.6 General Demographic Differences

Finally, the authors examined demographic variability for qualitative comparison. Demographic differences (see Table 6) were noted between the three groups based on one-way ANOVA with Boniferroni posthoc comparisons, independent t-tests, and Chi-Square. The TD group was significantly younger than the OCD and TD+OCD group at time of evaluation ($p = 0.000$). Tic symptoms emerged at a younger age in children in the TD group (in comparison with the comorbid group; $p < 0.01$). However, onset age of OCD symptoms did not differ between the OCD and comorbid groups ($p = 0.62$). The TD group also had a younger age of primary symptom onset than the OCD group ($p = 0.004$). Significant differences in mother-reported family history of tic and OCD symptoms also emerged. Youth with comorbid TD+OCD were significantly more likely (12.1%) to have a first degree relative with tics than either the TD (7.5%) or OCD (3.4%) groups ($p = 0.05$). Moreover, the OCD (20.2%) and TD+OCD (9.1%) groups had significantly higher

percentages of first degree relatives reporting a history of OCD symptomology than the TD group ($p = 0.01$).

4. Discussion

This purpose of this exploratory study was to examine whether youth with TD+OCD presented with increased ADIS clinician-rated severity, higher incidence of comorbidity, elevated behavioral and emotional problems, or diminished global functioning. Overall, the authors aimed to replicate and extend a similar study completed in adults (Coffey et al., 1998) by contrasting severity and clinical correlates among children with TD, OCD, and TD +OCD.

Contrary to our expectations, our data did not demonstrate increased severity, comorbidity burden, worsened global functioning, or more severe clinical profile (based on CBCL scores). These data suggest that having both a tic disorder and OCD did not result in worsened severity of either disorder. OCD symptoms were not found to be exacerbated in the TD+OCD group (in fact, the CY-BOCS Obsession Scale was lower for TD+OCD in comparison to the OCD group. This is in contrast to adult findings by Tukel et al. (2002) where comorbidity was associated with exacerbated obsessions and compulsions. Additionally, we did not find support for our hypothesis that youth with TD+OCD presented with increased occurrence of other comorbidities (contrary to adult findings by Coffey et al., 1998).

Similarly, analysis of dimensional symptom patterns did not find youth with both conditions to have increased behavioral and emotional problems. This is in contrast to a study by Ivarsson et al. (2008) that found increased aggressive behavior problems and thought problems (using the CBCL) in youth with OCD and Tourette's Disorder in comparison to youth with OCD without Tourette's.

Overall, our data was inconsistent with the Coffey et al. (1998) study in adults. We were unable to conclude, based on these data, that the TD+OCD group represented a more severe presentation, on the basis of severity of diagnosis, comorbidity, and co-occurring symptoms than the OCD or TD groups. In fact, the TD+OCD group in our sample had significantly lower rates of anxiety disorders than the OCD group and significantly lower rates of ADHD and ODD than the TD group.

Our data suggest notable group differences in demographic factors such as gender, age of onset, and family history. These findings are largely consistent with the extant literature. However, it is noteworthy that demographic information (e.g., first age of symptom-onset and family history of symptoms) were assessed via parent report. We refer the reader to more sophisticated family incidence assessments based on community or population samples in the extant literature (e.g., Pauls et al., 1988; Geller et al. 1998; Lenane et al., 1990; Pauls et al., 1995; Nestadt et al., 2000; Grados et al. 2001; Leckman, 2002; Geller et al., 2004; Shavitt et al. 2006).

Overall, our results suggest that the TD+OCD group shares some diagnostic and clinical overlap with both the TD and OCD alone groups. Contrary to our hypothesis and to findings in adults by Coffey et al. (1998), the comorbidity data as well as clinician ratings of symptom severity and adaptive functioning suggest that youth with TD+OCD do not appear to represent a more severe population with respect to ADIS-diagnosed anxiety and affective disorders than youth with OCD or TS alone. In fact, our data suggest that the TD+OCD group appears to be diagnostically and clinically intermediate between the TD and OCD alone groups.

A rationale for the discrepancy with the findings in adults cannot be conclusive. One possibility is that just because a child presents with a single diagnosis, it does not necessitate that that child is less ill or burdened than a child who meets criteria for multiple diagnoses. In other words, the number of comorbidities might not necessitate severity. Referral bias may also explain our lack of significant findings. Given that this research was conducted at a specialty center for the treatment for OCD and tic-spectrum disorders, the threshold for a parent to bring-in a child for evaluation for even a single condition (e.g., Tourette's Disorder) may be higher than cumulative burden of many youth in the community with multiple disorders. Additionally, this study examined only a limited range of factors and it is entirely possible that the characteristics which distinguish these two subgroups are more likely found in other domains not assessed in the current research (e.g., characteristics of the OCD symptoms themselves, neurobiological, genetic, etc.). Although OCD symptom differences have been found for TD+OCD and OCD (e.g., Hanna et al., 2002), Storch and colleagues (2008) found only minimal differences in OCD symptoms between youth with OCD and TD+OCD. Future, longitudinal population-based research studies focusing on the impact of comorbidity on these populations might elucidate these confounds.

It is also important to emphasize the lack of support for our hypothesis in the present sample does not suggest a minimal impact of comorbidity in youth with OCD or Tourette's Disorder. For example, Ivarsson and colleagues (2008) found a high comorbidity burden among youth with OCD. Specifically, using the CBCL, the authors found that elevated levels of depression/anxiety, aggressive behavior, thought problems and attention problems; comorbidity explained from 25 to 50% scores of the CBCL sub-syndrome scales.

The findings of this study need to be evaluated in light of several methodological limitations including the relatively small number of TD children in the sample both on an absolute basis and in comparison to the number of OCD children, lack of a normal comparison group, and possible ascertainment bias associated with subjects being drawn from a specialty OCD clinic and tertiary care center. Data are drawn from a clinical sample of convenience limiting generalizations of these findings. Unequal group size also limited our statistical power. In order to further clarify the diagnostic boundaries between OCD and TD, larger, more representative samples assessing the full spectrum of childhood psychiatric comorbidity and impairment are needed. Measurement issues may also limit generalization external validity. Both CSR and GAF are broad indicators of functioning – future research could benefit from a more focused array of assessment. Additionally, tic severity data from the Yale Global Tic Severity Scale (YGTSS; Leckman et al., 1989) were not available in this study. Although data from the Children's Yale-Brown Obsessive Compulsive Scale (CYBOCS; Scahill et al., 1997) was available from a sequential subset of the sample, the incomplete catchment limits interpretation of the findings. It is noteworthy that group severity differences using these measures were found in adults (Coffey et al., 1998) despite finding difference in rates of diagnostic comorbidity. Finally, our report of symptom onset relied on parent report and could not be corroborated with other records. Moreover, given that participants were drawn from a sample of convenience rather than from a community sample/epidemiological sample, limiting our ability to interpret clinical phenomenological findings.

Clinically, this study suggests that when assessing youth with TD+OCD, comorbid anxiety and externalizing disorders are common, but not in higher proportions to youth with OCD or TD alone, respectively. Given this finding combined with our data suggesting that severity and impairment are not elevated in youth with both TD and OCD, more aggressive treatment may not be warranted. Although the present data failed to support our hypothesis that TD +OCD represents a more severe group of youth, clearly replication is required. Further studies are also needed to determine the impact of comorbidity on behavioral (Storch et al., 2008) and pharmacological treatment outcomes.

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Table 1

Clinician severity ratings by diagnostic group

Group		Percentage of youth by respective ADIS CSR			
		4	5	6	7
OCD	OCD CSR	21.5	31.6	35.7	6.9
TD	Tic CSR	60	32.5	7.5	0
TD + OCD	OCD CSR	24.2	45.5	27.3	3
Combined	Tic CSR	54.5	21.2	18.2	6.1

Note: Range is restricted given that CSR ≥ 4 was required for study inclusion. CSR = Clinician Severity Rating; ADIS = Anxiety Disorders Interview Schedule; OCD = Obsessive-Compulsive Disorder; TD = Tic Disorder.

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Table 2
Symptom and comorbidity severity by diagnostic group

		OCD Only	TD Only	TD + OCD Combined
OCD CSR	Mean	5.3	--	5.1
	SD	0.8	--	0.8
Tic CSR	Mean	--	4.5	4.8
	SD	--	0.6	0.9
Mean Number of Comorbid Diagnoses	Mean	2.2	1.8	2.0
	SD	1.1	0.9	0.9
Summed Severity of Comorbid Conditions	Mean	13.4	11.7	15.0
	SD	5.3	3.6	5.2
Average Severity of Comorbidity	Mean	4.9[a]	4.6[a]	4.8
	SD	0.8	0.6	0.6

Note: CSR = Clinician Severity Rating; OCD = Obsessive-Compulsive Disorder; TD = Tic Disorder

Table 3
Comorbidity rates (%) by diagnostic group

DIAGNOSIS	TD (N=40)	OCD (N=206)	TD+OCD (N=32)	*p*
Any Anxiety Disorder	7.5% [a]	40.3% [ab]	18.2% [b]	0.000
Generalized Anxiety	2.5 [a]	23.2 [ab]	6.1 [b]	0.000
Social Phobia	2.5	12.0	3.0	0.06
Separation Anxiety	0.0 [a]	11.6 [ab]	6.1 [b]	0.05
Specific Phobia	0.0	4.3	0.0	0.19
Depression / Dysthymia	2.5	12.1	11.6	0.20
ADHD	35.0 [a]	12.9 [ab]	24.2 [b]	0.001
ODD/CD	17.5 [a]	5.6 [ab]	12.1 [b]	0.02

Note: Means sharing superscripts (a b) are significantly different at the (minimum) $p < 0.05$ level. χ^2 coefficients are present χ^2ed in the text. N = Number of participants; ADHD = Attention Deficit Hyperactivity Disorder; ODD = Oppositional Defiant Disorder; CD = Conduct Disorder; OCD = Obsessive-Compulsive Disorder; TD = Tic Disorder

Table 4

Global functioning and dimensional severity by diagnostic group

Rating Scale	TD Mean (SD)	OCD Mean (SD)	TD+OCD Mean (SD)	*F (3, 554)*	*p*
Clinician rated GAF	55.4 (10.4)	53.4 (6.7)	51.4 (5.1)	3.3	0.08
CBCL (T-scores)					
Internalizing Score	56.3 [a] (13.1)	66.0 [a] (8.9)	65.0 (7.6)	2.0	0.000
Externalizing Score	53.1 (13.1)	54.5 (10.1)	58.0 (10.8)	0.27	0.190
Total Competence Score	43.3 (10.3)	41.0 (9.9)	43.3 (11.5)	0.72	0.370
Delinquent behavior	55.7 (8.2)	54.8 [a] (6.8)	58.6 [a] (7.6)	2.1	0.040
Aggressive behavior	57.8 (9.7)	57.4 (8.2)	61.2 (7.7)	1.4	0.110
Attention Problems	66.6 (10.4)	63.6 (10.0)	65.6 (10.3)	4.0	0.250
Withdrawal	56.6 (9.4)	60.4 (9.9)	58.6 (8.3)	1.8	0.140
Somatic Complaints	57.9 (8.2)	60.7 (8.9)	62.1 (8.9)	1.5	0.190
Social Problems	57.9 (9.3)	59.0 (9.0)	59.7 (9.3)	0.45	0.760
Thought Problems	62.7 [a] (10.7)	73.4 [a] (7.0)	71.4 (8.9)	10.6	0.000
Anxiety / Depression	59.1 [a] (11.4)	68.5 [a] (9.5)	64.7 (9.4)	9.5	0.000

Note: Note: Means sharing superscripts (a b) are significantly different at the (minimum) $p < 0.05$ level.; CBCL = Child Behavior Checklist; GAF = Global Axis of Functioning

Table 5

Clinically significant status by diagnostic group

	Percentage of youth at or exceeding clinically-significant cutoffs§				
Rating Scale	**TD**	**OCD**	**TD+OCD**	***X²* (df=3)***	***p***
CBCL Scales					
Internalizing Score	12.5[ab]	34[a]	27[b]	11.5	0.009
Externalizing Score	10	6	12	1.9	0.59
Total Competence Score	0	0	0	NA	NA
Delinquent behavior	3	3	6	4	0.27
Aggressive behavior	12	8	12	2.1	0.55
Attention Problems	30[a]	23	18[a]	8.3	0.04
Withdrawal	10	16	6	2.7	0.44
Somatic Complaints	5	3	12	5.0	0.17
Social Problems	10	12	12	5.0	0.92
Thought Problems	15[ab]	64[a]	55[b]	115.0	0.000
Anxiety / Depression	15[a]	40[a]	21	28.4	0.000

Note: Means sharing superscripts (a b) are significantly different at the (minimum) $p < 0.05$ level. CBCL = Child Behavior Checklist; NA = Non-applicable;

§Defined at T-Score ≥ 70 (i.e., at least two standard deviations above published means); *Omnibus chi-squares (follow-up X^2 tests were conducted in cases of significant initial omnibus tests).

Table 6
Demographic status by diagnostic group

	TD (N=40)	OCD (N=206)	TD+OCD(N=33)	*P*
Study Age at interview Mean (SD)	9.6 [a] (2.3)	11.8 [a] (3.1)	11.5 (2.5)	0.000
Gender % Male	85% [a]	58% [a]	63%	0.006
Family History of Tics	7.5%[a]	3.4%[b]	12.15%[ab]	0.05
Family History of OCD	2.5%[a]	20.2%[ab]	9.1%[b]	0.01
Onset age of OCD	NA	8.5 (3.6)	8.0 (3.8)	0.62
Onset age of Tics	5.3 (3.1)[a]	NA	8.1 (2.0)[a]	0.01

Note: Means sharing superscripts (a b) are significantly different at the (minimum) $p < 0.05$ level.