RESEARCH ARTICLE

Association between early-life trauma and obsessive compulsive symptoms in community youth

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Abstract

Background: Obsessive-compulsive symptoms (OCS) in youth are common, have heterogeneous manifestations, and have been shown to be associated with serious psychopathology. While early-life trauma exposure is associated with increased risk for obsessive-compulsive disorder (OCD), its association with different OCS and its clinical relevance for serious psychopathology is unclear. Here we aimed to evaluate associations among traumatic stressful events (TSE), OCS, and serious psychiatric conditions in community youth.

Methods: We studied nonmental-help seeking youths from the Philadelphia Neurodevelopmental Cohort ($N = 7054$, aged 11–21, 54% females, 52% prepubertal), assessed for lifetime TSE exposure and OCS. Regression models investigated cross-sectional associations of TSEs with OCS, and associations with depression, suicide ideation and psychosis. Models examined sex and puberty effects, controlling for age and socioeconomic status.

Results: Trauma exposure was associated with higher OCS rates, especially in females (Trauma × Sex interaction Wald = 7.93, $p = 0.005$) and prepuberty (Trauma × Puberty interaction Wald = 7.68, $p = 0.006$). TSEs were associated with all OCS manifestations, most prominently with bad intrusive thoughts (odds ratio [OR] = 1.63). Assaultive TSEs, especially sexual assault, showed stronger associations with OCS compared with nonassaultive TSEs. While TSEs and OCS were independently associated with depression, suicide ideation, and psychosis, a significant interaction was observed only in association with increased rates of psychosis (Trauma × OCS interaction Wald = 5.08, $p = 0.024$).

Conclusion: Early-life trauma is associated with OCS in a dose-response manner, more so in females and prepuberty. The trauma-OCS association varied by load, type of trauma, and by OCS subtypes. Trauma-OCS appears a detrimental combination in association with psychosis.

KEYWORDS
child/adolescent, depression, obsessive-compulsive disorder, posttraumatic stress disorder, stress, suicide, trauma

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Ran Barzilay and Ariana Patrick contributed equally to this work.

1 | INTRODUCTION

Early life traumatic stressful events (TSEs) are associated with increased rates of psychopathology, above and beyond posttraumatic stress disorder (PTSD; Barzilay, Calkins, et al., 2019; Heim & Nemeroff, 2001; Lowe et al., 2017; McGrath et al., 2017; McLaughlin et al., 2012; Teicher, Tomoda, & Andersen, 2006). TSEs are also associated with obsessive-compulsive disorder (OCD; Boudreaux, Kilpatrick, Resnick, Best, & Saunders, 1998; Briggs & Price, 2009; De Silva & Marks, 1999; Gothelf, Aharonovsky, Horesh, Carty, & Apter, 2004; Lochner et al., 2002; Ojserkis, McKay, & Lebeaut, 2018), with rates as high as 50–70% of patients experiencing OCD symptoms following a TSE (Sadock, Sadock, & Ruiz, 2015), and with increased severity of OCD symptoms in people with a history of trauma exposure (Cromer, Schmidt, & Murphy, 2007). In the largest prior study, Park et al. (2014) cross-sectionally examined a community sample of 6,027 adults and found that those who experienced multiple traumatic events in childhood were more likely to develop OCD compared with individuals who experienced a single traumatic event in childhood. Among patients with PTSD, cross-sectional data have shown rates of OCD varying from 5% to 22%, and among OCD patients, PTSD rates ranging from 12% to 75% (Huppert et al., 2005). The relationships among specific types of trauma and OCD are less clear. For example, in two cross-sectional studies of about 400 adult, community ascertained women (Boudreaux et al., 1998; Saunders, Villeponteaux, Lipovsky, Kilpatrick, & Veronen, 1992) and one longitudinal study of 36 adults with OCD (Grisham et al., 2011) an association was reported between sexual assault and OCD. However, two other cross-sectional studies that focused on adults diagnosed with OCD (Carpenter & Chung, 2011), and a large sample of college students (Mathews, Kaur, & Stein, 2008) did not support this relationship.

OCD presentations are heterogenous (i.e., two patients can have no overlapping obsessions/compulsions and share the same diagnosis). One possibility to address this phenotypic heterogeneity is through studying OCD symptom dimensions, identified by factor analysis (Barzilay, Patrick, et al., 2019; Mckay et al., 2006; Nikolajsen, Nissen, & Thomsen, 2011; Stewart et al., 2007, 2007). Limited research exists on the relationship between trauma exposure and different clinical OCD presentations. In adult studies, factors related to symmetry (Cromer et al., 2007; Rosso, Albert, Asinari, Bogetto, & Maina, 2012) and obsessions/checking (Cromer et al., 2007) were associated with stressful life events. In youth populations, only one cross-sectional study has examined how trauma exposure and OCD dimensions are associated in 263 children with OCD, reporting no differences in symptom dimensions in children with OCD with and without a comorbid PTSD diagnosis (Lafleur et al., 2011). No data exists in community (nonpsychiatric help seeking) youths that examines the association of childhood trauma with the presence of obsessive-compulsive symptoms (OCS), which we have previously reported are associated with serious psychiatric conditions, including depression, suicide ideation, and psychosis (Barzilay, Patrick, et al., 2019).

Two large community sample studies have shown that OCS in youths are prevalent (Barzilay, Patrick, et al., 2019; Fullana et al., 2009) and are phenotypically heterogeneous (Alvarenga et al., 2016; Leckman, Bloch, & King, 2009). Most youths with OCS do not reach threshold levels fulfilling OCD criteria. Research has shown that the phenotypic heterogeneity of OCS can be reduced to the following factors: Bad Intrusive Thoughts, Repeating/Checking, Symmetry, and Cleaning/Contamination; and Hoarding as a separate single-symptom factor (Alvarenga et al., 2015; Barzilay, Patrick, et al., 2019; Bloch, Landeros-Weisenberger, Rosario, Pittenger, & Leckman, 2008; Fullana et al., 2009). We have recently shown in the Philadelphia Neurodevelopment Cohort (PNC), a large sample of community youth with substantial trauma exposure (Barzilay, Calkins, et al., 2019), that OCS are common (~40%) and can be stratified to symptom dimensions, with Bad Intrusive Thoughts showing particularly robust associations with serious clinical conditions (Barzilay, Patrick, et al., 2019). Here, we use the same data set to add and expand upon our previous findings, through elucidating the complex relationship between childhood trauma and OCS in association with each other, as well as with serious psychiatric conditions like depression, suicide ideation, and psychosis. These specific conditions were chosen to highlight the serious clinical impairment that can be observed in community nonhelp seeking samples, as well as for their association with childhood trauma exposure and OCS.

We examined the cross-sectional associations among trauma exposure, OCS dimensions, depression, suicide ideation, psychosis, sex, and puberty, in a large sample of nonmental-help seeking community youths ($N = 7054$, aged 11–21). We hypothesized that, (a) youths who experienced TSEs would show elevated rates of OCS, and this effect would be strongest in females (Sex × Trauma interaction); (b) youths with both high TSE exposure and high OCS would show higher rates of serious psychological comorbidities; (c) youths who experienced sexual trauma would have higher rates of OCS compared with nonexposed youths.

2 | MATERIALS AND METHODS

2.1 | Participants

Participants were from the PNC, a collaboration between the Children's Hospital of Philadelphia and the Brain Behavior Laboratory of the University of Pennsylvania (Calkins et al., 2015). Enrollment criteria included: (a) age 8–21 years; (b) ambulatory in stable health; (c) English proficiency; (d) physical and cognitive ability to participate in study procedures; and (e) absence of significant physical conditions or developmental delay impairing motility or cognition (e.g., paresis or palsy, intellectual disability). Participants were recruited from a large pool ($N = 50,293$) of children previously genotyped as part of a genomic study at the Children's Hospital of Philadelphia health care network (see Calkins et al., 2015). Notably, participants were recruited from pediatric and not psychiatric clinics, and the sample is not enriched for those seeking psychiatric services. Participants were excluded if they did not meet enrollment criteria or

could not be contacted. From the remaining pool ($N = 13,598$), 2,699 declined to participate, 1,401 were excluded, and 9,498 youths were enrolled. This community cohort is racially (56% Caucasian, 33% African American and 11% other) and socioeconomically diverse (Moore et al., 2016). The clinical assessment was administered to caregivers or legal guardians, who were considered collateral informants, for participants ages 8–10; to probands and collateral informants for probands ages 11–17; and to probands for participants ages 18–21. For the current analyses, we included only proband interviews and therefore only data from probands ages 11–21 were analyzed ($N = 7,054$). Missing data on trauma, OCS and pubertal status ($N = 424$, 6.01% of the sample) was handled by listwise deletion.

2.2 | Clinical assessment

Psychopathology symptoms were evaluated by trained and supervised assessors using a structured screening interview (Calkins et al., 2015), based on the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS; Kaufman et al., 1997). Lifetime depressive episode, OCD, and PTSD diagnoses were determined if symptoms were endorsed with frequency and duration approximating DSM-IV disorder or episode criteria, accompanied by significant distress or impairment. Lifetime suicide ideation was determined on the basis of a direct question regarding thoughts of killing oneself. Psychosis determination was based on endorsed hallucinations or delusions, with duration ≥ 1 day, occurring outside the context of substance use, illness, and medicines, and accompanied by significant impairment or distress (Calkins et al., 2014). Pubertal status was determined based on self-report of genital development (Tanner score of 5 was considered postpubertal; Satterthwaite et al., 2014).

2.3 | Assessment of TSE

The TSE screen assessed lifetime exposure to eight traumatic events. Participants were asked if they have ever experienced any of the following events: (a) a natural disaster; (b) thought they or someone close to them was going to be killed or hurt badly; (c) been attacked by somebody or badly beaten; (d) been forced to do something sexual (including but not limited to rape); (e) been threatened with a weapon; (f) been in bad accident; (g) seen or heard somebody get killed, hurt badly, or die; and (h) been upset by seeing a dead body or seeing pictures of the dead body of somebody they knew well. Cumulative trauma load was represented by a count of endorsed TSEs (0–8). For visualization purpose, we categorized traumas into four groups of load: no TSEs, one TSE, two TSEs, and three or more TSEs, as in previous work (Barzilay, Calkins, et al., 2019; McCutcheon et al., 2009). For analyses of TSE subtypes, we considered endorsement of being attacked, badly beaten or threatened with a weapon as Physical Assault TSE, being sexually forced (including but not limited to rape) as Sexual Assault TSE, and all other endorsements as Nonassaultive TSE. Every participant who endorsed a TSE was assigned to one subtype. Participants who endorsed multiple TSEs were categorized according to the following hierarchy: (a) Sexual Assault TSE, (b) Physical Assault TSE, (c) Nonassaultive TSE. For example, if a participant endorsed all trauma exposures, s/he was placed in the Sexual Assault TSE subtype.

2.4 | Assessment of OC symptoms

The OCD screen assessed lifetime experience of eight obsessions and nine 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: (a) concern with harming others/self; (b) pictures of violent things; (c) thoughts about contamination/germs/ illness; (d) fear that you would do something/say something bad without intending to; (e) feelings that bad things that happened were your fault; (f) forbidden/bad thoughts; (g) need for symmetry/ exactness; and (h) 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: (a) cleaning or washing (e.g., your hands, your house); (b) counting; (c) checking (e.g., doors, locks, ovens); (d) getting dressed over and over again; (e) going in and out a door over and over again; (f) ordering or arranging things; (g) doing things over and over again at bedtime, like arranging the pillows, sheets or other things; (h) saving up so many things that people complain or they got in the way; and (i) feeling the need to do things just right (like they have to be perfect).

2.5 | Factor analysis

Exploratory factor analysis (least-squares extraction with oblimin rotation) was performed on the tetrachoric correlations among the obsessive-compulsive items, as previously described (Barzilay, Patrick, et al., 2019). The factors that emerged were: F1—Bad Intrusive Thoughts, including 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—Cleaning/Contamination.

2.6 | Statistical analysis

All analyses were conducted using SPSS Statistics 24 (IBM, Armonk, NY). For multivariate analyses, we performed binary logistic regressions. We investigated the association of TSEs (as a continuous measure representing TSE count), sex, pubertal status, and their interaction with the endorsement of any of the obsessive/compulsive symptom (OCS, dichotomous measure) as the dependent variable, covarying for age (puberty-regressed) and socioeconomic status. Participants were categorized into the OCS group if they endorsed at least one obsession or compulsion. Associations of TSEs and OCS with serious psychiatric conditions were evaluated using binary logistic regressions with either depression, suicide ideation, or

TABLE 1 Demographic characteristics and exposure rates for traumatic stressful events by count and type of traumatic stressful event in PNC participants

	Total N = 7,054	No TSE n = 3,465 (49%)	1 TSE n = 1,762 (25%)	2 TSE n = 950 (14%)	3 + TSE n = 778 (11%)
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Age (years)	15.8 (2.7)	15.4 (2.7)	15.8 (2.7)	16.4 (2.7)	17.1 (2.5)
	N (%)	n (%)	n (%)	n (%)	n (%)
Sex, female	3,769 (54)	1,871 (54)	1,004 (57)	505 (53)	389 (50)
Postpubertal	3,318 (48)	1,454 (42)	866 (48)	519 (55)	479 (62)
OCS	2,699 (38)	1,039 (30)	760 (43)	462 (49)	438 (56)
OCD[a]	208 (3)	61 (2)	45 (3)	35 (4)	66 (9)
PTSD[a]	838 (12)	0 (0)	236 (13)	241 (25)	361 (46)
	Total N = 7,054	No TSE n = 3,464 (49.1%)	Nonassaultive TSE[b] n = 2,568 (36.4%)	Physical Assault TSE[c] n = 643 (9.1%)	Sexual Assault TSE[d] n = 269 (3.8%)
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Age (years), M (SD)	15.8 (2.7)	15.4 (2.7)	15.9 (2.7)	17.1 (2.5)	17.6 (2.3)
	N (%)	n (%)	n (%)	n (%)	n (%)
Sex, female	3,761 (54)	1,870 (54)	1,459 (57)	195 (30)	237 (88)
Postpubertal	3,308 (48)	1,453 (42)	1,281 (50)	376 (59)	198 (74)
OCS	2,694 (38)	1,039 (30)	1,181 (46)	302 (47)	172 (64)
OCD[a]	208 (3)	61 (2)	72 (3)	43 (7)	32 (12)
PTSD[a]	836 (12)	0 (0)	456 (18)	204 (32)	175 (65)

Note. OCD: obsessive compulsive disorder; OCS: obsessive compulsive symptoms; PNC: Philadelphia neurodevelopmental Cohort; PTSD: posttraumatic stress disorder; TSE: traumatic stressful event.

[a]OCD and PTSD were determined using a structured screening interview, based on the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS) for DSM-IV.

[b]Nonassaultive TSE includes natural disaster, bad accident, thinking someone close could be killed or hurt badly, witnessing someone getting killed, badly beaten, or die, and/or seeing a dead body.

[c]Physical Assault TSE includes being attacked, badly beaten, and/or threatened with a weapon.

[d]Sexual Assault TSE includes being sexually forced and/or raped.

psychosis as the dependent variable, and TSE count, OCS (as a binary variable), and their interaction as independent variables. Models controlled for sex, pubertal status, age, and socioeconomic status. To examine the specific associations of different subtypes of TSEs (Nonassaultive TSEs, Physical Assault TSEs, Sexual Assault TSEs) and their associations with each of the OCS factors (Bad Intrusive Thoughts, Repeating/Checking, Symmetry, Cleaning/Contamination, and Hoarding), we used separate binary logistic regressions models, controlling for sex, pubertal status, age, and socioeconomic status. Due to the possibility of clinical overlap of OCS that compose Bad Intrusive Thoughts and symptoms of PTSD, models controlled for PTSD.

3 | RESULTS

3.1 | Sample characteristics, trauma exposure, and OCS rates

The sample population was balanced for pre- and postpubertal status and included more females than males, with half of participants endorsing exposure to ≥1 TSE and ~10% with ≥3 TSEs or ≥1 assaultive trauma. Almost 40% of the participants endorsed at least

one OCS, while 3% of the sample fulfilled threshold level DSM criteria for an OCD diagnosis (Table 1).

3.2 | TSE associations with OCS

Endorsement of experiencing traumatic events was associated with OCS (Figure 1a, odds ratio [OR] = 1.46 for each additional TSE, $p < 0.001$, controlling for sex, puberty, age, and SES). The association of trauma exposure and OCS was greater in females (TSE cumulative count × Sex interaction, Wald ($df = 1$) = 7.93, $p = 0.005$) and more pronounced pre-puberty (TSE cumulative count × Puberty interaction, Wald ($df = 1$) = 7.68, $p = 0.006$). Evaluation of trauma type with OCS revealed that assaultive TSEs showed greater associations with OCS compared to Nonassaultive TSEs, with Sexual Assault TSEs showing the greatest association with OCS (Figure 1b, Nonassaultive TSE OR = 2.03, Physical Assault TSE OR = 2.52, Sexual Assault TSE OR = 4.82, all ps < 0.001). Females showed higher OCS rates in association with Nonassaultive TSEs (Nonassaultive TSE × Sex interaction, Wald ($df = 1$) = 5.20, $p = 0.023$). There were no sex or pubertal status effects for Physical or Sexual Assault TSEs (Figure 1b, all Assault by sex and Assault × Puberty interactions $p > 0.05$). Analyses
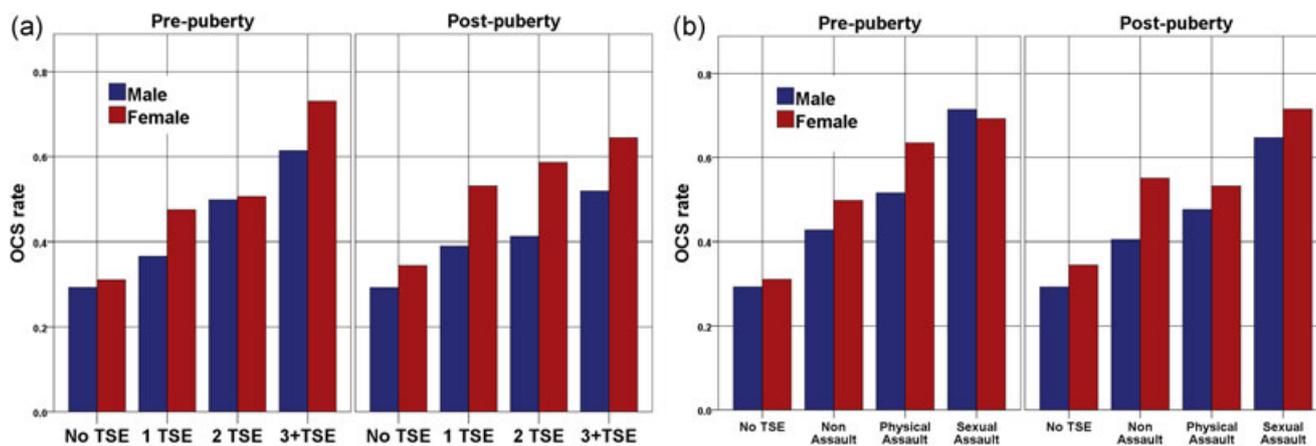
FIGURE 1 Association between TSE Exposure by count (a) and type (b) with OCS rate. Endorsement of at least one OCS was considered as having OCS. OCS: obsessive-compulsive symptoms; TSE: traumatic stressful event

separating rape and nonrape sexual assault showed similar results (OR = 5.12 and OR = 4.98, respectively, both ps < 0.001). History of TSE was also associated with a threshold OCD diagnosis (OR = 1.45 for each additional TSE, p < 0.001, controlling for sex, puberty, age, and SES).

3.3 | Association of cumulative trauma load with specific OCS manifestations

To examine whether trauma exposure was differentially associated with specific OCS manifestations, we conducted separate regression models with each OCS factor as the dependent variable. All OCS factors were associated with trauma (Table 2), with Bad Intrusive Thoughts showing the strongest associations with trauma exposure (OR = 1.63). Significant interactions showed higher rates of Bad Intrusive Thoughts in prepubertal youth and females with trauma exposure, while prepubertal youth with trauma exposure also showed higher rates of Repeating/Checking, and Symmetry obsessions and compulsions (Table 2).

3.4 | Types of TSE and their associations with OCS factors

We investigated the relationship between specific types of traumatic stressful events (Nonassaultive TSEs, Physical Assault TSEs, and Sexual Assault TSEs) with the endorsement of specific OCS factors (Bad Intrusive Thoughts, Repeating/Checking, Symmetry, Cleaning/Contamination, and Hoarding; Table 3). Among trauma types, assaultive traumas showed stronger association across OCS factors, with sexual assault victims showing the highest rate of OCS endorsement compared to other individuals. No differences were found between sexual assault nonrape and sexual assault rape TSEs (please see Table S1). History of assaultive TSEs showed greater association with threshold OCD diagnosis (OR = 4.12; 95% confidence interval [CI], 2.67–6.37 for physical assault and OR = 6.47; 95% CI,

4.03–10.41 for sexual assault; p < 0.001 for both models) compared with the association of Nonassaultive trauma with OCD diagnosis (OR = 1.63; 95% CI, 1.14–2.32; p = 0.007). All models covaried for sex, age, pubertal status, and SES.

3.5 | Associations of TSE and OCS with psychopathology

Next, we investigated the relationship between TSE exposure and OCS in association with serious psychiatric conditions (Figure 2). TSE exposure and OCS were both independently associated with higher rates of depression (Figure 2a, OR = 3.55 for addition of a single TSE, OR = 1.40 for having OCS, ps < 0.001), suicide ideation (Figure 2b, OR = 3.32 for addition of a single TSE, OR = 1.40 for having OCS, ps < 0.001) and psychosis spectrum (Figure 2c, OR = 3.96 for addition of a single TSE, OR = 1.42 for having OCS, ps < 0.001). A significant trauma by OCS interaction was found in psychosis spectrum youth with OCS and high TSE exposure, as individuals who endorsed OCS endorsed psychosis at a higher rate compared to individuals with the same amount of traumatic exposure who did not endorse OCS (TSE × OCS interaction, Wald (df = 1) = 5.08, p = 0.024). This interaction was not found with depression or suicide ideation (ps > 0.05).

3.6 | Sexual assault association with OCS factors

We examined the association between sexual assault and OCS with depression, suicide ideation, and psychosis. We found that individuals who had experienced sexual assault showed higher levels of all three conditions, regardless of OCS endorsement (main effect for suicide ideation, depression, psychosis, all ps < 0.001); and individuals who endorsed OCS also showed higher levels of all three conditions, regardless of sexual trauma endorsement (main effect for suicide ideation, depression, psychosis, all ps < 0.001). No sexual assault by OCS interaction was observed (all ps > 0.05, please see Table S2).

TABLE 2 Association of TSE, sex, puberty, and their interactions with each OCS Factor (F1–F4, Hoarding)

OCS factors	Variables in model	OR[a]	Lower 95% CI	Upper 95% CI	Wald (df)	p Value
F1—Bad Intrusive Thoughts[b]	TSE Load	1.63	1.55	1.71	383.71	<0.001
	Female Sex	1.28	1.13	1.45	14.31	<0.001
	Puberty	0.96	0.84	1.08	0.51	0.476
	TSE count × Sex				6.08	**0.014**
	TSE count × Puberty				14.01	**<0.001**
	Sex × Puberty				0.04	0.833
F2— Repeating/Checking	TSE load	1.29	1.233	1.35	119.62	< 0.001
	Female sex	1.33	1.184	1.50	22.66	< 0.001
	Puberty	1.09	0.971	1.23	2.18	0.140
	TSE count × Sex				1.39	0.239
	TSE count × Puberty				3.97	**0.048**
	Sex × Puberty				0.69	0.407
F3—Symmetry	TSE load	1.44	1.371	1.52	202.76	<0.001
	Female sex	1.54	1.337	1.77	36.39	<0.001
	Puberty	0.89	0.773	1.02	2.89	0.089
	TSE count × Sex				0.45	0.505
	TSE count × Puberty				7.58	**0.006**
	Sex × Puberty				1.64	0.201
F4—Cleaning/Contamination	TSE load	1.41	1.332	1.50	133.92	<0.001
	Female sex	1.52	1.276	1.81	22.26	<0.001
	Puberty	0.98	0.829	1.17	0.04	0.846
	TSE Count × Sex				2.34	0.126
	TSE Count × Puberty				0.91	0.341
	Sex × Puberty				0.39	0.532
Hoarding	TSE load	1.43	1.337	1.53	108.00	<0.001
	Female sex	1.42	1.146	1.77	10.22	0.001
	Puberty	1.01	0.817	1.25	0.01	0.912
	TSE count × Sex				1.15	0.284
	TSE count × Puberty				2.88	0.090
	Sex × Puberty				2.85	0.091

Note. CI: confidence interval; OCS: obsessive compulsive symptoms; OR: odds ratio; PTSD: posttraumatic stress disorder; TSE: traumatic stressful event.
[a]All models controlled for age (puberty regressed) and socioeconomic status. For TSE load, values represent OR for every single additional TSE. Significant interactions are marked in bold.
[b]Model controlled for PTSD in addition to age and socioeconomic status.

4 | DISCUSSION

We present the first large study to examine the relationship between experiencing a traumatic stressful event and subclinical OCS (that do not fulfill threshold OCD criteria) in a sample of community, nonhelp-seeking children and adolescents. We report that trauma is associated with the presence of OCS in youths, especially in females and prepuberty. TSEs were associated with all OCS manifestations, but more so with OCS symptoms of Bad Intrusive Thoughts. We previously found that such symptoms represent a "red flag" for psychopathology (Barzilay, Patrick, et al., 2019) and their association with trauma exposure adds to the growing recognition that the presence of trauma complicates the clinical presentation (Nemeroff, 2016). Indeed, we found that endorsement of both TSEs and OCS were associated with higher rates of depression, suicide ideation, and psychosis. Lastly, we report that the history of TSEs and OCS interact in association with an increased rate of psychosis.

Consistent with the literature on trauma association with OCD (Cromer et al., 2007; Lochner et al., 2002; Real et al., 2011), we found that endorsing more TSEs was associated with having OCS. In

addition, our finding that the TSE-OCS association is especially strong in females aligns with previous studies examining clinical samples showing that females who have experienced trauma more frequently meet criteria for OCD compared with male counterparts (Bogetto, Venturello, Albert, Maina, & Ravizza, 1999; Real et al., 2011). We found that prepubertal youth endorsed higher rates of OCS, consistent with studies showing that OCS often emerge in two distinct periods, in youth ages 10–13 and in young adults ages 21–29 (De Luca, Gershenzon, Burroughs, Javaid, & Richter, 2011; Zohar, 1999).

Results indicated that TSEs were significantly associated with heterogeneous OCS manifestations (all OCS factors), but most prominently with Bad Intrusive Thoughts. These findings are consistent with a single study that evaluated the relationship between trauma exposure and OCS in youth and reported higher trauma exposure in OCD youth compared with non-OCD controls (Lafleur et al., 2011). In addition, that study reported that youth with OCD and comorbid PTSD showed higher OCD severity; however, the phenotypic manifestations of OCS symptoms were not altered by a PTSD diagnosis. Notably, Lafleur and colleagues studied youth

TABLE 3 Association of trauma type and OCS factors (F1–F4, Hoarding)

OCS factors	Trauma type	OR	Lower 95% CI	Upper 95% CI	Wald (*df*)	*p* Value
F1—Bad Intrusive Thoughts	Nonassaultive TSE	2.57	2.25	2.95	187.64	<0.001
	Physical Assault TSE	4.31	3.51	5.29	195.75	<0.001
	Sexual Assault TSE	8.15	6.13	10.84	208.26	<0.001
F2—Repeating/Checking	Nonassaultive TSE	1.80	1.59	2.03	86.25	<0.001
	Physical Assault TSE	2.07	1.69	2.53	49.84	<0.001
	Sexual Assault TSE	2.41	1.82	3.20	37.15	<0.001
F3—Symmetry	Nonassaultive TSE	2.12	1.83	2.47	100.22	<0.001
	Physical Assault TSE	2.99	2.39	3.76	90.27	<0.001
	Sexual Assault TSE	4.00	2.97	5.38	83.32	<0.001
F4—Cleaning/Contamination	Nonassaultive TSE	1.91	1.60	2.30	47.48	<0.001
	Physical Assault TSE	2.68	2.03	3.54	48.52	<0.001
	Sexual Assault TSE	4.41	3.16	6.17	75.64	<0.001
Hoarding	Nonassaultive TSE	2.06	1.63	2.62	35.36	<0.001
	Physical Assault TSE	2.61	1.84	3.70	28.57	<0.001
	Sexual Assault TSE	5.96	4.10	8.65	87.74	<0.001

Note. All models controlled for age (puberty regressed) and socioeconomic status. Values represent OR compared with No TSE.
CI: confidence interval; OCS: obsessive-compulsive symptoms; OR: odds ratio; TSE: traumatic stressful event.

ascertained for having OCD and used non-OCD matched controls, dichotomizing the population to PTSD/Non-PTSD. In contrast, our study regarded OCS and trauma exposure as dimensions, and the overall rate of OCD (*n* = 208, 3% of the sample) and PTSD (*n* = 836, 12% of the sample) was as expected in a community sample. Our study therefore adds to the understanding of the trauma-OCS relationship by showing that even in a community sample with subclinical level symptoms (not meeting DSM criteria), there is a significant association between trauma exposure and OCS in youth. Our finding that Bad Intrusive Thoughts showed the strongest association with trauma exposure is consistent with a study reporting an association between trauma exposure and obsessions that included aggressive, sexual, and religious thoughts in adults with OCD (Cromer et al., 2007).

Analyses examining the associations among trauma, OCS and serious psychiatric conditions showed that presence of OCS acts as a possible additive risk factor in the development of depression, suicide ideation, and psychosis; further, the association is stronger than when examining youth with trauma exposure alone (without the presence of OCS). While these results support our hypothesis that youths with both high TSE exposure and high OCS would show higher rates of serious psychiatric conditions, they may be evidence against previous notions regarding the possibility that developing OCS following trauma might be an efficient coping mechanism to avoid negative thoughts or emotions related to trauma (Gershuny & Thayer, 1999). If indeed youth develop OCS as a way to cope with trauma, we might expect to see lower rates of depression, suicide ideation, and psychosis in youth who endorsed OCS and TSEs. Instead, we found that those who endorsed OCS and TSEs reported elevated rates of serious psychiatric conditions. Psychosis showed the strongest association with trauma exposure (OR = 3.96) as well as an interesting synergistic relationship, where trauma-exposed youth endorsed higher rates of psychosis if they had also endorsed OCS. This finding highlights the importance of early identification of youth who have a history of trauma and also have OCS. When OCS are identified early, a mental health assessment can possibly bring these
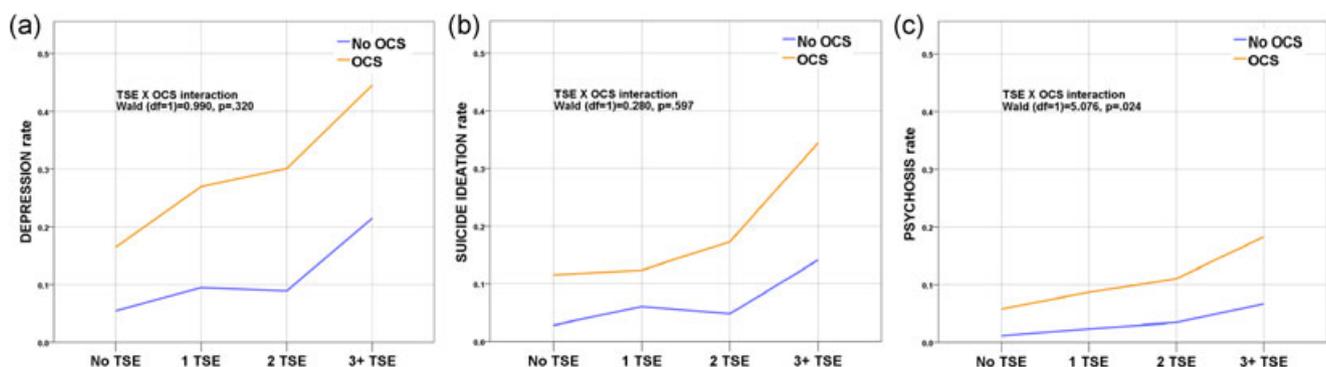

FIGURE 2 Association among traumatic stress exposure, OCS and serious psychiatric conditions. TSE × OCS interaction with (a) depressive episode (*p* = 0.32), (b) suicide ideation (*p* = 0.60), and (c) psychosis spectrum (*p* = 0.02) was evaluated using binary logistic regression with each of the three conditions as dependent variable and TSE load, OCS, and TSE × OCS interaction as independent variables. Models controlled for sex, pubertal status, age (puberty regressed) and socioeconomic status. OCS: obsessive-compulsive symptoms; TSE: traumatic stressful event

youths to psychiatric care providers' attention, facilitating early intervention as deemed necessary, in an attempt to prevent the detrimental trajectory of comorbid OCD and psychotic disorder (Fenton & McGlashan, 1986; Lysaker et al., 2000). This is the first study to examine the relationships among trauma exposure, subthreshold OCS dimensions, and psychosis in youth. Longitudinal studies are needed to examine causal pathways from trauma to OCS to serious psychopathology, such as psychosis.

Lastly, we examined how specific types of trauma interact with OCS factors. Consistent with our hypotheses, all types of trauma were associated with increased reports of all OCS factors, with assaultive traumas, especially Sexual Assault TSEs, showing the most robust associations. These results are in accordance with previous studies showing that interpersonal trauma in adults, specifically sexual assault, is associated with OCS (Boudreaux et al., 1998; Cath, Van Grootheest, Willemsen, Van Oppen, & Boomsma, 2008; Grisham et al., 2011; Miller & Brock, 2017; Vidal-Ribas et al., 2015). Studies examining life-events preceding OCD onset have suggested that events interpreted as negative and uncontrollable are especially prevalent in the years preceding an OCD diagnosis, which might explain why sexual assault continues to show robust associations with OCS, above other types of trauma (Khanna, Rajendra, & Channabasavanna, 1988). Notably, we found no differences between rape and nonrape sexual assault. It is possible that since both of these events are associated with loss of control, they are equally detrimental when determining associations with OCS factors (Bolstad & Zinbarg, 1997).

Interpretation of our findings should be made cautiously in light of some limitations. First, we used cross-sectional data that do not allow causal inferences to be made among TSEs, OCS and their related outcomes. Second, we inquired about a slightly restricted number of TSEs, and lacked measures of TSE recency, timing, and chronicity of exposure, which significantly affect development (McLaughlin & Sheridan, 2016). Still, the finding that we observed a dose-response pattern of TSE exposure by cumulative count and by TSE type (Nonassaultive TSE < Physical Assault < Sexual Assault) may suggest that the measures we used to quantify TSE exposure were sufficient for the present study.

5 | CONCLUSION

In conclusion, in a community sample of sociodemographically diverse and generalizable US youth, we found that traumatic stress exposure is strongly associated with OCS manifestations, especially Bad Intrusive Thoughts. A significant number of youth endorse both trauma and OCS, and this is associated with serious clinical conditions, including depression, suicide ideation, and psychosis. Females and prepubertal youth show greater trauma-OCS association compared to their counterparts and sexual trauma is especially associated with OCS and serious psychiatric conditions. Clinically, these results can help clinicians better stratify youth at risk for serious psychiatric conditions when

encountering common nonspecific presentations such as having a history of trauma and OCS manifestations.

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