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Obsessive Compulsive Symptomatology in Community Youth: Typical Development or a Red Flag for Psychopathology?

RH = Obsessive Compulsive Spectrum in Youth

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Supplemental Material
Clinical Guidance

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ABSTRACT

**Objective:** Obsessive compulsive symptoms (OCS) are common throughout development and often considered developmentally appropriate. We evaluated the prevalence and phenotypic heterogeneity of self-reported OCS in a large community youth sample not ascertained for seeking mental-health help. We aimed to identify patterns in OCS that are associated with serious psychopathology and may thus represent a “red flag” that merits psychiatric evaluation.

**Method:** Data were analyzed from youth from the Philadelphia Neurodevelopmental Cohort (N=7054, ages 11-21, 54% females). Participants underwent structured psychiatric interviews, including screening for OCS (8 obsessions, 8 compulsions, and hoarding) and other major psychopathology domains. Factor analysis was conducted to identify clustering of OCS presentation. Regression models were used to investigate association of OCS with threshold lifetime diagnoses of obsessive compulsive disorder (OCD), depressive episode, psychosis and suicide ideation.

**Results:** OCS were common in non-mental health-seeking individuals (38.2%), although only 3% met threshold OCD criteria. OCS were more common in females and post puberty. Factor analyses resulted in four factors: F1 – Bad Thoughts; F2 - Repeating/Checking; F3 – Symmetry; F4 – Cleaning/Contamination; and Hoarding as a separate item. All OCS were associated with higher rates of OCD, depression, psychosis and suicide ideation. However, endorsement of F1 symptoms, prevalent in more than 20% of the sample, showed the most substantial associations with major psychiatric conditions.

**Conclusion:** OCS are common in community youth. While for most youths OCS symptoms may be benign, some patterns of OCS are associated with major psychiatric conditions. These findings may help identify youth at risk for serious psychopathology.
Keywords: obsessive compulsive, developmental psychopathology, factor analysis, child psychiatry
INTRODUCTION

Obsessive and compulsive symptoms (OCS) are characterized by repetitive thoughts, urges, or mental images (obsessions) and/or repetitive behaviors (compulsions). Self-reported OCS rates are not reliably characterized, ranging from 8-72% in children, adolescents, and young adults.\(^1\text{–}^3\) When these obsessions and compulsions are accompanied by distress and impairment levels that become intrusive and debilitating, a formal diagnosis of obsessive compulsive disorder (OCD) is more appropriate.\(^4\) OCD affects 2-4% of children and adolescents;\(^5\text{–}^7\) however, OCD goes undetected and untreated in as many as 90% of cases.\(^8\)

Engaging in repetitive and ritualistic behaviors is a part of typical child development.\(^9,10\) Young children use these behaviors as a tool to help enforce consistency, connect with peers, and improve socialization.\(^9\) However, as children grow older, these behaviors may no longer be necessary to help reach age-appropriate goals.\(^9\) A study of community sample children, ages 8-14, showed that overall OCS endorsement declines as children reach adolescence, although a subset of children show a surge in OCS in 8th grade.\(^11\) For patients in whom OCS reach threshold OCD, there are two patterns of OCD onset: childhood vs. adult onset.\(^12\) Puberty is the decisive feature in these two patterns, where childhood onset is characterized by symptoms antedating puberty and commonly affecting more males.\(^8\) Adult onset is characterized by symptoms starting during or after puberty and commonly affecting more females.\(^13\)

OCD is heterogeneous across individuals with differing patterns of obsessions or compulsions.\(^14\) Likewise, comorbidity patterns are also heterogeneous.\(^15\) Studies examining adults diagnosed with OCD have shown that the most common comorbid disorder with OCD is depression (lifetime: 54%, concurrent: 36%),\(^16\) but adults with OCD often present with other comorbid serious psychiatric conditions, such as psychosis (25%)\(^17\) and suicidal thoughts
(36%). Children with OCD are similarly affected by a range of comorbidities. Earlier onset OCD is associated with comorbid externalizing and anxiety disorders at younger ages, while later onset OCD comorbidity patterns resemble that of adults, regardless of age of onset.

A method used to reduce phenotypic heterogeneity across individuals is factor analysis. Previous dimensional studies using factor analyses in children and adolescents with OCD have revealed similar (though not identical in all studies) factors. The factors can be generally divided into: an aggressive, sexual, religious thoughts factor; a symmetry, ordering, counting, repeating factor; a contamination and cleaning factor; and a hoarding factor.

While previous studies have almost exclusively focused on identifying dimensions that emerge among children and adolescents who meet criteria for threshold OCD, two studies have examined these factors in community samples of children and adolescents who report subthreshold OCS and one study has examined OCS dimensionally without the use of factors. Fullana et al. (2009) examined the presence of 4 obsessions and compulsions in a sample of 792 11-year old children and reported 8% OCS endorsements. Alvarenga et al. (2015) found that parent-reported OCS endorsement gradually increased with age, and was associated with comorbid psychiatric disorders and decreased school and behavioral function. From the same cohort of children, Saad and colleagues (2017) assessed more specific comorbidity associations of a subset of 2,512 self-reporting 6-12 year old children and found that higher rates of OCS, as determined by the Child Behavior Checklist – Obsessive Compulsive Scale, were associated most significantly with comorbid anxiety disorders, ADHD, disruptive disorders, and mood disorders. These two studies suggest that subthreshold OCS may be associated with psychiatric comorbidities. However, no studies have been performed on large samples of interviewed
community adolescents, spanning pre- and post-puberty with self-report of multiple OCS and clinical phenotyping for major psychiatric conditions.

Given the prevalence of children and adolescents who engage in some obsessions and/or compulsions but do not reach threshold criteria for an OCD diagnosis, it remains a clinical challenge to identify subsets at risk for major psychiatric conditions. In the current study, we aimed to fill this gap through analysis of the Philadelphia Neurodevelopmental Cohort (PNC) dataset. PNC includes a large, non-help seeking community sample (N=7,054) of children and adolescents ages 11-21 who were psychiatrically assessed and reported on lifetime occurrence of major domains of psychopathology, including obsessive compulsive symptoms and disorder, depression, psychosis and suicidal ideation. The aims of this study were twofold: first, to evaluate prevalence and heterogeneity of subthreshold OCS in a community youth sample; and second, to identify patterns of OCS presentations that are most suggestive of serious psychopathology and should trigger further psychiatric evaluation or intervention.
METHODS

Participants

The Philadelphia Neurodevelopmental Cohort is a collaboration between Children’s Hospital of Philadelphia and Brain Behavior Laboratory at the University of Pennsylvania.\textsuperscript{32} Enrollment criteria included: (1) age 8 to 21 years; (2) ambulatory in stable health; (3) proficient in English; (4) physically and cognitively capable of completing study procedures; and (5) absence of a significant physical condition or developmental delay that impairs motility or cognition (e.g., paresis or palsy, intellectual disability). Participants were recruited from a pool (N=15,293) of children previously genotyped as part of a genomic study at Children’s Hospital of Philadelphia health care network, which extends to over 30 clinical community sites in the tri-state area of Pennsylvania, New Jersey and Delaware, in the United States. Participants were not recruited from psychiatric clinics and the sample is not enriched for those seeking mental health services. Based on electronic medical records review or follow-up phone contact, potential participants from this pool were excluded if they were not proficient in English, had significant developmental delays or other conditions that would interfere with their ability to complete study procedures, or could not be contacted. From the remaining pool, 13,598 individuals were invited, 2,699 declined, 1,401 were excluded, and 9,498 youths (age 8-21) were enrolled. The sample is large (N=9,498) and racially diverse (56% Caucasian, 33% African American and 11% other), with diverse socioeconomic background.\textsuperscript{33} Clinical assessment was administered to collateral informants who were caregivers or legal guardians for participants ages 8-10, to both probands and collaterals for participants ages 11-17, and solely to probands for participants ages 18-21. After complete description of the study, written informed consent was obtained from participants aged \( \geq \) 18, and written assent and parental permission were obtained from children aged<18 and
their parents/legal guardian. University of Pennsylvania and CHOP’s Institutional Review Boards approved all procedures.

For the current analyses we included only proband interviews and therefore only data from probands ages 11-21 were analyzed (N=7,054).

Clinical assessment

Psychopathology symptoms were evaluated by trained and supervised assessors (Bachelor's and Master's level who underwent a rigorous standardized training and certification protocol) using a structured screening interview (GOASSESS), as detailed elsewhere, which was based on Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS). Lifetime OCD or depressive episode diagnoses were determined if symptoms were endorsed with frequency and duration meeting DSM-IV disorder or episode criteria, accompanied by significant distress or impairment. Lifetime suicide ideation was determined based on a direct question regarding having thought of killing oneself. Psychosis was considered for participants that endorsed having hallucinations or delusions based on K-SADS screen, with duration ≥1 day, occurring outside the context of substance, illness and medicines, and accompanied by significant impairment or distress. Level of function was evaluated by the Children’s Global Assessment Scale (C-GAS). Pubertal status was determined based on self-report of genital development (Tanner score of 5 was considered post pubertal).

Assessment of obsessive and compulsive symptoms

GOASSESS OCD screen assessed lifetime experience of 8 obsessions and 9 compulsions. Participants were asked the following about obsessions: “Have you ever been bothered by thoughts that don’t make sense to you, that come over and over again and won’t go away?”
Obsessions included: (1) concern with harming others/self; (2) pictures of violent things; (3) thoughts about contamination/germs/illness; (4) fear that you would do something/say something bad without intending to; (5) feelings that bad things that happened were your fault; (6) forbidden/bad thoughts; (7) need for symmetry/exactness; and (8) religious thoughts. Next, participants were asked the following about compulsions: “Have you ever had to do something over and over again – that would have made you feel really nervous if you couldn’t do it?” Compulsions included: (1) cleaning or washing (for example, your hands, your house); (2) counting; (3) checking (for example, doors, locks, ovens); (4) getting dressed over and over again; (5) going in and out a door over and over again; (6) ordering or arranging things; (7) doing things over and over again at bedtime, like arranging pillows, sheets or other things; (8) saved up so many things that people complain or they got in the way; and (9) feel need to do things just right (like they have to be perfect). If at least one obsession/compulsion was endorsed, subsequent questions assessed further lifetime criteria of OCD, which was assigned if: >=one obsession (that were experienced as intrusive despite attempts at suppression or that the participant tried to avoid) or compulsion was endorsed which reportedly prevented the participant from doing activities s/he normally would do, were time consuming (>=1 hour per day), lasted for >=6 months, and accompanied by significant distress or impairment (either rated >=5 on an 11-point scale).

For 406 participants (6.5% of PNC), clinical items including GOASSESS OCD screen and/or pubertal status items were missing and therefore excluded from analyses. In the present analyses, we compared participants who endorsed at least one symptom on the OCD screener, i.e. having obsessive compulsive symptoms (OCS, n=2,697), to participants who endorsed no obsessive-compulsive symptoms (non-OCS, n=3,951, Table 1).
Factor Analysis

Exploratory factor analysis (least-squares extraction with oblimin rotation) was performed on tetrachoric correlations among obsessive compulsive items. The hoarding item was excluded from factor analysis given reasons suggesting hoarding may be a distinct construct from OCD. This decision was supported by preliminary factor analyses (not shown, available upon request). Number of factors to extract from all OCS was determined by a combination of five empirical methods: parallel analysis with Glorfeld correction, Zoski multiple regression procedure, Cattell-Nelson-Gorsuch method, minimum Bayesian Information Criterion (BIC), and minimum average partial.

Statistical analysis

Univariate comparisons between OCS and non-OCS participants were conducted using two-tailed t-tests or chi-square tests, as appropriate. For multivariate analyses, we performed binary logistic regressions to investigate associations of sex, pubertal status and their interaction with endorsement of at least one obsessive/compulsive symptom (OCS) as the dependent variable, controlling for age (puberty regressed) and socioeconomic status as covariates. Associations of different OCS factors with serious psychiatric conditions were evaluated using binary logistic regression models with the index dichotomous variable (OCD, depression, psychosis or suicide ideation) as dependent variable and the five obsessive/compulsive factors as independent variables controlling for sex, pubertal status, age and socioeconomic status as covariates. A separate binary logistic regression model was used to investigate associations between specific symptoms in obsessive/compulsive factor of F1 – Bad Thoughts with OCD, depression, psychosis or suicide, controlling for sex, pubertal status, age and socioeconomic status as covariates. In all analyses, depression, psychosis, and suicidal thoughts variables did not exclude
individuals with other disorders—e.g. a “depressed” person in these analyses might also have other disorders. A two-tailed p-value less than .05 was considered statistically significant in all analyses. Statistical analyses were performed using SPSS Statistics 24 (IBM, Armonk, New York, USA), except for factor analysis, which was performed using nFactors and psych packages in R.

RESULTS

Prevalence of obsessive and compulsive symptoms endorsement

We included participants (aged 11-21, N=7,054) who reported symptoms including 209 participants (3%) who met criteria for a lifetime OCD diagnosis. Almost 40% of the cohort (n=2,697, 38.2%) endorsed at least one obsession or compulsion on the OCD screener (OCS participants). Female sex (OR 1.30, Wald=25.97, df=1, p<.001) and puberty (OR=1.18, Wald=9.95, df=1, p=.002) were associated with OCS endorsements. There was a sex by puberty interaction in association with OCS manifested by higher OCS proportion in post-pubertal females (Wald=4.30, df=1, p=.038, Figure 1). Compared to non-OCS participants, OCS group was on average slightly older, had a higher proportion of females and a lower proportion of Caucasians (Table 1). For rates of OCS endorsement by age and sex, see Table S1, available online. Regarding major psychopathology phenotypes, OCS participants had higher prevalence of lifetime depression, psychosis and suicide ideation. OCS participants were rated as having lower level of global function (Table 1). Notably, of 2,697 OCS participants, the vast majority did not fulfill criteria for a lifetime OCD diagnosis (n=2,488, 92.3%).

Factor analysis of obsessive and compulsive symptoms
Five empirical methods employed here suggested 2, 3, 4 and 5 factors (see Table S2, available online). Four of the fit indices suggested that as few as 2 factors are necessary to explain adequate variance; however, $\chi^2$ values were all significant (indicating misfit), and chi-square difference tests revealed that 7 factors are optimal. For these reasons we opted to choose the median number of suggested factors (4), with hoarding as a separate, stand-alone indicator (Table 2). The factors that emerged comprise: F1 – Bad Thoughts, including negative intrusive thoughts about harming others/self, fear of doing/saying something bad without intending to, feeling that bad things that happened were your fault, and having forbidden, bad, religious, or violent thoughts; F2 – Repeating/Checking, which also included counting; F3 – Symmetry, and F4 – Contamination (Table 2). Endorsement of symptoms across factors showed substantial overlap (Figure S1, available online). In all four factors and hoarding, self-reported OCS were more prevalent in females, with main effect for puberty in F1 and F2, and not in other OCS factors. No sex by puberty interaction was observed in association with any OCS factors (Table S3, available online).

Clinical associations for different OCS factors

Next, we investigated association of each OCS factors with lifetime report of major comorbid psychopathology (OCD, depression, psychosis and suicide ideation), controlling for pubertal status, age, sex, and socioeconomic status (Figure 2, Table S4, available online). Endorsement of at least one OCS was significantly associated with a higher rate for lifetime history of depression, psychosis, and suicide ideation (all OR > 4.0, all $p$'s<.001). Probing for associations of each factor in a model that accounts for all OCS factors revealed that F1 had the most robust associations with comorbid psychopathology phenotypes: OCD (OR=11.7), depression (OR=4.3), psychosis (OR=3.3), and suicide ideation (OR=4.4, all $p$’s<.001). Other significant
associations included F2 with depression (OR=1.5, \( p<.001 \)), F3 with psychosis (OR=1.8, \( p<.001 \)), and Hoarding with depression (OR=1.9, \( p<.001 \)). F4 was not associated with any major psychiatric conditions we evaluated except for OCD itself (OR=1.8, \( p<.001 \), Figure 2, Table S4, available online). Analysis of comorbid associations with OCS treated as a continuous measure (sum of endorsements) showed similar findings (Table S5, available online).

**Specific clinical correlations for Bad Thoughts (F1) symptoms**

To further probe which symptoms within F1 are associated with serious psychopathology phenotypes we conducted a regression model including all F1 symptoms controlling for pubertal status, age, sex, and socioeconomic status (Table 3). Endorsement of thoughts that included concern with harming others/self was significantly associated with OCD, depression, psychosis and suicide ideation (all \( p’s < .023 \)). Endorsement of having thoughts that include envisioning pictures of violence was significantly associated with depression, psychosis, and suicide ideation (all \( p’s=.015 \)). Endorsement of having thoughts that include fear of doing or saying something bad without intending to was significantly associated with OCD, depression, and psychosis (all \( p’s=.001 \)). Thinking or feeling that bad things that happened were one’s fault was associated with OCD, depression, and suicide ideation (all \( p’s < .003 \)). Endorsement of having forbidden/bad thoughts was associated with OCD, depression and suicide ideation (all \( p’s<.001 \)). Religious thoughts were associated with OCD and psychosis (both \( p’s<.03 \)).
DISCUSSION

This study is the first and largest community youth sample (N=7054) that spans pre- and post-puberty (11-21 years-old) and that assessed for subthreshold obsessions and compulsions and their associated serious psychiatric comorbidities. Several key findings emerge from the data. We found that obsessive compulsive symptoms are common in community youth, more so in females and after puberty. OCS can be clustered into 4 factors: F1 – Bad Thoughts, F2 – Repeating/Checking, F3 – Symmetry, and F4 – Cleaning/Contamination. Hoarding stood alone as a single item, similar to work showing that hoarding is a separate disorder from OCD.\(^4,38\) One OCS factor, F1 – Bad Thoughts, is especially associated with serious psychopathology beyond OCD, while cleaning and contamination OCS are not.

Endorsement rate of at least one OCS in the sample was 38.2%, and while this is higher than some studies looking at self-reported rates of OCS,\(^1,45,46\) it fell into 27-72% endorsement range reported previously.\(^3\) Our rate of OCS endorsement may be higher because we asked about several obsessions and compulsions, and because our age range extended into post-puberty. In agreement with previous studies, we found that 3.0% of the sample met criteria for threshold OCD diagnosis.\(^5,19,45,46\) Also in accordance with previous findings, we documented a sex by puberty interaction, where post-pubertal females endorsed higher OCS compared to male counterparts.\(^8\) Unlike previous studies, we did not find that pre-pubertal males endorsed higher rate of OCS compared to female peers.\(^6,13\) Alvarenga and colleagues (2015) reported that pre-pubertal boys showed an increase in OCS endorsements from ages 6-10, and that at age 11 OCS endorsements started to decrease, whereas girls OCS endorsements started to peak at age 11.\(^30\) It is possible that we did not find pre-pubertal boys endorsing higher OCS because age 11 was the lowest age for self-reported data we analyzed. However, Zohar and Bruno reported an increase
in both boys’ and girls’ OCS endorsement in 8th grade, where girls endorsed more cleaning symptoms and boys endorsed more checking symptoms. These results are in accordance with our data, as we saw a slight increase in OCS endorsement in both males and females at ages 13-14 in comparison to ages 11-12.

It has been suggested that in order to help identify more homogenous phenotypes in psychiatric research, and in line with RDoC (research domain criteria), it may be useful to study OCD using factor analysis. The emerging factors we found are similar to a large meta-analysis including 21 studies and 5,124 participants, which found that a four-factor model explained much of the heterogeneity in OCS endorsement. That study reported four factors: (1) symmetry, (2) forbidden thoughts, (3) cleaning, and (4) hoarding. The four factors that we report map onto what was found across these 21 studies, except that our analysis separated symmetry from repeating/checking; while repeating/checking was a part of symmetry factor in the meta-analysis. Factors that emerged in the current study are also similar to factors generally found in factor analyses performed in children diagnosed with OCD.

Two previous studies factor-analyzed obsessions and compulsions in community-based youth samples. Fullana et al. (2009) examined presence of longitudinal obsessions and compulsions at ages 11, 26, and, 32 in a self-report, community sample. However at age 11, 792 children included in that study were asked about a limited set of 4 OCS (having thoughts or pictures you don’t like come into your head; having rules about things that you have to do over and over; feeling you have to do things in exactly the same way; feel you have to count something and can’t stop even when you try to). Eight percent of the sample endorsed OCS, and hoarding was not assessed. Our study assessed a wider range of OCS and also captured a broader age range that spans development at critical ages around puberty. These two strengths may
explain the discrepancy of OCS endorsement between 8% in Fullana et al. (2009) and 38.2% in the current study. The second study to investigate dimensional factors in a community sample used parent report of Dimensional Yale-Brown Obsessive-Compulsive Scale (DY-BOCS\textsuperscript{40}) in a large cohort of 9,937 Brazilian school-children (6-12-year-old).\textsuperscript{30} That study showed that OCS endorsement gradually increased with age, was associated with comorbid psychiatric disorders, and with decreased school and behavior function. However, there is a major limitation in using parent report instead of youth self-report, as children can try to hide their obsessions from parents, and parent-child dyads are known to have high discordance in OCS reporting.\textsuperscript{49} In the PNC dataset, for whom there is available proband and parent report (ages 11-18), we have observed significant discrepancies in endorsement of OCS, with lower endorsement of OCS among parents compared to youth probands (unpublished data).

We found that endorsing any obsessions or compulsions is associated with serious comorbid psychiatric conditions. Some self-reported OCS were more suggestive of serious comorbid psychiatric conditions, especially F1 – Bad Thoughts while other OCS were not, like F4 – Cleaning/Contamination. Previous work reported similar associations of bad thoughts, including aggressive, sexual, and religious thoughts, with depression in adults diagnosed with OCD.\textsuperscript{50,51} In accordance, we found that F1 factor showed significantly stronger association with OCD compared to other OCS factors, suggesting that having F1 symptoms is strongly associated with severity levels that constitute core features of OCD diagnosis, like having symptoms for significant portions of the day or significant distress and impairment. Although some content of F1 items seems to be confounded with its comorbid psychopathology beyond OCD (i.e. concern with harming others/self, and suicide ideation, OR = 5.0), other non-intuitive associations are present as well. For example, feeling like bad things that happened were your fault was also
associated with suicide ideation (OR = 2.4), perhaps suggesting a tendency toward the ruminating thought process that often underlies depression.\textsuperscript{18} Regarding psychosis, while previous studies show that OCD is commonly comorbid with psychosis,\textsuperscript{17} this study is the first to examine subthreshold OCS dimension comorbidity with psychotic symptoms in youth. Our results may suggest that endorsing any cognitions that make up F1 flags an individual to be at serious risk for four major psychiatric conditions: OCD, depression, psychosis, and suicidal ideation.

Some limitations should be noted. Data were cross-sectional and assessed lifetime symptoms, not current symptoms, therefore no causal claims may be made from the current analyses. The OCS screen, though detailed, did not include a severity scale for obsessive compulsive symptomatology like DY-BOCS. Nonetheless, our large sample of youth self-reporting in an interview on a detailed list of OCS with robust clinical phenotyping around puberty onset, facilitated analyses crucial for understanding a common (almost 40% prevalence of OCS in the current sample) phenomenon in child and adolescent mental development. That is, our results using a large community sample are more likely to be generalizable than results using smaller or non-community samples.

This study may have two immediate clinical implications. First, we show that while OCS are common, for vast majority of children and adolescents (92.3% of OCS endorsing youth) it does not reach OCD clinical threshold. However, for some individuals, OCS is associated with serious psychiatric conditions besides OCD. This manifested with, (1) more than 1 in 4 of OCS youth fulfilling criteria for a lifetime depressive episode, (2) 1 in 6 OCS reporting lifetime suicide ideation, and (3) almost 1 in 10 OCS youth endorsing threshold psychotic symptoms. Association of OCS with suicide ideation is of special importance in light of a recent population-
based national cohort study in Sweden reporting that patients with OCD are at a substantial risk of suicide. For these youths who endorse OCS and a serious comorbid psychiatric condition, identification of OCS may be a “window” through which clinicians may probe and rapidly identify serious psychiatric conditions. Second, we show that, among OCS youth, some phenotypic subtypes are more suggestive of comorbid serious psychiatric conditions compared to others. Specifically, some factors that comprise compulsive symptoms, like cleaning, have relatively low associations with comorbidities compared to bad thoughts. This finding has major implications for mental health policies and for general adolescent health policies. Specifically, we suggest that probing for the six specific OCS that make up F1 can help assign patients to levels of risk for serious psychiatric conditions. This suggestion may have practical implications for the clinical encounter, as time with clinician is costly and therefore there is a need to identify “high yield” clinical questions that can help stratify risk in a short time. Future research is warranted to develop specific clinical guidelines.

To conclude, we report a high rate of obsessive-compulsive symptoms in a large, generalizable sample of US youth. Results show that, while endorsing OCS may represent an appropriate developmental milestone for most adolescents, in a significant proportion of self-reporting OCS youth, these symptoms are associated with depression, psychosis and suicide ideation. We show that specific phenotypes of OCS presentations, especially bad obsessive thoughts, are strongly associated with serious psychiatric conditions. We hope that these results will propel mental health professionals and non-mental health professionals alike (i.e. pediatricians) to probe for these symptoms during clinical evaluations, as these may prove vital for identifying youth who are on a potentially debilitating psychiatric developmental trajectory.
References


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Figure legends:

Figure 1 Title: Relationship Between Sex and Pubertal Status in Association with Rate of Obsessive-Compulsive Symptoms in Study Participants

Figure 2 Title: Visual Presentation of Odds Ratios and 95% CIs of each Obsessive Compulsive Symptoms (OCS) Factor in Association with Lifetime Obsessive-Compulsive Disorder (OCD), Depression, Psychosis, or Suicide Ideation

Note: Values were calculated based on binary logistic regression models including all OCS factors and controlling for pubertal status, age, sex and socioeconomic status. OCS = endorsement of any obsessive or compulsive symptom. OCD= obsessive compulsive disorder. F1 – Bad Thoughts, F2 – Repeating/Checking, F3 – Symmetry, F4 – Cleaning/Contamination.

Table 1: Comparison of Participants That Had Endorsed At Least One Obsessive Compulsive Symptom (OCS) to Participants Who Did Not Endorse Any OCS (controls)
<table>
<thead>
<tr>
<th></th>
<th>Total N=7054</th>
<th>OC spectrum n=2697 (38.2%)</th>
<th>Controls n=3951 (56%)</th>
<th>Test</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years (SD)</td>
<td>15.8 (2.7)</td>
<td>15.8 (2.6)</td>
<td>15.5 (2.7)</td>
<td>T-test</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sex, female n (%)</td>
<td>3807 (54%)</td>
<td>1581 (58.6%)</td>
<td>2005 (50.7%)</td>
<td>Chi-square</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Post-pubertal, n (%)</td>
<td>3079 (43.6%)</td>
<td>1348 (50.1%)</td>
<td>1731 (44.3%)</td>
<td>Chi-square</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Race, white n (%)</td>
<td>3970 (56.3%)</td>
<td>1432 (53.1%)</td>
<td>2303 (58.3%)</td>
<td>Chi-square</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>SES, Z-score (SD)</td>
<td>.01 (1)</td>
<td>-.05 (1)</td>
<td>.05 (1)</td>
<td>T-test</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>OCD, n (%)</td>
<td>209 (3%)</td>
<td>209 (7.7%)</td>
<td>0 (0%)</td>
<td>Chi-square</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Depression, n (%)</td>
<td>1030 (14.6%)</td>
<td>712 (26.4%)</td>
<td>310 (7.8%)</td>
<td>Chi-square</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Psychosis, n (%)</td>
<td>348 (4.9%)</td>
<td>258 (9.6%)</td>
<td>83 (2.1%)</td>
<td>Chi-square</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Suicide ideation, n (%)</td>
<td>671 (9.5%)</td>
<td>444 (16.5%)</td>
<td>180 (4.6%)</td>
<td>Chi-square</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Level of function, C-GAS (SD)</td>
<td>78.7 (12.1)</td>
<td>75.4 (12.9)</td>
<td>81.2 (10.8)</td>
<td>T-test</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Note: C-GAS = Children’s Global Assessment Scale; OCD = obsessive-compulsive disorder; SES = socioeconomic status
Table 2: Factor Loadings of Seventeen Obsessions and Compulsions Resulting in Four Factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Item</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
</tr>
</thead>
<tbody>
<tr>
<td>(F1) Bad Thoughts</td>
<td>Forbidden/bad thoughts</td>
<td>0.88</td>
<td>0.04</td>
<td>-0.02</td>
<td>-0.05</td>
</tr>
<tr>
<td>(n=1462)</td>
<td>Concern with harming self/others</td>
<td>0.87</td>
<td>-0.03</td>
<td>-0.05</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>Pictures of violent things</td>
<td>0.78</td>
<td>0.11</td>
<td>-0.06</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Fear that you would do something/say something bad without intending to</td>
<td>0.77</td>
<td>-0.03</td>
<td>0.16</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Feelings that bad things that happened were your fault</td>
<td>0.74</td>
<td>0.01</td>
<td>0.10</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Religious thoughts</td>
<td>0.51</td>
<td>0.08</td>
<td>0.03</td>
<td>0.18</td>
</tr>
<tr>
<td>(F2) Repeating/Checking</td>
<td>Getting dressed over and over again</td>
<td>0.08</td>
<td>0.77</td>
<td>-0.08</td>
<td>0.09</td>
</tr>
<tr>
<td>(n=1646)</td>
<td>Going in and out a door over and over again</td>
<td>0.13</td>
<td>0.76</td>
<td>0.00</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td>Doing things over and over again at bedtime, like arranging pillows, sheets or other things?</td>
<td>0.05</td>
<td>0.58</td>
<td>0.25</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Checking (for example doors, locks, ovens)</td>
<td>0.13</td>
<td>0.51</td>
<td>0.19</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Counting</td>
<td>0.09</td>
<td>0.43</td>
<td>0.34</td>
<td>0.06</td>
</tr>
<tr>
<td>(F3) Symmetry</td>
<td>Need for symmetry/exactness</td>
<td>0.09</td>
<td>-0.11</td>
<td>0.88</td>
<td>0.04</td>
</tr>
<tr>
<td>(n=1106)</td>
<td>Ordering or arranging things</td>
<td>-0.05</td>
<td>0.32</td>
<td>0.69</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Do you feel the need to do things just right (like they have to be perfect)?</td>
<td>0.12</td>
<td>0.06</td>
<td>0.61</td>
<td>0.05</td>
</tr>
<tr>
<td>(F4) Cleaning/Contamination</td>
<td>Thoughts about contamination/germs/illness</td>
<td>0.05</td>
<td>-0.03</td>
<td>0.00</td>
<td>0.99</td>
</tr>
<tr>
<td>(n=663)</td>
<td>Cleaning or washing (for example, your hands, your house)?</td>
<td>-0.07</td>
<td>0.43</td>
<td>0.13</td>
<td>0.50</td>
</tr>
</tbody>
</table>
Note: Hoarding stood alone as a single factor. Numbers (n) in each factor represent total participants that endorsed at least one obsessive compulsive symptom in a factor.

Figure S1: Venn Diagram of the Overlap Between Obsessive-Compulsive Symptom (OCS) Factors

Note: Values represent number of participants that endorsed at least one obsessive compulsive symptom in each factor.
Table 3: Association of Each F1 – Bad Thoughts Item With Comorbid Psychiatric Conditions (Obsessive-Compulsive Disorder [OCD], Depressive Episode, Psychosis or Suicide Ideation)

<table>
<thead>
<tr>
<th>Factor 1 endorsed symptom: Obsessive thoughts including…</th>
<th>OCD n=209</th>
<th>95% CI</th>
<th>Depression n=973</th>
<th>95% CI</th>
<th>Psychosis n=338</th>
<th>95% CI</th>
<th>Suicide Ideation n=620</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>…concern with harming others/self (n=396)</td>
<td>80 (20.2%)</td>
<td>2.5 1.7 3.8 0.000</td>
<td>205 (51.8%)</td>
<td>2.3 1.7 3.0 0.000</td>
<td>75 (18.9%)</td>
<td>1.5 1.1 2.2 0.022</td>
<td>184 (46.5%)</td>
<td>5.0 3.8 6.7 0.000</td>
</tr>
<tr>
<td>…pictures of violent things (n=371)</td>
<td>59 (15.9%)</td>
<td>1.3 0.9 2.0 0.194</td>
<td>156 (42.0%)</td>
<td>1.5 1.1 2.0 0.014</td>
<td>75 (20.2%)</td>
<td>2.0 1.4 2.8 0.000</td>
<td>119 (32.1%)</td>
<td>1.5 1.1 2.1 0.008</td>
</tr>
<tr>
<td>…fear of doing/saying something bad without intending to (n=796)</td>
<td>112 (14.1%)</td>
<td>2.7 1.8 4.0 0.000</td>
<td>321 (40.3%)</td>
<td>1.9 1.5 2.3 0.000</td>
<td>127 (16.0%)</td>
<td>2.1 1.6 2.9 0.000</td>
<td>194 (24.4%)</td>
<td>1.2 0.9 1.5 0.254</td>
</tr>
<tr>
<td>…feeling that bad things that happened were your fault (n=861)</td>
<td>113 (13.1%)</td>
<td>2.5 1.7 3.7 0.000</td>
<td>370 (43.0%)</td>
<td>3.2 2.6 4.0 0.000</td>
<td>119 (13.8%)</td>
<td>1.6 1.2 2.2 0.002</td>
<td>229 (26.6%)</td>
<td>2.4 1.9 3.1 0.000</td>
</tr>
<tr>
<td>…forbidden/bad thoughts (n=379)</td>
<td>72 (19.0%)</td>
<td>1.9 1.2 2.8 0.003</td>
<td>178 (47.0%)</td>
<td>1.6 1.2 2.1 0.003</td>
<td>71 (18.7%)</td>
<td>1.3 0.9 1.9 0.129</td>
<td>131 (34.6%)</td>
<td>1.7 1.2 2.3 0.001</td>
</tr>
<tr>
<td>…religious thoughts (n=337)</td>
<td>58 (17.2%)</td>
<td>2.1 1.4 3.1 0.000</td>
<td>133 (39.5%)</td>
<td>1.3 1.0 1.7 0.093</td>
<td>57 (16.9%)</td>
<td>1.5 1.0 2.2 0.030</td>
<td>76 (22.6%)</td>
<td>0.9 0.6 1.2 0.424</td>
</tr>
</tbody>
</table>

Note: For each comorbidity, we ran a binary logistic regression analysis with the comorbidity as dependent variable and the six F1 items as independent variables, controlling for age (puberty regressed), sex, and socioeconomic status. All significant OR (p-value<.05) are in bold.
Obsessive Compulsive Symptomatology in Community Youth: Typical Development or a Red Flag for Psychopathology?

Ran Barzilay, MD, PhD, Ariana Patrick, MSc, Monica E. Calkins, PhD, Tyler M. Moore, PhD, Daniel H. Wolf, MD, PhD, Tami D. Benton, MD, James F. Leckman, MD, PhD, Ruben C. Gur, PhD, Raquel E. Gur, MD, PhD

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Drs. Calkins, Moore, Wolf, Benton, R. C. Gur, R. E. Gur, and Ms. Patrick report no biomedical financial interests or potential conflicts of interest.
A graph showing the rate of obsessive compulsive symptoms in pre-puberty and post-puberty individuals. The x-axis represents the age group (pre-puberty and post-puberty), and the y-axis represents the rate of symptoms. The graph includes data for males and females, with separate lines for each gender in their respective age groups.