Traumatic Events and Obsessive Compulsive Disorder in Children and Adolescents: Is There a Link?

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Abstract

Background—The extant literature supports an association between psychological trauma and development of OCD in adults, and this link is a plausible mediator for environment gene interactions leading to phenotypic expression of OCD.

Objective—To explore the relationship between OCD and traumatic life events in children and adolescents.

Methods—We examined the prevalence of traumatic life events and PTSD in a large sample of systematically assessed children with OCD. OCD symptoms and severity were assessed using the Children's Yale Brown Obsessive Compulsive Scale (CY-BOCS) in those with and without concurrent PTSD.

Results—Rate of PTSD and trauma exposure was higher in children with OCD than in a comparable control group of non-OCD youth matched for age, gender and SES. Children with concurrent PTSD had more intrusive fears and distress and less control over their rituals than children with OCD but without PTSD. Total CY-BOCS scores were higher in those with concurrent PTSD. Specific type of OCD symptoms was not altered by a PTSD diagnosis.

Conclusions—A history of psychologically traumatic events may be over-represented in children with OCD. Given the need to search for non-genetic factors that may lead to onset of OCD, better and more systematic methods to obtain and quantify psychologically traumatic life events are needed in clinical populations.

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Introduction

Obsessive Compulsive Disorder (OCD) is a highly prevalent disorder, affecting 1–2% of children, adolescents and adults (Kessler et al., 2005; Valleni-Basile et al., 1994) and is characterized by intrusive anxiety-provoking obsessions that frequently lead to compulsions (Goodman, Price, Rasmussen, Riddle, & Rapport, 1991). Posttraumatic Stress Disorder (PTSD) has also been described across the life cycle with a 12-month and lifetime prevalence of 3.5% and 7.8% respectively in the USA (Kessler, Chiu, Dealer, Merikangas, & Walters, 2005; Kessler, Sonnega, Brome, Hughes, & Nelson, 1995). In youth, there are no reliable national prevalence data, but it has been reported that children are exposed to psychological trauma at rates as high as 25%, (e.g., McCloskey & Walker, 2000), and studies of children and teenagers exposed to violence have found prevalence rates of PTSD ranging from 24% to 35% (Berman, Kurtines, Silverman, & Seraing, 1996; Breslau, Davis, Andreski, & Peterson, 1991). Among adults, there is evidence that rate of PTSD in those with OCD is elevated above expected population rates, (Huppert et al., 2005), and conversely rate of OCD in those affected with PTSD is also greater than expected, (Helper, Robins, & McEvoy, 1987; Huppert et al., 2005), suggesting a link between the two disorders. For example, among patients with OCD, cross-sectional studies have shown rates of PTSD ranging from 12% to 75% (Huppert et al., 2005). Among psychiatric inpatients admitted for treatment-resistant OCD, one study found a 39% prevalence rate of PTSD (Gershuny et al., 2008). Patients with OCD and comorbid PTSD have been found to have a poorer response to residential intensive cognitive behavioral therapy using exposure and response prevention for OCD (Gershuny, Baer, Jenike, Minichiello, & Wilhelm, 2002).

Several hypotheses could account for the unexpectedly frequent co-occurrence of OCD and PTSD, including the notion that an anxiety disorder diathesis may manifest as multiple anxiety disorders co-occurring in vulnerable subjects. Another hypothesis is that there may be a causal link between psychologically traumatic events and the occurrence of OCD. Several cases have been published describing an onset of OCD with timing and symptoms suggestive of a traumatic etiology (de Silva & Marks, 1999; Janet, 1903; Pitman, 1993; Rhéaume, Freeston, Leger, & Ladouceur, 1998; Sasson et al., 2005). In one classical case report, Pitman (1993) described a Vietnam combat veteran with no pre-combat psychopathology who developed severe checking, hoarding, and hand-washing compulsions concurrent with PTSD. In de Silva's (1999) series of adult cases of OCD following trauma, a case is reported of a woman who developed contamination obsessions and compulsive washing soon after a sexual assault. Another subject developed PTSD and washing, counting, and touching rituals following a robbery at knifepoint. Sasson et al. (2005) found that specific OCD symptoms were associated with particular types of trauma in a descriptive case series of 13 veterans of the Israeli Defense Force who had concurrent onset of PTSD and OCD after combat trauma.

Although PTSD symptoms can appear similar to those of OCD (*i.e.* re-experiencing events presenting as intrusive images resembling an obsession, or avoidance of feared stimuli), PTSD does *not* include intrusive thoughts that are unrelated to the precipitating trauma, nor does it include ritualistic behavior unrelated to avoidance or hypervigilance. Careful assessment of symptoms to disentangle these syndromes could therefore permit concurrent diagnoses of PTSD and OCD in some individuals.

There is also evidence of elevated rates of OCD among those exposed to psychological trauma, even in the absence of a formal PTSD diagnosis. For example, among male Vietnam veterans, rates of OCD were strongly correlated with combat exposure intensity, with typical population lifetime rates of OCD of 0.5% found among those with low to moderate combat exposure, but rates of 5.5% among those with high combat exposure (Jordan et al., 1991). In

a community sample of 391 women, lifetime rates of OCD were found to be significantly higher in those who had a history of childhood rape (15.4%; RR 6.7; p<0.001) or molestation (10.5%; RR4.5; p<0.01) (Saunders, Villeponteaux, Lipovsky, Kilpatrick, & Veronen, 1992). Among 265 consecutive patients admitted to the National Institute of Mental Health (NIMH) OCD Clinic, the severity of OCD as measured by the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) correlated significantly with a history of one or more traumatic life events, (Cromer, Schmidt, & Murphy, 2007) and among 104 patients admitted to the McLean Hospital OCD Institute for treatment-resistant OCD, 82% reported a history of trauma (Gershuny et al., 2008). Additionally, adult patients with OCD have been found to have higher rates of childhood trauma than controls (Lochner et al., 2002).

Little is known about the association between trauma, PTSD and OCD in the pediatric population. Studies have found a significantly elevated rate of "negative life events" reported in the 6 months (Khanna, Rajendra, & Channabasavanna, 1988) (using Paykel's Schedule for Life Events), (Paykel & Mangen, 1980) or one year (Gothelf, Aharonovsky, Horesh, Carty, & Apter, 2004) (using Sarason's Life Events Checklist) (Sarason, Johnson, & Siegel, 1978) prior to onset of OCD in children in an outpatient setting. In a study of 1035 German adolescents, Essau (2000) found a 23% rate of PTSD among teens with OCD and an 18% rate of OCD in those with a diagnosis of PTSD, underscoring the frequently observed co-occurrence of these two disorders. A positive association between OCD and PTSD could have both clinical importance, *e.g.* affecting severity and treatment response, and scientific significance, *e.g.* shared underlying neurobiological mechanisms.

In the current study, we used existing data systematically acquired from a specialized pediatric OCD program to explore the relationship between OCD and PTSD in children. We hypothesized that children with OCD would show elevated rates of PTSD and trauma history, and that the link between psychological trauma and the occurrence of OCD is not limited to adults alone.

Methods

Participants

Children and adolescents with OCD derived from a family genetic study of pediatric OCD (N=130)(NIMH K08 MH0148) and OCD clinic patients (N=133) who were systematically assessed using identical methods. As a comparison group, we used data from two large, case-control family studies of boys and girls with and without attention-deficit hyperactivity disorder (ADHD) ascertained from psychiatric and pediatric settings (Biederman et al., 1992). Detailed study methodology is reported elsewhere (Biederman et al., 1992; Biederman et al., 2002; Rosenbaum et al., 2000). Comparison subjects were the siblings of control probands. These subjects had not been referred for clinical care and were selected for comparison because *no* a priori psychiatric diagnoses were used as exclusion criteria for their participation. For the purposes of this analysis, we selected children without OCD but all other diagnoses were permitted. We selected only one sibling from each family to maintain independence of observations and to create a comparison group that was similar in age and sex to the OCD group. All studies excluded patients if they were adopted or if their nuclear family was not available for assessment, had major sensorimotor handicaps (paralysis, deafness, blindness), psychosis, autism, or a full scale IQ less than 80. All subjects in this study population had hospital IRB-approved written informed consent from a parent and the subjects themselves provided written assent to participate. For clinic patients, IRB approval was obtained to collect and analyze data anonymously.

Assessment Measures

Psychiatric assessments of all subjects were made using the Kiddie SADS-E (Epidemiologic Version) for DSM-III-R (controls) (Orvaschel & Puig-Antich, 1987) or DSM-IV (OCD subjects) (Orvaschel & Puig-Antich, 1994) and were based on independent interviews with the mothers as indirect informants and direct interviews of children at least 12 years of age. Raters who were blind to clinical status evaluated all subjects. Different interviewers met with mothers and children in order to maintain blindness and to prevent information from one informant influencing the assessment of the other. All raters had undergraduate degrees in psychology and were trained to high levels of inter-rater reliability. Kappa coefficients of agreement were computed by having experienced, board certified child and adult psychiatrists and licensed clinical psychologists diagnose subjects from audiotapes made by the interviewers. Based on 500 assessments from interviews of children and adults, the median kappa coefficient was 0.98. Kappa coefficients for individual diagnoses included: ADHD (0.88), OCD (0.87), Oppositional Defiant Disorder (0.90), Major Depressive Disorder (1.0), Generalized Anxiety Disorder (0.95), and specific phobia (0.95). These measures indicated excellent reliability between ratings made by the non-clinician raters and experienced clinicians.

A diagnostic review team of at least two board-certified child psychiatrists or PhD level licensed psychologists blindly weighed each source of information from direct and indirect Kiddie SADS-E and narrative information provided in each report to yield diagnoses using a Best Estimate method described by Leckman et al. (1982). Data were then combined such that endorsement of a diagnosis by either reporter resulted in a positive diagnosis. Diagnoses were considered definite only if DSM criteria were met to a degree that would be considered clinically meaningful.

OCD symptoms and severity were evaluated using both reports and direct assessment of youth with their parent(s) using the clinician-administered Children's Yale-Brown OCD Scale (CY-BOCS) administered by the senior investigator for systematic anamnesis of symptoms and quantitative assessment of symptom severity. The CY-BOCS is a 10-item anchored ordinal scale (0–4) that rates the clinical severity of the disorder by scoring the time occupied, degree of life interference, subjective distress, internal resistance and degree of control for both obsessions and compulsions. During administration of the CY-BOCS, parents and children were asked when OC symptoms *first* appeared with efforts to link their appearance to specific life events (*e.g.* birthdays or starting school). Next they were asked to say when OC symptoms were first considered *clinically impairing* by asking when symptoms interfered with functioning, created significant distress or took up more than one hour per day. This is reported as the age at onset of OCD. In order to be considered positive, the senior author corroborated all diagnoses of OCD.

PTSD diagnoses were based upon KSADS-E interviews with a screening question that did not vary for any subject regardless of whether they were a control (DSMIIIR) or OCD subject (DSMIV) ("Have you ever had a terribly frightening experience? For example, were you ever in danger of being killed or badly hurt or have you ever witnessed a loved one in danger of being killed or badly hurt?") In addition to reporting a traumatic event (criterion A endorsed), full diagnosis required at least one symptom from section B (re-experiencing of trauma), at least three symptoms from section C (persistent avoidance or numbing), and at least two symptoms from section D (persistent increased arousal). With minor variation in language, diagnostic questions and probes did *not* vary for control and OCD subjects. Subthreshold diagnoses were assigned when the patient fulfilled criterion A (experienced a traumatic event), and met *all* criteria for two out of the three remaining sections (B, C and D), or met for more than half of *all* criteria for *all* three remaining sections (B, C and D). In particular, a PTSD diagnosis was not assigned if symptoms were related to OCD only and

an OCD diagnosis was not assigned if intrusive mental experiences were related to trauma only so that to have concurrent diagnoses, syndromatic criteria of both disorders were fulfilled (full *or* subthreshold for PTSD). In addition, if subjects or their parents endorsed criterion A (trauma), this was reviewed independently by the diagnostic review team to judge if it met the standard described in the DSM-IIIR of an *event involving actual or threatened death or serious injury, or a threat to the physical integrity of self or others and intense fear, helplessness, or horror.* When reported trauma was judged to meet this criterion, a designation of "trauma" was assigned regardless of PTSD diagnostic status. Socioeconomic status (SES) was assessed with the Hollingshead four-factor scale. (Hollingshead, 1975) As a measure of overall functioning, we used the Global Assessment of Functioning (GAF) (Orvaschel & Puig-Antich, 1987).

Statistical Analysis

Comparisons were made between subjects with (N=263) and without (N=151) OCD and between OCD subjects with (N=17) and without (N=246) PTSD. We used an expanded PTSD phenotype to include children with full *and* subthreshold diagnoses to improve our power to explore this relationship and because the DSM-IV notes that children may express their reaction to trauma in ways not typical of adults. As we note in the Introduction, evidence of elevated rates of OCD are reported among those exposed to psychological trauma, even in the absence of a full PTSD diagnosis (*e.g.,* Jordan et al., 1991). Pearson's chi-squared tests were used to compare categorical variables, and two sample t-tests were used for continuous variables. Fisher's exact tests and Wilcoxon rank-sum tests were used when distributional assumptions of Pearson's chi-squared test and t-tests were not met, respectively. Exact logistic regression was used to obtain an odds ratio for the association between OCD and PTSD. All tests were two-tailed with alpha set at 0.05.

Results

Mean age, gender and family SES did not differ between control (N=151) and OCD (N=263) subjects (Table 1). The rate of PTSD (full and subthreshold diagnoses) in control (0%) and OCD (6%) subjects was significantly different (odds ratio=14.6, 95% confidence interval=[2.5, ∞], p<.001). OCD remained significantly associated with PTSD after controlling for comorbid disruptive behavior, mood, and tic disorders (all p<0.04)(Table 2). In half of the affected comorbid subjects, symptoms of PTSD preceded, usually within several months, or onset concurrently with OCD. In remaining subjects with OCD+PTSD, PTSD onset typically within months of OCD onset (Table 2). The rate of "trauma" without PTSD in control (1%) and OCD children (11%) was significantly different (odds ratio=9.3, 95% confidence interval=[1.2, 69.4], p=0.03).

Several quantitative symptom CY-BOCS scalar scores were higher in those children with OCD who also had concurrent PTSD (OCD+PTSD)(Table 3). Scores for obsessions interference (a measure of "intrusiveness" of symptoms) of 2.2 ± 0.8 OCD vs. 3.0 ± 0.5 OCD+PTSD (z=−3.15, p=.002), and obsessions distress 2.4 ± 0.8 OCD vs. 3.0 ± 0.5 OCD+PTSD (z=−2.41, p=.02) produced a significantly higher obsessions subtotal score in the comorbid children; 11.2 ± 3.1 OCD vs. 13.7 ± 2.4 OCD+PTSD (z=−2.63, p=.008). Similarly, the compulsion distress score was 1.9 ± 0.8 OCD vs. 2.4 ± 0.9 OCD+PTSD (z=−1.96, p=.049) while the compulsion control score (the ability to inhibit anxiety-relieving rituals, e.g. checking for safety) was 2.3 ± 0.8 OCD vs. 2.8 ± 0.4 OCD+PTSD (z=−1.99, p=.046). The total CYBOCS was significantly higher in children with both OCD and PTSD; 21.3 ± 5.7 OCD vs. 25.5 ± 5.2 OCD+PTSD (z=−2.21, p=.03). Males and females with OCD had similar rates of PTSD (6.7% and 6.1%, respectively, p=0.84). We did not have sufficient power to determine if the associations of PTSD and specific outcome measures (e.g., CYBOCS) varied by gender.

We used the four-factor structure of symptom dimensions described by Stewart et al. (2008) [1) aggressive/sexual/religious/somatic/checking; 2) symmetry/ordering/counting/repeating; 3) contamination/cleaning; and 4) hoarding] and found no differences among OCD groups regardless of a PTSD diagnosis. Lifetime global functioning (GAF) scores were numerically but non-significantly lower in those with concurrent PTSD; 47±5.8 OCD vs. 45±7.3 OCD +PTSD ($t_{(254)}$=1.52, p=0.13).

Examples of case descriptions of children with OCD with full or subthreshold PTSD, and those endorsing "trauma" (criterion A) who did not have symptoms sufficient to meet criteria for any diagnostic category of the PTSD syndrome are shown in Table 4. Qualitative detailed review of cases revealed two cases of physical abuse but only one met full criteria for PTSD. Three children experienced vicarious abuse by witnessing physical abuse of first-degree family members; of these two had sub-threshold PTSD. One child experienced sexual abuse but did not meet DSM IV criteria for any level of PTSD diagnosis. Numerous cases of anxiety-provoking life events such as house break-ins, near-drowning and dramatic hospitalizations were recorded in the children with OCD but did not meet DSM IV diagnostic criteria for PTSD.

Discussion

This is one of the first studies to explore the relationship between traumatic life events, as captured by an expanded PTSD diagnosis, and incidence of OCD in the pediatric population, using systematic data from a large pool of carefully assessed youth seen in a specialized setting. We found that, although only a small minority of OCD subjects also had PTSD (6%), rate of concurrent PTSD was still significantly greater in children with OCD than in a comparable control group. In those children with concurrent OCD and PTSD, obsessions were experienced as more intrusive and distressing, and compulsions as more distressing and difficult to suppress than the children with OCD without PTSD. Total CY-BOCS scores were significantly higher in children with concurrent illness. In practical terms, a CY-BOCS scale score of 2 means moderate interference and distress while a score of 3 is used to record severe interference and distress. A scale score of 2 denotes moderate control over rituals while a score of 3 is used to denote little control. Most salient, a total CY-BOCS scale score of 21.3 (mean score in OCD group) is in the moderate range overall while a scale score of 25.5 (mean score OCD+PTSD group) is in the severe range. In this sample of children with OCD, a PTSD diagnosis and trauma was associated with CY-BOCS scale scores that increased in severity in clinically meaningful measures.

Our finding of a significant association between OCD and PTSD in children is consistent with the literature from adult studies over more than two decades, which provides compelling evidence of such a link. The Epidemiological Catchment Area (ECA) Study (Helzer et al., 1987) found that among Vietnam veterans with PTSD, the relative risk (RR) of having OCD was 10.1, higher than for any other comorbid diagnosis including mood disorder (dysthymia RR 7.8, bipolar disorder RR 5.7), alcoholism (RR 1.9) and drug abuse or dependence (RR 5.0). In a survey of the extant literature, rates of OCD among adults with PTSD were found to range from 5–22%, much higher than the general population lifetime prevalence of OCD of 1–2% (Huppert et al., 2005). Furthermore, OCD is a psychiatric disorder whose phenotype is fairly consistent across the lifespan, without the ambiguity seen in some other child psychiatric disorders. Diagnostic criteria and treatment approaches are similar in children and adults and it is reasonable to pursue significant associations derived from adult OCD research in early-onset subjects. From a clinical viewpoint, increased severity of OCD and comorbid status may have treatment and outcome implications. A recent study of the impact of trauma on treatment outcome in a comparative treatment study

of depressed adolescents (Lewis et al., 2010) found that a trauma history moderated treatment outcomes.

Cognitive-behavioral theory provides an empirically based, well-established framework for understanding a possible association between trauma and OCD and our finding that children with concurrent OCD and PTSD had more severe OCD symptoms. Central to the behavioral framework is Mowrer's (1939) two-factor theory, which states that the acquisition of fears is based on classical conditioning and maintained by operant principles (*i.e.,* negative reinforcement). In the conditioning process, a previously neutral stimulus becomes associated with a feared stimulus (e.g. a psychological trauma) and thereby produces distress. The person engages in ritualistic behavior that reduces distress and anxiety and increases the likelihood of future ritual engagement. Threat appraisals in OCD are associated with multiple cognitive errors such as an exaggerated importance attributed to thoughts or an inflated concern about the ability to control these thoughts (Barrett & Healy, 2003; Obsession Compulsive Cognitions Working Group, 1997). Similar threat-based attention and interpretation biases have been observed among individuals with PTSD (Kaspi, McNally, & Amir, 1995; Vrana, Roodman, & Beckham, 1995). Shared psychological mechanisms underlying both disorders may therefore cause degrees of intrusiveness and distress that are additive. Biological mechanisms may also be common to both disorders. Photon emission tomography (PET) has shown both PTSD and OCD patients have reductions in right caudate blood flow (Lucey et al., 1997) and activation of the right posterior medial orbito-frontal region (Rauch, Savage, Alpert, Fischman, & Jenike, 1997).

There are good reasons to explore salience of potential environmental triggers in children with OCD. Our findings documenting an association between pediatric OCD and traumatic life events are consistent with data from genetic studies suggesting that a considerable proportion of the variance in the occurrence of OCD can be explained by *non-genetic environmental* factors. For example, in a meta-analysis of family studies, (Hettema, Neale, & Kendler, 2001) found only modest estimated heritability coefficients for OCD of 30–40%. In a cross-cultural sample of 4246 twin pairs, Hudziak et al. (2004) used structural equation modeling using an 8-item Obsessive Compulsive scale (OCS) from the CBCL as a proxy for OCD to examine the influence of both genetic (45%-58%) and unique environmental (42%-55%) factors and concluded that both were about equally important. Even lower estimates of heritability of OCD were reported by Jonnal et al. (2000) in a population sample of 527 female twin pairs using items from the Padua Inventory. These studies support the role of environmental risk factors that could influence the expression of OCD and underscore the importance of seeking to understand such triggers.

Even if a small amount of variance (in the expression of OCD) is explained by psychological trauma, all gene-environment mediators are of potential importance. Genetic models may be helpful in that, for complex psychiatric disorders, research posits many common variants, each explaining but a small amount of the variance in phenotype. The cumulative effect of multiple common genetic variants, each with small effect, may lead to a critical threshold for phenotype expression. Similarly, any significant environmental associations are of interest and merit further study.

Limitations

Several limitations could affect interpretation of our data. This was a secondary analysis of existing data collected for a study whose design did not, a priori, focus on the present research question. As such the design was not ideally suited to explore the relationship between OCD and trauma in children and could have lead to potential sampling bias. The overall prevalence of PTSD in our sample was quite low making comparisons more difficult. In particular, absence of PTSD in our control group is at variance with the cited

pediatric literature and is possibly explained by the relatively high SES in our sample (upper middle class and predominantly Caucasian subjects) whose risk for exposure to trauma may not be representative of the greater population at large. If true, then we would expect our findings to retain their significance as all our subjects had a similar SES. Our findings of a significant difference in the sub- and total scores of the CY-BOCS, considered the most sensitive quantitative assessment scale for pediatric OCD, (Scahill et al., 1997) is even more noteworthy in the small cohort of OCD+PTSD subjects. Another possibility is that the DSM-III-R diagnostic criteria for PTSD used to assess the control group were less sensitive (*i.e.,* more restrictive) than the DSM-IV criteria used for the OCD subjects who represented a later cohort. However, the screening question/probe that we used to elicit a trauma history did not vary between the KSADS interview instruments and with some minor variation in language, also did not differ in itemized probes for PTSD criteria B, C, D or E (distress and impairment). However, the use of sequential versions of the DSM for PTSD represents a further limitation of this work.

Another concern is that diagnoses could be confounded and that the apparent higher than expected concurrence of PTSD and OCD is an artifact caused by mis-attribution of symptoms. This assumption is at odds with the extensive literature on this subject including epidemiological studies (*i.e.,* non-clinically referred subjects that avoids Berkson's bias) (Berkson, 1946) although the extant literature may be limited by the changing nosology of the DSM and the stringency or sensitivity of evolving PTSD diagnostic criteria. It is important to note that even if a trauma acts as a trigger for obsessions, the CY-BOCS measures *syndrome-specific* symptoms and severity, not PTSD symptoms. If more severe OCD symptoms in children with concurrent OCD and PTSD represented an artifact of the PTSD diagnosis (*e.g.* PTSD symptoms masquerading as OCD symptoms) we would expect fears of harm and aggression characteristic of PTSD to be overrepresented in these children. This is not the case; symptoms and symptom dimensions did not differ between groups, suggesting that increased severity of OCD is a true finding. We took particular care to include only children who met syndrome criteria for diagnoses attending to potential overlap in symptoms. Indeed a large number of plausible traumatic events including physical and sexual abuse were *not* included in the PTSD sample, as they did not meet diagnostic criteria, even though we used an expanded phenotype to increase our diagnostic sensitivity to such cases.

We elected to include subthreshold cases in an expanded phenotype in our analysis as detailed in Methods. Given the criteria we used for a subthreshold diagnosis that specified a patient must have had a trauma and met *all* criteria for two out of the other three DSM-IIIR sections, or more than half of *all* criteria for *all* three remaining sections, this operational threshold was judged reasonable to define some quantifiable measure of trauma for an exploratory analysis. Since such an experience is largely subjective, the DSM language requiring "an event involving actual or threatened death or serious injury, or a threat to the physical integrity of self or others *and* intense fear, helplessness, or horror" may be excessively strict for vulnerable individuals. This may be especially true for children whose perception of serious threat is developmentally sensitive.

Another potential limitation is that our findings of a link between trauma and OCD may not be specific to the modeled variable of OCD but rather a general effect on psychopathology in youth. However, we argue that specificity of the association is demonstrated in several ways. First, the association between OCD and PTSD remained significant after controlling for common comorbid disorders that might represent proxy associations. Second the temporal link between syndrome onsets is noted, and thirdly, the nature of the symptoms is often thematically linked as seen in case descriptions in Table 4.

Finally, not every child had complete data of symptom types and scalar scores so that our denominator was slightly smaller for this analysis. Despite this, our sample is the largest ever reported using systematic expert assessments applied consistently over the duration of the data collection.

Conclusions

Children with OCD also had PTSD and evidence of psychological trauma at rates higher than found in a comparable non-OCD cohort and those affected with concurrent disorders had more severe OCD symptoms. Although a minority of children may be included in this association, the threshold criteria for defining a meaningful trauma for children who are vulnerable remain unclear. Since genetic influences account for only some of the expression of OCD, the search for environmental mediators (epigenetic factors) of large and small effect in genetically vulnerable individuals is important. The adult literature points towards psychological trauma as a plausible factor to study in early onset cases. In this large sample of children with OCD we found a positive signal suggesting further systematic study of this association is needed.

Acknowledgments

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Table 1

Demographics of Youth with OCD and Controls

	Controls	OCD	Test Statistic	p-value
	N=151(%)	**N=263(%)**		
Age at Ascertainment (years) Mean±SD	12.1 ± 3.3	11.9 ± 3.0	$t_{(412)}=0.90$	0.37
Gender (male) N(%)	87 (58)	164 (62)	$\chi^2_{(1)}=0.90$	0.34
Age of OCD onset (years) Mean±SD	--	7.9 ± 0.7	--	--
Age of PTSD onset (years) Mean±SD	--	8.0 ± 3.1	--	--
Social Economic Status (SES)	1.6 ± 0.8	1.5 ± 0.7	z=0.83	0.41

Table 2

Prevalence of PTSD and Trauma in Youth with OCD and Controls

	Controls	OCD	Test Statistic	p-value
	N=151(%)	N=263(%)		
PTSD (Full)	0 (0)	6 (2)	OR=4.8 [0.7, ∞]	0.13
PTSD (Full or Subthreshold)	*0 (0)*	*17 (6)**	*OR=14.6 [2.5, ∞]*	*<0.001***
Trauma	*1 (1)****	*28 (11)*	*OR=9.3 [1.2, 69.4]*	*0.03*

*
 OCD onset after PTSD = 5 (1 for full PTSD)

PTSD and OCD concurrent onset = 3 (1 for full PTSD)

PTSD onset after OCD = 9 (4 for full PTSD)

**
 OCD remained significantly associated with PTSD after controlling for comorbid disruptive behavior, mood, or tic disorders (all p<0.04)

***
 Denominator N=79

Table 3

Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS) in Youth with OCD with and without PTSD

	No PTSD[*] N=201(%)	PTSD[*] N=10(%)	Test statistic	p-value
Obsessions				
Time Spent	2.3 ± 0.8	2.7 ± 0.9	z=−1.32	0.19
Interference	*2.2 ± 0.8*	*3.0 ± 0.5*	*z=−3.15*	*0.002*
Distress	*2.4± 0.8*	*3.0 ± 0.5*	*z=−2.41*	*0.02*
Resistance	2.0 ± 0.9	2.6 ± 0.9	z=−1.84	0.07
Control	2.4 ± 0.8	2.9 ± 0.6	z=−1.95	0.051
Subtotal	*11.2 ± 3.1*	*13.7 ± 2.4*	*z=−2.63*	*0.008*
Compulsions				
Time Spent	1.9 ± 0.7	2.1 ± 0.6	z=−0.75	0.45
Interference	1.9 ± 0.8	2.4 ± 1.0	z=−1.82	0.07
Distress	*1.9 ± 0.8*	*2.4 ± 0.9*	*z=−1.96*	*0.0498*
Resistance	2.1 ± 0.9	2.4 ± 0.7	z=−1.47	0.14
Control	*2.3 ± 0.8*	*2.8 ± 0.4*	*z=−1.99*	*0.046*
Subtotal	10.0 ± 3.1	11.8 ± 2.9	z=−1.69	0.09
CYBOCS Total	*21.3 ± 5.7*	*25.5 ± 5.2*	*z=−2.21*	*0.03*
Four Factor Symptom Dimension[34][*]				Fisher's exact p value
Factor 1	175 (92)	8 (89)		0.56
Factor 2	143 (75)	7 (78)		1.00
Factor 3	133 (70)	7 (78)		0.73
Factor 4	63 (33)	2 (22)		0.72

[*] Four Factor Structure of Symptom Dimensions34

Factor 1 AGGRESSIVE/SEXUAL/RELIGIOUS/SOMATIC/CHECKING

Factor 2 SYMMERY/ORDERING/COUNTING/REPEATING

Factor 3 CONTAMINATION/CLEANING

Factor 4 HOARDING

Table 4

Case Descriptions of Youth with OCD with and without PTSD and with Trauma

Age (y) & Gender	Traumatic Event	Obsessional Symptoms
Full Syndromal PTSD[*]		
16yo female	Alone with sister at home when robbers broke in, locked self in room, screamed and called 911	Thoughts of something bad happening, someone would die or get shot, fear of death, dying, repetitive religious thoughts
15yo male	Attempted sexual assault by older kid.	Contamination, wouldn't leave house, showers compulsively, and washes hands
12yo male	Anaphylactic reaction, ate a watermelon and felt itchy, rushed to hospital, could not breathe	Eats very limited range of food, seeks excessive reassurance regarding ingredients, wont eat out, wears specific clothes, magical and showering rituals
13yo female	School bus accident, had to be driven to school for the remainder of the year	Keep changing clothes because didn't feel "right", erases and re- writes letters, has to re-read words, checks food to make sure it is fresh, contamination concerns
17yo male	Parents hit him a lot through childhood. In school beaten by classmates, afraid to go to school	Repetitive words, numbers and phrases that can't get out of head, checks alarm before bed, thinks about appearance/hair, has to check $ in pocket
Subthreshold PTSD[**]		
9yo male	Drunk driver drove into them, car accident and police chase	Worried was going to die, contamination concerns
13yo female	Man followed her in a van while walking home with a friend, they ran home, and called police but man was never found. Freaks out when she sees trucks/vans	Something bad will happen such as being kidnapped, germs & contamination concerns, obsesses over what she is wearing
15yo female	Seeing Dad taken to hospital via ambulance for diabetes, insulin shock	Thinks it will happen again, bad dreams, counts to four over and over, repeating phrases, gets stuck checking
9yo male	Stepped into bees' nest, stung many times	Thinks about things being in the right order, worries where his special things are, legos have to be in the same order/direction, searches pockets in certain order for objects, has to touch things a certain way
6yo male	Sister died suddenly after virus attacked her heart. Was asleep and never saw her again	Intrusive thoughts of something terrible happening to his mom, bad dreams
15yo male	Witnessed adult beating his brother, stood by and after questioned himself why he could not help him	Blood contamination concerns, washing, fear of hurting bugs, sexual thoughts, dirty hands, prays
"Trauma" endorsed without meeting diagnosis for either Full or Subthreshold PTSD		
15yo female	Sister nearly hit by car, pushed sister out of way just in time	Germ obsessions, afraid of people getting hurt, hair must be perfect, carries a mirror checking and counting by 3's
17yo female	Badly hurt in gymnastics accident with painful compound fracture of elbow	Afraid something bad will happen to herself or her family and it will be her fault, making sure things are "OK", washing hands, checking light switches, touching things with her elbow
16yo male	Sexually assaulted at age 8	Afraid to go to sleep, fear of being blown up, wants everyone to be safe, afraid to become a "bad" person, repeats things in 2"s,
16yo male	Witnessed uncle and father in a knife fight	Has to walk back and forth over a certain area to keep others safe, counts, germ obsessions, bad luck is going to happen, afraid of saying the wrong things
13yo male	While climbing on rocks, foot slipped and almost fell 30 feet onto jagged rocks, has nightmares and flashbacks	Obsessions that he was going to die of injury or of AIDS infection
8yo female	Head on car accident, saw it coming, hospitalized for 3 days in ICU, severe injury	Afraid of some movie characters including ET, intrusive visual images
16yo male	Hazing, was beat up daily at school	Intrusive graphic images of death scenes, thought might die or others around him might die, wasn't good enough, washed hands

Age (y) & Gender	Traumatic Event	Obsessional Symptoms
15yo male	Witnessed domestic violence, Dad hitting Mom	Intrusive imagines of people getting their limbs cut off, blood, thoughts of sex/incest/homosexuality, has to verbalize or else will obsess about it, washes hands

Not all original cases included. Examples elucidate thematic links between PTSD, trauma & OCD symptoms.

*
N=5 of 6 cases

**
N=6 of 17 cases

***
N=8 of 28 cases