

Trauma Exposure and Externalizing Disorders in Adolescents: Results From the National Comorbidity Survey Adolescent Supplement



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Objective: Exposure to violence and other forms of potentially traumatic events (PTEs) are common among youths with externalizing psychopathology. These associations likely reflect both heightened risk for the onset of externalizing problems in youth exposed to PTEs and elevated risk for experiencing PTEs among youth with externalizing disorders. In this study, we disaggregate the associations between exposure to PTEs and externalizing disorder onset in a population-representative sample of adolescents.

Method: We analyzed data from 13- to 18-year-old participants in the National Comorbidity Survey Replication-Adolescent Supplement (NCS-A) ($N = 6,379$). Weighted survival models estimated hazard ratios (HRs) for onset of oppositional defiant disorder (ODD), conduct disorder (CD), and substance use disorders (SUDs) associated with PTEs, and for exposure to PTEs associated with prior-onset externalizing disorders. Multiplicative interaction terms tested for effect modification by sex, race/ethnicity, and household income.

Results: All types of PTEs were associated with higher risk for SUD (HRs = 1.29–2.21), whereas only interpersonal violence (HR = 2.49) was associated with onset of CD and only among females. No associations were observed for ODD. Conversely, ODD and CD were associated with elevated risk for later exposure to interpersonal violence and other/nondisclosed events (HRs = 1.45–1.75).

Conclusion: Externalizing disorders that typically begin in adolescence, including SUDs and CD, are more likely to emerge in adolescents with prior trauma. ODD onset, in contrast, is unrelated to trauma exposure but is associated with elevated risk of experiencing trauma later in development. CD and interpersonal violence exposure exhibit reciprocal associations. These findings have implications for interventions targeting externalizing and trauma-related psychopathology.

Key words: child behavior disorders, substance-related disorders, adolescents, childhood trauma, exposure to violence

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Externalizing disorders (EDs), including oppositional defiant disorder (ODD), conduct disorder (CD), and substance use disorders (SUDs), are associated with a range of adverse outcomes, including poor academic achievement,¹ poor social functioning,² mental and physical health problems in adulthood,^{3,4} long-term economic and interpersonal difficulties,⁴ and risk for violence perpetration and criminal behavior.^{4,5} Violence and offending associated with EDs produce substantial costs to society.^{6,7} Identifying modifiable risk factors for EDs is critical for improving early interventions within both the mental health and criminal justice systems.

Prior studies of children and adolescents show that exposure to potentially traumatic events (PTEs), especially violence and polyvictimization,^{8,9} is associated with behavior problems and SUDs.^{10–13} Maltreatment, adverse family environments, and interpersonal violence in childhood are consistently associated with elevated risk for externalizing

problems in youth.^{14–18} In addition, EDs are common in trauma-affected clinical samples.^{15,19} Conversely, youths with EDs might also be at elevated risk for experiencing PTEs. The disruptive and aggressive behaviors associated with EDs may select youth into high-risk situations in which PTEs are more likely to occur^{5,20} or may provoke violence from others.⁵ Theoretical models suggest recursive associations between trauma and externalizing behaviors, in which exposure to trauma initiates a trajectory of deviance and criminality that in turn may increase the likelihood of exposure to more trauma.^{12,13,21}

Disentangling the direction of association between PTEs and EDs is important for targeting early interventions. The current body of evidence on this topic has several limitations. First, few studies have examined these reciprocal associations between trauma and externalizing within the same dataset, accounting for age of exposure or disorder onset. Second, most studies have focused on child maltreatment and adverse home environments as the exposures of interest, even though noninterpersonal PTEs are well-established risk factors for mental disorders in adults.²² Third, most studies have not examined specificity in risk for EDs after trauma, instead focusing on distress symptoms, behavioral delinquency, a single behavior



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disorder, or a composite of disorders.^{10,18,23} Fourth, parental psychopathology or substance misuse could increase risk for certain PTEs (e.g., vehicular crashes, family violence), as well as for EDs in children.^{24,25} However, prior studies have either treated these exposures as a separate form of adversity⁹ or have not adjusted for them as potential confounders.¹⁰ Finally, prior studies reveal conflicting findings about whether the associations between different types of PTEs and psychiatric disorders vary by sociodemographic characteristics. Some studies have found sex differences,^{16,18,26} whereas others have shown that these effects are invariant by sex, race/ethnicity, or socioeconomic position.^{17,27,28} Evidence from population-based samples, distinguishing between specific disorders, could help to resolve some of this conflicting evidence.

The aims of the current study were to examine the bidirectional associations of PTEs with ODD, CD, and SUD in a representative sample of US adolescents. First, we determined whether exposure to PTEs was associated with the subsequent onset of EDs. Second, we evaluated whether youths with EDs were at elevated risk for experiencing later trauma. Finally, we determined whether these associations were modified by sex, race/ethnicity, or household income.

METHOD

Sample and Study Design

The National Comorbidity Survey Replication–Adolescent Supplement (NCS-A) is a representative, face-to-face survey of 13- to 18-year-olds in the continental United States.²⁹ This dual-frame survey was carried out between 2001 and 2004, and comprises household and school subsamples.^{30,31} The household subsample enrolled 904 adolescents from households that participated in the National Comorbidity Survey Replication (NCS-R; response rate, 86.8%). The school subsample included 9,244 adolescents drawn from a representative sample of schools in counties selected for the NCS-R sample (response rate, 82.6%).

Cases from the household sample were weighted for variation in within-household probability of selection. The full sample was weighted for residual discrepancies from population-level socio-demographic and geographic distributions based on the 2000 US census. The merged household and school samples of 10,148 English-speaking adolescents included sums of weights proportional to relative sample sizes, adjusted for design effects in estimating disorder prevalence. Details of weighting procedures are available elsewhere.^{30,31}

A parent or caretaker was asked to complete a self-administered questionnaire (SAQ) pertaining to the participating adolescent's mental health and developmental history. The response rate for SAQs was 83.7% in the school subsample and 82.5% in the household subsample, conditional on adolescent participation. We excluded adolescents missing a parent SAQ to improve accuracy of diagnoses of ODD and CD, which rely on parent report. We also excluded participants missing a response for any of the PTEs ($n = 165$), for a final analytic sample of 6,379 adolescents.

Written informed consent from adults and assent from adolescents was obtained, and each participant received \$50. The human subjects committees of Harvard Medical School and the University of Michigan approved all recruitment and consent procedures. The current study was approved by the Human Subjects Committee at Columbia University.

Measures

Potentially Traumatic Events. Potentially traumatic events were assessed in the posttraumatic stress disorder (PTSD) section of the Composite International Diagnostic Interview (CIDI) for *DSM-IV*.⁹ The CIDI is a fully structured diagnostic instrument administered by trained lay interviewers.³² Lifetime exposure to 20 PTEs and age of first exposure were reported by adolescents. We created variables for exposure to any traumatic event along with four distinct trauma categories based on prior work in this sample^{8,17,33}: interpersonal violence (physical abuse by caregiver, physical assault by romantic partner, other physical assault, mugged/threatened with weapon, rape, sexual assault, stalked, witnessed domestic violence), accidental/nonintentional events (automobile crash, other life-threatening accident, man-made/natural disaster, exposed to poison/chemical substance, life-threatening illness, accidentally harmed others), social network/witnessed events (unexpected death of loved one, traumatic event to loved one, witnessed death/injury), and other/nondisclosed events (kidnapped, other event not listed, private event). We calculated age at first exposure for each trauma category.

Externalizing Disorders. *DSM-IV* EDs were assessed in the CIDI,²⁹ and parents reported on their child's externalizing psychopathology in the SAQ. Parent and child reports were combined at the symptom level using an "or" rule for diagnosis of ODD and CD, based on previous studies showing that diagnostic accuracy improved by including parent reports.^{34,35} Adolescent report only was used to diagnose SUD (alcohol abuse with or without dependence, drug abuse with or without dependence, nicotine dependence). *DSM-IV* organic exclusion rules were used for all diagnoses. CD and SUDs were defined using hierarchy rules, whereas ODD was defined as with or without CD. Age-of-onset (AOO) was assessed for each focal disorder using procedures shown experimentally to improve the accuracy of such reports.³⁶

Statistical Analysis

Associations of trauma with first-onset of *DSM-IV* EDs were assessed using discrete-time survival analysis, with person-year as the unit of analysis. Respondents for whom the onset of the ED of interest preceded exposure to the traumatic event of interest were not considered at risk, and were included in the referent group for analysis so as to establish temporality. We first regressed EDs on trauma categories, adjusting for covariates. Additional models examined multiplicative interactions of trauma with sex, race/ethnicity, and income level in predicting EDs. The same procedures were followed for the converse associations, regressing incident PTEs on EDs and covariates.

All models used hazard ratios (HRs) as their measure of association and were considered significant with a *p* value $\leq .05$ (95% CI). All analyses adjusted for sex, age, race/ethnicity, household income, and number of biological parents in the home. Regression models also controlled for parent substance misuse and psychopathology, based on adolescent report.

Three sensitivity analyses were conducted. First, we examined whether SUD associations were robust to removal of adolescents with nicotine dependence only ($n = 173$; 20.9% of those with SUD), given that nicotine dependence is relatively common among adolescents and lacks the intoxicating effects of alcohol and other drugs, suggesting possible different etiologies. Second, we excluded adolescents with attention-deficit/hyperactivity disorder (ADHD; $n = 549$), which may predispose youths to both trauma exposure and later-onset EDs. Third, we explored multiplicative interaction terms between sex, race/ethnicity, and income level with PTE exposure to determine whether there was evidence of heterogeneity of the effect size across these demographic covariates. Analyses were conducted

TABLE 1 Prevalence of Externalizing Disorders by Sociodemographic and Traumatic Event Exposure Among Adolescents in the National Comorbidity Survey—Adolescent Supplement (N = 6,379)

	ODD (n = 775)		CD (n = 630)		SUDs ^a (n = 827)	
	n	% (SE)	n	% (SE)	n	% (SE)
Sex						
Male	410	13.74 (1.18)	380	12.15 (1.36)	448	15.06 (1.18)
Female	365	10.53 (0.74)	250	8.22 (1.00)	379	12.03 (1.03)
$\chi^2 =$		7.50*		6.83*		6.67*
Age, y						
13	105	10.51 (1.44)	63	6.25 (1.18)	22	2.57 (0.70)
14	165	11.31 (1.40)	111	7.37 (1.44)	68	5.47 (0.82)
15–16	318	12.49 (1.21)	263	10.61 (1.43)	355	13.96 (1.23)
17–18	187	13.55 (1.45)	193	14.87 (1.69)	382	27.70 (2.25)
$\chi^2 =$		2.94		15.02*		71.10**
Race/ethnicity						
White, non-Hispanic	504	12.24 (0.87)	353	9.33 (1.13)	594	15.45 (1.19)
African American, non-Hispanic	123	11.06 (1.53)	129	11.46 (2.33)	64	6.05 (1.69)
Hispanic	104	14.03 (2.38)	105	13.24 (2.29)	113	13.02 (1.63)
Other	44	9.64 (2.00)	43	10.15 (2.08)	56	13.59 (2.66)
$\chi^2 =$		3.13		2.85		18.94*
Household income						
Low income	127	13.01 (1.86)	116	12.93 (1.79)	112	12.69 (1.80)
Low–middle income	184	16.61 (2.01)	151	12.39 (1.51)	146	12.09 (1.91)
High–middle income	238	11.54 (1.14)	197	10.40 (1.66)	284	15.50 (1.50)
High income	226	9.89 (0.99)	166	7.70 (1.10)	285	12.98 (1.26)
$\chi^2 =$		11.44*		12.16*		3.81
Number of biological parents at home						
2	299	8.10 (0.62)	189	5.32 (0.77)	363	10.24 (0.84)
1	357	16.34 (1.32)	333	14.78 (1.76)	363	16.57 (1.81)
0	119	20.70 (2.26)	108	22.54 (2.46)	101	22.46 (3.10)
$\chi^2 =$		39.73**		52.21**		20.35*
Parent substance misuse						
Yes	214	20.87 (1.98)	217	21.43 (2.93)	286	28.25 (2.47)
No	471	9.50 (0.67)	336	7.19 (0.66)	470	10.28 (0.90)
$\chi^2 =$		28.74**		23.22**		34.79**
Parent psychopathology						
Yes	353	20.82 (1.57)	295	17.26 (1.67)	353	22.84 (1.76)
No	335	7.97 (0.68)	261	6.44 (0.65)	403	9.45 (0.90)
$\chi^2 =$		56.43**		36.49**		40.17**

TABLE 1 Continued

	ODD (n = 775)		CD (n = 630)		SUDs ^a (n = 827)	
	n	% (SE)	n	% (SE)	n	% (SE)
Any PTE exposure						
Yes	593	16.07 (1.16)	523	14.33 (1.34)	681	18.91 (1.34)
No	182	6.23 (0.71)	107	3.98 (0.72)	146	5.43 (0.61)
$\chi^2 =$		45.05**		52.81**		73.12**
Interpersonal trauma exposure						
Yes	341	26.53 (2.31)	333	25.37 (1.89)	388	31.20 (2.83)
No	434	8.23 (0.70)	297	6.08 (0.77)	439	8.41 (0.75)
$\chi^2 =$		44.31**		86.21**		33.19**
Accidental trauma exposure						
Yes	306	18.02 (1.67)	276	15.08 (2.06)	355	19.80 (1.90)
No	469	9.70 (0.74)	354	8.19 (0.85)	472	10.95 (0.82)
$\chi^2 =$		20.93**		12.19*		23.51**
Network/witnessing trauma exposure						
Yes	412	16.79 (1.21)	381	16.19 (1.54)	491	20.99 (1.53)
No	363	9.26 (0.85)	249	6.48 (0.85)	336	8.90 (0.91)
$\chi^2 =$		31.59**		40.07**		51.43**
Other/nondisclosed trauma exposure						
Yes	121	23.23 (2.90)	115	22.31 (3.69)	142	31.15 (3.12)
No	654	11.11 (0.75)	515	9.08 (0.81)	685	11.89 (0.89)
$\chi^2 =$		15.93*		13.58*		29.60**

Note: All analyses adjusted for complex survey design. CD = conduct disorder; ODD = oppositional defiant disorder; SE = standard error; SUD = substance use disorder.

^aSubstance use disorders include alcohol abuse, alcohol dependence, drug abuse, drug dependence, and nicotine dependence.

*p < .05; **p < .0001.

in SAS v9.3 and included sample weights to account for the complex survey design of the NCS-A.

RESULTS

The prevalence of socio-demographic variables, PTEs, and EDs in the NCS-A sample is reported elsewhere.^{8,37} Weighted prevalence of ODD, CD, and SUD by socio-demographic variables and trauma exposure is shown in Table 1, with Wald χ^2 tests for prevalence differences. The prevalence of ODD was about two times higher in adolescents reporting accidental trauma (18.0% vs. 9.7%) and other trauma (23.2% vs. 11.1%) relative to their peers, and more than three times higher in adolescents reporting exposure to interpersonal violence (26.5% vs. 8.2%). CD was more than two to four times higher (e.g., 25.4% vs. 6.1% for interpersonal violence) among adolescents reporting all forms of trauma exposure, relative to those with no exposure. Finally, SUD was also two to four times higher (e.g., 31.2% vs. 11.9% for other trauma) among adolescents reporting all forms of trauma. Predicted marginal prevalence of disorders and PTEs based on fully adjusted models are shown in Tables S1 and S2, available online.

The mean age of exposure to any trauma was 9 years and was similar for female and male participants (Table 2). Average AOO was relatively similar for males and females, with the exception of ODD, for which males were diagnosed at a younger age than females on average. Of note, the mean age at the time of the interview was about 15 years, so averages reported here are lower than estimates from adult samples, due to ceiling effects.

Potentially Traumatic Events and Externalizing Disorders
Controlling for sociodemographic and parental covariates, exposure to any PTE was associated with higher risk for incident CD (HR = 1.66, CI = 1.04–2.67) and SUD (HR = 2.16, CI = 1.66–2.81), but not ODD (Table 3). When we examined trauma types separately, exposure to interpersonal violence was associated with higher risk for incident

CD (HR = 1.57, CI = 1.11–2.23) and SUD (HR = 2.21, CI = 1.69–2.89), but not ODD. Exposure to accidental/nonintentional events (HR = 1.29, CI = 1.02–1.64), network/witnessing events (HR = 1.54, CI = 1.18–2.02), and other events (HR = 1.68, CI = 1.25–2.27) were each associated with higher risk for developing SUD. Accidental, network/witnessing, and other trauma categories were not associated with ODD or CD onset.

Sensitivity analyses evaluated whether associations remained when excluding adolescents with nicotine dependence from the SUD definition. Effect estimates were slightly lower, but associations remained statistically significant (Table S3, available online). We additionally determined whether associations persisted among adolescents with no lifetime diagnosis of ADHD. The pattern of associations between PTEs and risk for externalizing disorders was unchanged in this subsample (Table S4, available online).

We also tested for effect modification of the association between exposure to PTEs and onset of EDs by using multiplicative interaction terms among sex, race/ethnicity, and income level with PTE exposure. The only interaction to reach statistical significance was for sex and interpersonal violence predicting CD, whereby females (HR = 2.49, CI = 1.50–4.14) were at higher risk than males (HR = 1.04, CI = 0.68–1.59) after PTE exposure ($p = .01$).

Externalizing Disorders and Exposure to Potentially Traumatic Events

We next examined whether EDs were associated with risk for exposure to PTEs (Table 4). ODD (HR = 1.48, CI = 1.15–1.91) and CD (HR = 1.45, CI = 1.12–1.87) were both associated with elevated risk for exposure to interpersonal violence. ODD (HR = 1.69; CI = 1.06–2.70) and CD (HR = 1.75; CI = 1.01–3.03) were also associated with higher risk for exposure to other/nondisclosed PTEs. ODD (HR = 1.46; CI = 1.15–1.85) was associated with greater risk for exposure to network/witnessing events. CD and SUDs were associated with lower risk for exposure to accidental PTEs, network/witnessing events, and any PTE.

TABLE 2 Mean Age of Potentially Traumatic Event (PTE) Exposure and Onset of Externalizing Disorders for Males and Females in the National Comorbidity Survey—Adolescent Supplement (N = 6,379)

	Full Sample		Females		Males		<i>F</i> Statistic (<i>p</i> Value)
	n	Mean (SE)	n	Mean (SE)	n	Mean (SE)	
Age of first PTE exposure	3,725	9.21 (0.14)	1,901	9.32 (0.19)	1,824	9.12 (0.19)	<i>F</i> = 0.60
Age of interpersonal PTE exposure	1,253	10.40 (0.24)	661	10.10 (0.25)	592	10.70 (0.31)	<i>F</i> = 3.91
Age of accidental PTE exposure	1,768	8.57 (0.17)	788	8.56 (0.24)	980	8.58 (0.23)	<i>F</i> = 0.01
Age of network/witnessing PTE exposure	2,453	11.36 (0.15)	1,324	11.47 (0.17)	1,129	11.23 (0.21)	<i>F</i> = 1.17
Age of other/nondisclosed PTE exposure	489	10.86 (0.38)	297	11.22 (0.31)	192	10.29 (0.83)	<i>F</i> = 0.90
Age of ODD onset	671	9.59 (3.62)	320	10.56 (0.30)	351	9.29 (0.32)	<i>F</i> = 7.76 [†]
Age of CD onset	630	10.76 (3.31)	250	11.30 (0.27)	380	10.67 (0.30)	<i>F</i> = 1.92
Age of SUD onset	827	14.33 (1.88)	379	14.35 (0.12)	448	14.29 (0.18)	<i>F</i> = 0.47
Age at interview	6,379	15.08 (1.46)	3,276	15.23 (0.07)	3,103	15.15 (0.08)	<i>F</i> = 1.82

Note: All analyses adjusted for complex survey design. CD = conduct disorder; ODD = oppositional defiant disorder; SE = Standard error; SUD = substance use disorder.

[†]*p* < .0001.

TABLE 3 Associations Between Exposure to Potentially Traumatic Events (PTE) and Onset of Externalizing Disorders Among Adolescents in the National Comorbidity Survey–Adolescent Supplement (N = 6,379)

Traumatic Events	ODD (n = 618) HR (95% CI)		CD (n = 341) HR (95% CI)		SUD (n = 749) HR (95% CI)	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Any PTE	1.88 (1.36–2.59)*	1.36 (0.94–1.97)	2.50 (1.73–3.63)*	1.66 (1.04–2.67)*	2.86 (2.26–3.62)*	2.16 (1.66–2.81)*
Interpersonal violence	2.35 (1.65–3.35)*	1.28 (0.92–1.78)	2.59 (1.99–3.38)*	1.57 (1.11–2.23)*	2.91 (2.27–3.74)*	2.21 (1.68–2.89)*
Accidental PTE	1.25 (0.93–1.68)	1.06 (0.75–1.49)	1.18 (0.83–1.68)	0.89 (0.62–1.30)	1.54 (1.28–1.87)*	1.29 (1.02–1.64)*
Network/witnessing PTE	0.91 (0.65–1.28)	0.74 (0.52–1.06)	1.26 (0.93–1.72)	1.04 (0.73–1.49)	1.77 (1.38–2.26)*	1.54 (1.18–2.02)*
Other/h nondisclosed PTE	1.32 (0.91–1.90)	0.86 (0.55–1.35)	1.28 (0.78–2.10)	0.76 (0.41–1.42)	2.21 (1.70–2.89)*	1.68 (1.25–2.27)*

Note: Models: Adjusted hazard ratios (HR) from survival analysis models adjusted for age, sex, income, race/ethnicity, parents' marital status, parental psychopathology, and patient substance misuse. All analyses adjusted for complex survey design. For all models, the reference group is participants who reported experiencing no trauma of that type before externalizing disorder onset; CD = conduct disorder; ODD = oppositional defiant disorder; SUD = substance use disorder.

*p < .05.

Removing nicotine dependence from the SUD diagnosis did not change the pattern of results (Table S5, available online). Among adolescents without ADHD, results were unchanged (Table S6, available online), with the exception that CD was associated with increased risk for exposure to a network/witnessing PTE (HR = 1.37, CI = 1.03–1.82). We found no evidence for effect modification by sex, race/ethnicity, or income on the associations between EDs and exposure to PTEs.

DISCUSSION

In a population-representative sample of US adolescents, all types of traumatic experiences were associated with higher risk for SUD onset, whereas PTEs were unrelated to onset of ODD. Only interpersonal violence was associated with higher risk for CD onset, and this was true only for females. Conversely, ODD and CD were associated with higher risk for later exposure to interpersonal violence and other/non-disclosed events, and ODD was additionally associated with network/witnessing events. These associations persisted when controlling for the possible confounding effects of parental psychopathology and substance misuse, as well as lifetime ADHD among adolescents.

With these results, we provide evidence of both specificity and equifinality in the associations of childhood trauma exposure with externalizing psychopathology. Many prior studies have found no such evidence of specificity in the association between childhood trauma and psychopathology.^{38,39} The current results may differ for a number of reasons. First, most prior studies have looked at disorders among adults, in which the time at risk for disorder is longer compared to that in adolescents. PTEs often co-occur within individuals and alter development in ways that could result in greater likelihood of developing different or comorbid psychiatric disorders over time. Second, many past studies have examined a limited range of either adversities or disorders by focusing, for example, on violence^{40,41} or family dysfunction.³³ Such an approach may mask specificity in the associations with particular disorders. Third, prior epidemiological studies have focused on broad classes of psychiatric disorders, examining associations of PTEs and other adversities with mood, anxiety, behavior, and SUDs without examining specific disorders individually.^{33,42,43} We extend this work by documenting specificity in the associations of PTEs with EDs, such that PTEs have particularly strong associations with CD and SUDs.

Consistent with previous research, we show that interpersonal violence, which represents a significant environmental threat,^{44,45} is a particularly toxic form of early adversity associated with increased risk for the onset of SUDs and for CD among females. Interpersonal violence may increase risk for SUD and CD through a variety of mechanisms encompassing emotional, cognitive, social, and neurobiological domains. With regard to SUD, violence exposure is associated with difficulties with emotion regulation,^{46,47} which may increase risk for substance abuse either directly or indirectly if substances are used as a form of self-medication for coping with traumatic memories.⁴⁸

TABLE 4 Associations Between Externalizing Disorder Diagnosis and Incident Exposure to Traumatic Events Among Adolescents in the National Comorbidity Survey—Adolescent Supplement (N = 6,379)

Externalizing Disorders	Any PTE		Interpersonal Violence PTE		Accidental PTE		Network/Witnessing PTE		Other/Nondisclosed PTE	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
ODD	1.33 (1.13–1.56)*	1.01 (0.83–1.22)	2.24 (1.79–2.81)*	1.48 (1.15–1.91)*	1.15 (0.91–1.44)	0.98 (0.75–1.27)	1.79 (1.42–2.25)*	1.46 (1.15–1.85)*	2.44 (1.66–3.60)*	1.69 (1.06–2.70)*
CD	1.11 (0.94–1.31)	0.76 (0.62–0.93)*	2.07 (1.71–2.51)*	1.45 (1.12–1.87)*	0.84 (0.62–1.12)	0.71 (0.53–0.95)*	1.76 (1.32–2.35)*	1.25 (0.96–1.65)	2.21 (1.36–3.59)*	1.75 (1.01–3.03)*
SUD	0.74 (0.62–0.89)*	0.59 (0.48–0.73)*	1.22 (0.87–1.72)	0.94 (0.61–1.45)	0.48 (0.34–0.67)*	0.43 (0.31–0.60)*	1.08 (0.82–1.42)	0.87 (0.63–1.19)	1.14 (0.68–1.93)	1.11 (0.68–1.93)

Note: Models: Adjusted hazard ratios (HR) from survival analysis results adjusted for age, sex, income, race/ethnicity, parents' marital status, parent psychopathology, and parent substance misuse. All analyses adjusted for complex survey design. For all models, the reference group is participants who were not diagnosed with that disorder before experiencing that potentially traumatic event (PTE). CD = conduct disorder; ODD = oppositional defiant disorder; SUD = substance use disorder.

*p < .05.

Interpersonal violence may also diminish response inhibition and self-regulation, particularly in emotionally salient contexts,⁴⁹ further increasing risk for substance use.

With regard to mechanisms relevant to the onset of CD, violence exposure influences emotional and neurobiological processes involved in threat detection and salience processing,⁴⁷ and is associated with attention biases that facilitate the detection of anger,⁵⁰ social-information-processing biases that increase perceptions of hostility in others,⁵¹ heightened emotional responses to a wide range of stimuli that could signify threat,^{52,53} and difficulty discriminating between threat and safety cues.⁴⁹ Each of these patterns of atypical threat detection has been linked to externalizing problems, most notably CD in the absence of callous-unemotional traits.^{49,51,54}

Why these pathways would affect females who experienced interpersonal violence more than males is unclear. Past studies have found inconsistent results regarding effect modification by sex in the associations between violence exposure and EDs, and here we find differential effects by sex only in predicting CD after interpersonal violence. Future work should determine whether this is due to differences in the specific type or chronicity of violence experienced by females versus males (e.g., sexual vs. physical abuse) or whether posttraumatic reactions to violence exposure differentiate trajectories to CD in girls versus boys.²⁶ The inconsistency of findings across multiple populations and exposure types may indicate some specific pathways, risk factors, or subgroups that have yet to be identified.

In line with prior work,^{9,14,33} we found that all forms of trauma were associated with increased risk for SUDs. Our previous work in this sample documented that exposure to childhood trauma was associated with increased risk for lifetime use of marijuana, prescription drugs, other drugs, and polysubstance use among adolescents.¹¹ We extend this work here, showing that exposure to multiple forms of trauma increases risk not only for experimenting with drugs in adolescence but also for developing SUDs. These findings are particularly notable, given the young age of this sample. The mean age of interview in this study was 15 years, whereas the median age of onset of SUDs in the general population is 20 years (interquartile range [IQR], 18–27).⁵⁵ Our results therefore highlight a particularly vulnerable and high-risk group of adolescents who develop early-onset SUDs after exposure to trauma.

The fact that we find particularly strong associations between PTEs and CD and SUDs, disorders that typically begin in adolescence, is notable. Adolescence is a developmental period that involves substantial plasticity in neural systems that underlie emotional processing, cognitive control, and social cognition.^{56–59} The dynamic changes that occur during this period may produce heightened vulnerability to PTEs and contribute to the high incidence of mental disorders during this period.^{3,55} Alternatively, adolescence may also present opportunities for adaptive reorganization of regulatory systems after early-life adversity, resulting in positive changes for adolescents who are living in supportive environments.⁶⁰ More research is needed to determine

whether adolescence is not only a period of heightened vulnerability to PTEs with regard to externalizing psychopathology, but also a period when interventions might be particularly effective at preventing or remediating the mental health consequences of PTEs.

We also provide evidence for a role of ODD and CD in increasing risk for exposure to interpersonal violence and other/nondisclosed PTEs. Previous research has shown that conduct problems may lead to delinquency, socializing with deviant peers, legal problems, and substance use problems,⁶¹ all of which may select adolescents into contexts in which violence is likely to occur. This developmental cascade linking early conduct problems, adverse social contexts, and later violence exposure may exacerbate externalizing psychopathology and maintain trajectories of criminality.⁶²

Diagnosis with SUD was associated with lower risk for exposure to accidental and network PTEs. Developmental timing factors likely explain this apparent protective effect of SUD, as the mean age of SUD onset in this sample (~14 years) was older than the mean age for all forms of trauma exposure. As such, the group of adolescents who have not yet experienced a traumatic event by the time of onset of SUD may be a relatively select sample.

Study limitations include reliance on a cross-sectional survey, precluding causal inference about these associations. Although we used survival analysis to incorporate temporality into the reported associations, events are still retrospective self-reports, and are therefore subject to recall bias. This bias is somewhat reduced, however, in younger participants with shorter intervals between event occurrence and reporting.^{63,64} Another possibility is differential under-reporting of trauma, although the prevalence of trauma exposure is consistent with US adult samples.⁸ Third, although we adjusted for possible confounding by parental psychopathology and substance use, we cannot rule out the possibility that these parental conditions mediate the association between exposure to trauma and EDs among adolescents. However, unadjusted and adjusted models differed very little. Longitudinal studies of entire families should be conducted to explore the interplay of these shared experiences and home environments.

These results highlight complex associations between trauma exposure and externalizing psychopathology during the important period of social and neurobiological development in adolescence. Interventions must take a structural approach to addressing these interrelated, reciprocal, and

clustered exposures to adversity in order to address the social environmental contributions to externalizing problems and violence. Future research is needed to identify mechanisms for the association between trauma and EDs, to help better inform prevention and treatment efforts and target interventions during periods when they are likely to have the most meaningful effect on core developmental processes.

These results may inform clinical practice in a number of ways. First, among children exposed to trauma, early intervention could help prevent the development of EDs. Much of the focus of trauma-related practice is on PTSD, mood, and anxiety disorders. Strategies specifically targeting externalizing psychopathology (e.g., parent management training) might enhance the beneficial effects of trauma-related interventions on later conduct problems and substance abuse. Second, youths with EDs should be assessed for a trauma history, and trauma-informed treatment should be considered as a therapeutic option beyond typical disorder-focused approaches. Third, individuals in contact with youth exhibiting conduct problems, substance abuse, or EDs should recognize these as possible indicators for trauma, and particularly violence exposure, which may be ongoing. Fourth, youth with CD and ODD should be provided with interventions aimed explicitly at preventing future interpersonal violence. &

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TABLE S1 Predicted Marginal Prevalence and Standard Errors (SE) for Potentially Traumatic Events (PTE) Before Externalizing Disorders Among Adolescents in the National Comorbidity Survey–Adolescent Supplement (N = 6,379)

Traumatic Events	ODD (n = 618) % (SE)	CD (n = 341) % (SE)	SUD (n = 749) % (SE)
Any PTE			
Yes	12.11 (1.13)	10.17 (0.95)	17.07 (1.32)
No	6.23 (0.71)	3.98 (0.72)	5.43 (0.61)
Interpersonal violence PTE			
Yes	19.93 (2.18)	15.80 (1.67)	26.46 (2.24)
No	8.23 (0.70)	6.08 (0.77)	8.74 (0.75)
Accidental PTE			
Yes	13.33 (1.47)	9.83 (1.48)	17.22 (1.85)
No	9.70 (0.74)	8.19 (0.85)	10.95 (0.82)
Network/witnessing PTE			
Yes	10.37 (1.13)	8.53 (0.84)	17.29 (1.48)
No	9.26 (0.85)	6.48 (0.85)	8.90 (0.91)
Other/ Nondisclosed PTE			
Yes	14.25 (2.45)	11.86 (3.10)	25.55 (2.97)
No	11.11 (0.75)	9.08 (0.81)	11.89 (0.89)

Note: All analyses adjusted for complex survey design. Percentage signs show predicted marginal prevalence. CD = conduct disorder; ODD = oppositional defiant disorder; SUD = substance use disorder.

TABLE S2 Predicted Marginal Prevalence and Standard Errors (SE) for Externalizing Disorders Before Traumatic Events Among Adolescents in the National Comorbidity Survey–Adolescent Supplement (N = 6,379)

Externalizing Disorder	Any PTE % (SE)	Interpersonal Violence PTE % (SE)	Accidental PTE % (SE)	Network/Witnessing PTE % (SE)	Other/Nondisclosed PTE % (SE)
ODD					
Yes	68.18 (3.11)	35.97 (3.09)	30.70 (2.46)	44.94 (2.60)	14.26 (2.35)
No	55.20 (0.96)	16.47 (0.92)	25.51 (0.86)	35.09 (1.12)	7.47 (0.50)
CD					
Yes	68.78 (4.84)	39.82 (3.75)	27.09 (3.34)	49.19 (3.86)	16.24 (2.71)
No	57.79 (0.83)	17.97 (0.84)	28.28 (0.89)	36.24 (1.05)	7.67 (0.54)
SUD					
Yes	54.89 (4.04)	26.36 (4.11)	16.94 (2.78)	36.98 (3.40)	12.52 (2.10)
No	56.82 (0.81)	17.21 (0.76)	27.75 (0.78)	35.49 (0.98)	7.06 (0.49)

Note: All analyses adjusted for complex survey design. Percentage signs show predicted marginal prevalence. CD = conduct disorder; ODD = oppositional defiant disorder; PTE = Potentially Traumatic Event; SUD = substance use disorder.

TABLE S3 Associations Between Exposure to Potentially Traumatic Events (PTE) and Onset of Alcohol or Drug Abuse/Dependence Among Adolescents in the National Comorbidity Survey—Adolescent Supplement (N = 6,379)

Traumatic Events	Alcohol or Drug Abuse/Dependence (n = 653)	HR (95% CI)
	Any PTE	
Any PTE	1.95 (1.43–2.66)*	
Interpersonal violence	2.06 (1.51–2.83)*	
Accidental PTE	1.29 (0.98–1.71)	
Network/witnessing PTE	1.39 (1.01–1.92)*	
Other/nondisclosed PTE	1.58 (1.17–2.14)*	

Note: Models: Adjusted hazard ratios (HR) from survival analysis models adjusted for age, sex, income, race/ethnicity, parents' marital status, parent psychopathy, and parent substance misuse. All analyses adjusted for complex survey design. For all models, the reference group is participants who reported experiencing no trauma of that type before externalizing disorder onset.

*p < .05.

TABLE S4 Associations Between Exposure to Potentially Traumatic Events (PTE) and Onset of Externalizing Disorders Among Adolescents Without Attention-Deficit/Hyperactivity Disorder (ADHD) in the National Comorbidity Survey—Adolescent Supplement (n = 5,830)

Traumatic Events	ODD No ADHD (n = 553)	CD No ADHD (n = 446)	SUD No ADHD (n = 692)
	HR (95% CI)	HR (95% CI)	HR (95% CI)
Any PTE	1.51 (1.00–2.29)	1.80 (1.00–3.24)*	2.15 (1.60–2.89)*
Interpersonal violence	1.47 (0.98–2.19)	1.83 (1.26–2.64)*	2.31 (1.71–3.12)*
Accidental PTE	1.09 (0.75–1.59)	0.85 (0.57–1.28)	1.29 (1.00–1.66)
Network/witnessing PTE	0.94 (0.66–1.36)	1.34 (0.90–2.00)	1.63 (1.24–2.13)*
Other/nondisclosed PTE	0.86 (0.52–1.42)	0.80 (0.40–1.58)	1.83 (1.31–2.54)*

Note: Models: Adjusted hazard ratios (HR) from survival analysis models adjusted for age, sex, income, race/ethnicity, parents' marital status, parent psychopathy, and parent substance misuse. All analyses adjusted for complex survey design. For all models, the reference group is participants who reported experiencing no trauma of that type before externalizing disorder onset. CD = conduct disorder; ODD = oppositional defiant disorder; SUD = substance use disorder.

*p < .05.

TABLE S5 Associations Between Alcohol or Drug Abuse/Dependence and Incident Exposure to Potentially Traumatic Events (PTE) Among Adolescents in the National Comorbidity Survey—Adolescent Supplement (N = 6,379)

Externalizing Disorders	Any PTE	Interpersonal Violence	Accidental PTE	Network/Witnessing PTE	Other/Nondisclosed PTE
	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
Alcohol or drug abuse/dependence	0.58 (0.44–0.75)*	0.92 (0.57–1.48)	0.46 (0.32–0.68)*	0.89 (0.64–1.23)	1.22 (0.68–2.19)

Note: Models: Adjusted hazard ratios (HR) from survival analysis models adjusted for age, sex, income, race/ethnicity, parents' marital status, parent psychopathy, and parent substance misuse. All analyses adjusted for complex survey design. For all models, reference group is participants who were not diagnosed with that disorder before experiencing that potentially traumatic event.

*p < .05.

TABLE S6 Associations Between Externalizing Disorders and Incident Exposure to Potentially Traumatic Events (PTE) Among Adolescents Without Attention-Deficit/Hyperactivity Disorder (ADHD) in the National Comorbidity Survey—Adolescent Supplement (n = 5,830)

Externalizing Disorders	Any PTE	Interpersonal Violence	Accidental PTE	Network/Witnessing PTE	Other/Nondisclosed PTE
	No ADHD HR (95% CI)				
ODD	1.06 (0.83–1.35)	1.43 (1.05–1.94)*	0.94 (0.67–1.32)	1.55 (1.19–2.02)*	1.89 (1.20–2.99)*
CD	0.74 (0.59–0.92)*	1.41 (1.10–1.80)*	0.66 (0.47–0.95)*	1.37 (1.03–1.82)*	1.86 (1.04–3.32)*
SUD	0.58 (0.46–0.74)*	0.98 (0.63–1.53)	0.36 (0.26–0.51)*	0.83 (0.60–1.16)	1.15 (0.59–2.23)

Note: Models: Adjusted hazard ratios (HR) from survival analysis models adjusted for age, sex, income, race/ethnicity, parents' marital status, parent psychopathy, and parent substance misuse. All analyses adjusted for complex survey design. For all models, reference group is participants who were not diagnosed with that disorder before experiencing that potentially traumatic event. CD = conduct disorder; ODD = oppositional defiant disorder; SUD = substance use disorder.

*p < .05.