Published in final edited form as:

J Child Fam Stud. 2018 November ; 27(11): 3638–3649. doi:10.1007/s10826-018-1205-2.

A latent profile analysis of co-occurring youth posttraumatic stress and conduct problems following community trauma

Kathleen I. Crum,

Medical University of South Carolina, Department of Psychiatry and Behavioral Sciences,
National Crime Victims Research and Treatment Center; 67 President St, MSC 861, Charleston,
SC 29414

Danielle Cornacchio,

Florida International University, Department of Psychology, Miami, FL.

Stefany Coxe,

Florida International University, Department of Psychology, Miami, FL.

Jennifer Greif Green,

Boston University, School of Education, Boston, MA.

Jonathan S. Comer

Florida International University, Department of Psychology, Miami, FL.

Abstract

Although most research with youth exposed to violent manmade disasters has focused on internalizing problems, recent work suggests conduct problems (CPs) may also manifest in exposed youth. However, the extent to which youth postevent CPs present independently, versus co-present in conjunction with PTSD symptoms, remains unclear. The present study examined PTS and CP symptom profiles among affected Boston-area youth following the 2013 Boston Marathon bombing. This study used latent profile analysis to identify distinct PTS and CP symptom profiles among Boston-area youth ages 4–19 years ($N=344$) affected by the Boston Marathon bombing events. PTS and CPs were measured using the UCLA-PTSD-RI and the SDQ parent reports, respectively. Analyses identified 3 distinct profiles: presentations characterized by (a) low PTS, low CPs, (b) moderate PTS, low CPs, and (c) high PTS, elevated CPs. The profile characterized by the highest PTS was the only profile with elevated CPs; hyperarousal and

K. I. Crum (Corresponding Author): crumk@musc.edu.

Author Contributions

KIC: designed the present study (a secondary analysis using data from a larger study, as described in the Method section), conducted data analyses, and wrote the manuscript. DC: assisted with manuscript writing and preparation. SC: provided statistical consultation and assisted with conducting data analyses. JGG: assisted with manuscript writing and preparation. JSC: collaborated with design, analysis, and writing for the present study, as well as the larger study from which data for the present study were drawn.

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

The authors declare no conflicts of interest, and certify that Boston University Institutional Review Board approval was obtained prior to beginning the project wherein these data were obtained. All APA ethical standards were followed in the research protocol—including informed consent of all study participants.

No authors have financial relationships relevant to this article to disclose, and the authors declare that they have no conflict of interest.

emotional numbing/avoidance symptoms showed the greatest distinguishing properties among profiles with and without elevated CP. Types of traumatic exposure experienced by youth were differentially associated with profiles. Specifically, direct (but not relational) exposure distinguished youth classified in the profile showing elevated CPs. Findings suggest interventions following violent manmade disasters may do well to incorporate CP modules when working with youth showing the greatest hyperarousal and emotional numbing, and/or who have directly witnessed the most violence.

Keywords

Conduct Problems; PTSD; Youth; Terrorism; Trauma

Disasters cost millions of lives and trillions of dollars annually. In addition to resource loss, injuries, and death, exposed children are at risk for mental health problems (Chemtob, et al., 2008; Comer, Bry, Poznanski, & Golik, 2016; Comer et al., 2014; Comer et al., 2010; Comer & Kendall, 2007; Furr et al., 2010; Hoven et al., 2005; La Greca et al., 2010). Despite a focus, historically, on posttraumatic stress (PTS) symptoms (Comer & Kendall, 2007; Furr et al., 2010), recent research suggests that conduct problems (CPs; e.g., oppositionality, rule-breaking, aggression) are also an outcome of concern in disaster-exposed youth (Crum et al., 2017; Hoven et al., 2005; Marsee, 2008; Scott et al., 2014). Research has shown increases in antisocial behavior and related CPs following manmade disasters (Boer et al., 2009; Chemtob et al., 2008; Crum et al., 2017; Dubow et al., 2009; Hoven et al., 2005), although some studies suggest distally affected children may not show increased postdisaster CPs (Lengua et al., 2005). Given noted difficulties associated with CPs (Donenberg & Baker, 1993), understanding postdisaster CPs is critical. To better understand relationships between PTS and CP following violent community disasters, the present study explored specific profiles of youth PTS symptoms and CPs following the Boston Marathon bombing and associated manhunt.

Child CPs following proximal disaster exposure may be specifically intertwined with PTS. In a post-Hurricane Katrina sample Scheeringa and Zeanah's (2008) found 60% of preschoolers with elevated PTS also had oppositional defiant disorder (ODD). After Hurricane Katrina, Marsee (2008) and Scott and colleagues (2014) found that PTS may have played a role in variations of aggression—a key CP domain—among regionally affected youth. For example, Marsee (2008) found the association between exposure and reactive aggression was mediated by PTS and emotional dysregulation.

Research has shown child PTSD and CPs co-occur in the community (Breslau et al., 1991; Copeland et al., 2007), but the covariance versus distinctiveness of PTS and CP postdisaster remains unclear. Clarifying relationships between PTS and CPs following mass trauma has important implications. First, it could be argued that for a subpopulation of youth, PTS and CP co-occurrence is a manifestation of a single, underlying posttraumatic psychopathology, rather than distinct but simultaneous responses. In adults, PTS and depression co-presentations may reflect varied manifestations of a single general PTS response rather than distinct posttraumatic responses (Au et al., 2013). Given childhood depression and anxiety

can often present as irritability, oppositionality, and aggression (Cornacchio et al., 2016; Stringaris et al., 2013), research examining the extent to which PTS and CPs co-occur in disaster-exposed youth is critical for evaluating the distinctiveness of these responses when CPs are present postdisaster.

Second, PTSD comprises highly heterogeneous symptoms (Galatzer-Levy & Bryant, 2013). If child PTS and CPs are specifically linked, clarifying which PTSD symptom cluster(s) most tightly co-occur with CP is important for identifying disaster-exposed youth at greatest risk for CPs, and to inform tailored treatment efforts. It has been proposed that PTS-CP links may be specifically mediated by hyperarousal and emotional dysregulation (Kunimatsu & Marsee, 2012). Indeed, research in youth suggests that hyperarousal and emotional numbing (EN) play a role in CPs following traumatic exposure. Specifically, Allwood and colleagues (2011) found hyperarousal mediates the relationship between violence exposure and delinquency; emotional numbing is also associated with increased antisocial behavior—but only when hyperarousal levels are high. In contrast, research has not linked reexperiencing symptoms and CPs.

The limited research examining postdisaster PTS and CP co-presentation has focused on natural disasters (Marsee, 2008; Scheeringa & Zeanah, 2008; Scott et al., 2014). Importantly, research in this context may not speak to PTS-CP patterns among youth exposed to aggressive manmade disasters, given the added potential for modeling of aggression and social learning (Crum et al., 2017). Exploring PTS and CP co-occurrence with regard to specific forms of exposure during aggressive manmade disasters may provide valuable information for identifying youth at greatest risk.

Moreover, PTS and CP co-presentations are often evaluated categorically in research (e.g., Scheeringa and Zeanah, 2008). A binary definition of diagnosis presence does not account for subthreshold symptoms, may underestimate symptom co-occurrence, and may misrepresent important relationships. Latent profile analysis (LPA) is a person-centered mixture-model method of latent class analysis (LCA) for continuous data that accounts for heterogeneity among individuals, and therefore may better clarify co-occurring postdisaster presentations by incorporating the full symptom range. Whereas factor analysis describes how variables group together, LPA determines how a sample of children naturally group based on shared symptoms (McCutcheon, 1987). To date, to our knowledge, LPA has not been applied to examine co-occurring postdisaster child PTS and CPs.

The present study used LPA to examine PTS and CP profiles, and their co-presentations, among affected Boston-area youth following the 2013 Boston Marathon bombing. We hypothesized that: I) Analyses would identify distinct symptom presentation profiles characterized by varying PTS and CP levels, with different profiles characterized by differing levels of PTS and the most severe profile also characterized by elevated CPs; II) Profiles characterized by both elevated PTS and elevated CPs would be characterized by particularly high emotional numbing and hyperarousal; III) The extent and form of bombing and manhunt exposure would be associated with profile classification, such that greater exposure would be associated with more problems, and direct (relative to relational) exposures would be more strongly associated with high-CP profiles.

Method

Participants

As reported in Comer and colleagues (2014), caregivers ($N = 460$, $M_{\text{age}} = 43.8$, $SD_{\text{age}} = 7.8$) of youth ages 4–19 years ($M = 11.8$, $SD = 3.8$) living ≤ 25 miles of the attack site or Watertown, MA (where the final manhunt apprehension occurred) were recruited 2 to 6 months postevent. Allowing 2–6 months postattack for survey completion provided caregivers ample time to complete the survey, thus maximizing the participation rate while capturing symptoms surpassing the Acute Stress threshold. Of 1,105 caregivers showing initial interest, 460 completed the survey (41.6% response rate). For the present study, we restricted analyses to a subset of 344 affected youth (74.6% of the full sample) whose caregivers ($M_{\text{age}} = 44$, $SD_{\text{age}} = 7.6$) reported at least some exposure to the Marathon bombing or manhunt for their child or adolescent ($M_{\text{age}} = 11.1$, $SD_{\text{age}} = 3.9$). In the current subsample, most caregiver respondents were college-educated (60.5%), biological mothers (76.2%), with non-Hispanic Caucasian youth (80.8%). Non-biological mothers who participated as caregivers included biological fathers (17.7%), adoptive mothers (3.5%), relative/guardians (1.2%), adoptive fathers (0.9%), and foster mothers (0.3%). About half reported incomes less than \$100,000/year (<\$50K: 16.3%, \$50K-99,999: 33.2%, \$100K-199,999: 38.1%, \$200K: 11.9%). Roughly 43% lived <5 miles of Watertown and about 22% lived <5 miles of the bombing.

Procedure

Study procedures were approved by the Boston University IRB. Recruitment involved distribution of study brochures and presentations at area schools, community events, Boston Strong rallies, Marathon-related memorials, pediatric offices, and interviews given on local media. Interested caregivers Boston University study staff or visited the study website for survey information. After obtaining informed consent from all individual participants included in the study, either in person with study staff or online, caregivers completed surveys (~45 minutes) via Qualtrics, a secure web-based survey program using data encryption and server authentication. Caregivers with multiple children completed the survey regarding their oldest child or adolescent within the study age range. Participants were compensated \$30, or could donate their compensation to the OneFund Boston. Participating caregivers in the current subsample completed surveys an average of 3.51 months postattack ($SD = 1.0$); 41.9% ($n = 144$) completed the survey 2 months postattack, 30.7% ($n = 105$) completed the survey 3 months postattack, 17.9% ($n = 64$) completed the survey 4 months postattack, 7.5% ($n = 25$) completed the survey 5 months postattack, and 1.8% ($n = 6$) completed the survey 6 months postattack.

Measures

Boston Marathon bombing- and manhunt-related exposure was measured via Yes/No items asking which of the following their child or adolescent had directly experienced (not secondhand, through media): a) were injured in attack, b) directly witnessed injured people, c) directly witnessed dead bodies, d) were evacuated during attack, e) saw someone running in panic at Marathon, f) saw medical personnel attending to someone, g) directly witnessed bomb squad/SWAT team activities, h) knew a person injured in bombing, i) knew a person

killed in bombing, j) heard manhunt-related gunshots/explosions, k) saw manhunt-related gunfire/explosions, l) saw manhunt-related blood, m) knew the slain officer, and/or n) knew the transit officer injured in manhunt. An *exposure score* tallied the number of items endorsed ($\alpha = .84$ in present sample). Further, a *direct exposure score* tallied endorsements across items a to g and j to l (0 to 10), and a *relational exposure score* tallied endorsements across items h to i and m to n (0 to 4). Information was also collected on youth proximity to the attack and manhunt, which allowed estimation of youth distance from events (in miles). Number of days since the attack was calculated using survey completion date.

Youth PTS was measured using the 22-item UCLA-PTSD-Reaction Index for DSM-IV (UCLA-PTSD-RI) Parent-report (Steinberg et al., 2004). The school-age version of the UCLA-PTSD-RI was used across all participants. Parents rated items on a 0 to 4 scale (0 = “none of the time,” 2 = “some of the time,” 4 = “most of the time”). The UCLA-PTSD-RI is the most commonly used postdisaster measure of youth PTSD (Furr et al., 2010), has demonstrated strong psychometric properties, and has shown comparability across racial and ethnic groups (Steinberg et al., 2013). The scale yields a total score and three subscale scores assessing the three DSM-IV symptom clusters: Reexperiencing/Intrusive Symptoms (0 to 20; $\alpha = .90$ in present sample), EN/Avoidance (0 to 28; $\alpha = .92$ in present sample), and Hyperarousal (0 to 20; $\alpha = .81$ in present sample).

Youth CPs were measured using the 5-item CP subscale of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001), a widely-used and well-supported (Stone et al., 2010) parent-report assessing youth functioning. The school-age version of the SDQ was used across all participants. Parents rate items on a 0 to 2 scale (0 = “not true,” 1 = “somewhat true,” 2 = “certainly true”) about the youth’s symptoms over the past 6 months, and CP scores range from 0 to 10 ($\alpha = .68$ in present sample). CP items assess noncompliance, aggression, dishonesty, stealing, and temper outbursts (e.g., “Often fights with other youth or bullies them,” “Often lies or cheats”). Caregiver reports were collected across participants (rather than youth reports for adolescents) so differences across age could not be attributed to differences in assessment methodology or varying informant perspectives. Previous research (He et al., 2013) has confirmed the SDQ factor structure in adolescents and documented high construct and predictive validity of SDQ parent-reported CP.

Data analyses

Means, standard deviations, and pairwise correlations were first computed across all study variables. LPA was then used to examine profile patterns of PTS and CP symptoms.

LPA is a form of LCA drawing on continuous indicators allowing classification of individuals into latent profiles based on shared symptom constellations (McCutcheon, 1987). We used LPA to group youth into distinct latent profiles based on PTS and CP symptom severity. That is, youth showing specific patterns of PTS and CP symptoms (e.g., low PTS reexperiencing/avoidance, hyperarousal, and emotional numbing symptoms, and low CP symptoms) were identified as most likely constituting specific latent profiles. A missing values analysis assessed potentially significant missingness patterns. Youth age was significantly higher among those with missing values for CPs, youth attack proximity and

Watertown proximity. Accordingly, age was included as an LPA model covariate using an auxiliary variables approach (Graham, 2003).

LPA was conducted using MPlus 7.0 full-information maximum likelihood estimation (Muthén & Muthén, 2010), in which cases are used if data are present for at least one indicator variable. For ease of interpretation, subscale item mean scores were calculated by dividing subscale sum scores by the number of items in that subscale, given that sum scores yield considerably different ranges (Reexperiencing/intrusive range: 0–20; EN/avoidance range: 0–28; Hyperarousal range: 0–20; CP range: 0–10). Instead, item mean scores yield tighter ranges (Reexperiencing/intrusive range: 0–4; EN/avoidance range: 0–4; Hyperarousal range: 0–4; CP range: 0–2).

One-to six-class solutions were evaluated using Bayesian Information Criterion (BIC) and entropy indices, as well as the range of mean probabilities for profile membership, to determine the best model. Consensus guidelines for choosing the optimal number of profiles fitting the data involved choosing a profile solution most closely matching the desired pattern of lowest BIC, highest entropy (values closer to 1 indicate better fit), and highest low-point in the range of mean probabilities for profile membership (values closer to 1 indicate greater classification accuracy) (Nylund, Asparouhov, & Muthén, 2007; Tein, Coxe, & Cham, 2013). Demographic characteristics (youth age, race/ethnicity, maternal education, and family income) and factors related to type and intensity of traumatic exposure (attack proximity, final manhunt apprehension site proximity, days since attack, and traumatic, direct, and relational exposure) were entered as model covariates, to adjust for the potential influence of these variables on estimation of the latent profile solution using the three-step method from Clark and Muthén (2009). This also allowed us to examine differences across profiles in demographic and exposure-related variables, and thus explore potential links between symptom patterns and contextual factors.

Results

The time interval for participants (in months) between the bombing and their survey completion did not correlate with total PTS ($r = .02, p = .77$), reexperiencing ($r = .02, p = .78$), hyperarousal ($r = .04, p = .44$), numbing ($r = -.01, p = .89$), or CPs ($r = -.05, p = .41$).

Table 1 presents zero-order correlations, and Table 2 presents descriptive statistics. Approximately 4.4% of youth scored in the “likely” PTSD range (i.e., > 38 on UCLA-PTSD-RI), with 3.5% showing clinically significant reexperiencing symptoms, 14.0% showing clinically significant hyperarousal symptoms, and 9.6% showing clinically significant numbing symptoms. Approximately 16.9% of youth scored in the slightly elevated CP range (> 3) and 9.3% scored in the high substantial CP risk range (> 4). Regarding potentially traumatic exposure, 17.0% were exposed to 2 events and 12.6% were exposed to 3 events. Among youth exposed to traumatic events, 16.7% directly experienced or witnessed 2 events and 12.6% directly experienced or witnessed 3 events. Roughly 2.1% of youth experienced 1 relational exposure event. Both direct and relational exposures were significantly associated with reexperiencing symptoms, hyperarousal, numbing, and CPs. Significant associations fell in the small-to-medium range.

Youth with any direct exposure showed higher reexperiencing symptoms ($t(342) = 10.01$), hyperarousal ($t(342) = 7.59$), numbing ($t(342) = 8.35$), and CPs ($t(328) = 2.75$) than youth without direct exposure ($p < .01$). Youth with any relational exposure showed higher reexperiencing symptoms ($t(342) = 5.28$), hyperarousal ($t(342) = 6.33$), numbing ($t(342) = 8.49$), and CPs ($t(328) = 6.86$) than youth without relational exposure ($p < .001$). Those with “likely PTSD” had higher CP than those without likely PTSD ($t(328) = 5.75$, $p < .001$). Youth in the high substantial risk range (i.e., >4) had higher reexperiencing symptoms ($t(328) = 3.33$), hyperarousal ($t(328) = 5.81$), and numbing ($t(328) = 7.30$), than those not in this range ($p < .001$).

Analysis then identified latent profiles of PTS and CPs, and their co-presentations. Table 3 presents fit statistics for 1-to 6-profile solutions. A 3-profile solution yielded a good overall fit, resulting in low BIC and high entropy, suggesting high classification accuracy. High mean probabilities for profile membership indicated strong profile discrimination. Scree plots of fit indices for potential profile solutions were visually inspected for incremental change in BIC and entropy. Although the 5- and 6-profile solutions resulted in slightly lower BIC values, the 3- and 4-profile solutions offered higher entropy and mean probabilities for profile membership. The 3- and 4-profile solutions were comparable in terms of entropy and classification probability, but the 4-profile solution yielded one profile in which less than 10 youth were classified, calling the stability of this fourth profile into question. Therefore, the 3-profile solution was selected and submitted to further analysis. Figure 1 plots average subscale item means across these three latent profiles. Most youth (83.1%; $n = 285$) were classified as members of Profile 1 (characterized by low PTS and low CPs), 11.7% ($n = 40$) were classified as members of Profile 2 (characterized by low-moderate PTS and low CPs), and 5.2% ($n = 18$) were classified as members of Profile 3 (characterized by high PTS and elevated CPs).

Table 4 presents PTS and CP comparisons across latent profiles. Post-hoc independent samples t -tests assessed symptom differences, using model predicted means and standard deviations from the LPA. Significant differences in reexperiencing/intrusive symptoms were found between all profiles. Specifically, Profile 3 youth showed significantly higher reexperiencing/intrusive symptoms than Profile 1 youth ($t(301) = 19.81$, $d = 4.85$, $p < .01$) and Profile 2 youth ($t(56) = 6.06$, $d = 1.75$, $p < .001$). Profile 2 youth showed greater reexperiencing/intrusive symptoms than Profile 1 youth ($t(323) = 14.71$, $d = 2.18$, $p < .001$). A similar pattern emerged with regard to hyperarousal symptoms: Profile 3 youth showed significantly greater hyperarousal than Profile 1 ($t(301) = 32.28$, $d = 5.99$, $p < .001$) and Profile 2 ($t(56) = 4.97$, $d = 1.49$, $p < .001$) youth, and Profile 2 youth showed greater hyperarousal than Profile 1 youth ($t(323) = 26.08$, $d = 3.12$, $p < .001$). Differences in EN/avoidance were also found between all three profiles, such that Profile 3 youth showed significantly greater EN/avoidance than Profile 1 ($t(301) = 39.11$, $d = 5.66$, $p < .001$) and Profile 2 ($t(56) = 12.91$, $d = 3.52$, $p < .001$) youth. Youth in Profile 2 showed greater EN/avoidance than Profile 1 youth ($t(323) = 13.90$, $d = 1.71$, $p < .001$). Analyses also found CP differences: Profile 3 youth showed significantly more severe CPs than Profile 1 ($t(289) = 2.89$, $d = 0.55$, $p = .004$). Other comparisons did not show significant differences (d s = 0.23–0.36, p s = .17–.18).

Analyses next examined comparisons across latent profiles. No significant differences emerged between profiles with regard to youth age ($\chi^2(2, N = 341) = 2.73$), youth race/ethnicity ($\chi^2(2, N = 343) = 0.87$), household income ($\chi^2(2, N = 341) = 1.39$), and maternal education ($\chi^2(2, N = 343) = 0.66$), $ps = .255$ to $.720$.

Chi-square tests found differences with regard to youth attack site proximity ($\chi^2(2, N = 333) = 25.41, p < .001$) and Watertown proximity ($\chi^2(2, N = 333) = 9.45, p = .009$). Specifically, Profiles 1 and 2 youth were at comparable distances from the attack site during the bombing. Profile 3 youth were closer to the attack site than Profile 1 and 2 youth. The same pattern emerged with regard to proximity to Watertown during the final manhunt apprehension.

There were differences across latent profiles with regard to traumatic exposure ($\chi^2(2, N = 343) = 7.93, p = .019$; see Table 3). Specifically, Profile 3 youth experienced greater traumatic exposure than Profiles 1 and 2 youth. Profile 2 youth experienced similar traumatic exposure relative to Profile 1. Further analyses examining specific types of exposures found differences between youth classified across the three profiles with regard to direct exposures ($\chi^2(2, N = 343) = 8.24, p = .016$), but not relational exposures. Specifically, Profile 3 youth experienced more direct exposure than Profiles 1 and 2, and Profiles 1 and 2 youth experienced similar direct exposure levels. Relational exposure was comparable across the profiles.

Discussion

The present study adds to a growing body of research (Comer et al., 2014; Crum et al., 2017; Hoven et al., 2005; Marsee, 2008; Scott et al., 2014) documenting the presence of CPs and aggression in a considerable minority of disaster-exposed youth, and is the first of which we are aware to use LPA to examine CPs and postdisaster PTS co-presentation profiles. Findings were consistent with research showing most postdisaster youth endure well (e.g., Comer et al., 2014; Comer & Kendall, 2007; Masten & Narayan, 2012). A concerning minority, however, showed elevated PTS and CPs following the Boston Marathon bombing/manhunt. Regarding Hypothesis I, although clinically elevated CPs were relatively rare (9.3% of the sample), it is important to note that the only profile characterized by greater CPs than unaffected youth also showed the highest PTS and traumatic exposure, suggesting that elevated youth CPs do not reliably occur without elevated postdisaster PTS in our sample. Indeed, analyses did not identify a profile characterized by low PTS but elevated CPs. While findings must be interpreted considering the SDQ as a measure of CPs both related to the bombing, and that may have predated the bombing, this correspondence between PTS and CPs suggests these two phenomena are linked—perhaps by virtue of disaster exposure, by virtue of individual characteristics constituting vulnerability to a certain clinical profile, or an interaction between these constructs. However, findings were consistent with previous research (using categorical approaches) documenting comorbid PTSD and ODD among disaster-exposed youth (Scheeringa & Zeanah, 2008), as well as work suggesting that CPs and PTS may be intertwined among youth showing aggression (Marsee, 2008; Scott et al., 2014).

Co-presentation patterns of CPs and post-bombing PTS were further clarified by comparing specific PTSD symptom clusters across profiles. Regarding Hypothesis II, we found youth with the greatest CPs (Profile 3) also showed the greatest effect size difference from unaffected youth (Profile 1) with regard to EN and hyperarousal, whereas distinguishing properties of reexperiencing symptoms were lower. In terms of effect sizes, EN/avoidance emerged as the greatest distinguishing PTS cluster when comparing youth with elevated PTS and elevated CPs (Profile 3) to youth with elevated PTS but no elevated CPs (Profile 2) PTS. Findings suggest that youth showing elevated postdisaster emotional numbing and hyperarousal should also be assessed for CPs. This finding was consistent with theory linking anxiety-related symptoms and aggression through hyperarousal (Kunimatsu & Marsee, 2012), and research linking natural disaster exposure to aggression through PTS (Marsee, 2008; Scott et al., 2014) and emotional dysregulation (Marsee, 2008). Although the sympathetic nervous system activation thought to underlie hyperarousal symptoms represents a potential pathway for posttraumatic aggression, our findings did not differentiate between aggression and other CP aspects, (e.g., noncompliance or dishonesty). It is possible these CP aspects are related to PTS through different mechanisms. Although not possible in the present study, as the same measure was used to assess hyperarousal and PTS, future research should examine whether hyperarousal mediates links between varied aspects of PTS and CPs, including measures that examine aggression specifically rather than CPs broadly.

Development of co-occurring PTS and CPs in a subset of youth following exposure to violent disasters may also represent the manifestation of an underlying genetic neurobiological vulnerability following exposure to major stressors. Following a disaster, perhaps youth with a specific genotype or neural dysfunction may be more likely to manifest trauma response through the development of co-occurring PTS and CPs. For example, research has shown that genetic variations interact with maltreatment to influence youth aggression (Bryushkova et al., 2016), and youth Respiratory Sinus Arrhythmia before a natural disaster predicts post-disaster PTSD symptoms (Mikolajewski & Scheeringa, 2018). Similar physiological and neural pathways are implicated in youth PTS and CPs (e.g., Blair, Veroude, & Buitelaar, 2018; Morey, Haswell, Hooper, & De Bellis, 2016), perhaps accounting in part for the overrepresentation of CP among youth with the most severe PTS. Further research is needed to investigate potential interactions between genetics, neurobiology, and specific profiles of CP and PTS symptom presentation following exposure to violent manmade disasters.

Relatedly, our findings align with research examining the role of emotional numbing in links between violence exposure and delinquency (Allwood et al., 2011). Theories of empathy and prosocial behavior underscore the importance of relating affectively to others' emotions for adaptive social interactions (Eisenberg et al., 2010). Moreover, a subset of youth with CPs shows serious callous-unemotional traits and affective empathy deficiencies (Frick & Ellis, 1999), which are believed to underlie severe youth antisocial behavior (e.g., Blair et al., 2006). Perhaps for a subset of traumatized youth, emotional numbing interferes with affective empathy, which in turn confers risk for antisocial behaviors. Longitudinal work is needed to examine trajectories that eventuate in co-occurring PTS and CPs.

Furthermore, youth with the most severe hyperarousal symptoms showed the most severe EN symptoms, supporting research linking these two symptom clusters among youth with traumatic stress (Weems et al., 2003), as well as predominant classification systems defining co-occurring hyperarousal and difficulty engaging in positive, prosocial emotions as part of the PTS syndrome. Prospective research suggests these two symptom clusters may mutually influence one another. For example, Weems and colleagues (2003) found hyperarousal symptoms predicted emotional numbing over the course of one year, independent of other symptoms.

Post-bombing symptom profiles also differed with respect to traumatic exposure. Regarding Hypothesis III, youth who showed the greatest PTS and CPs also had the greatest exposure. This was consistent with previous research linking violent disaster exposure to CPs (Comer et al., in press; Hoven et al., 2005) and PTS (Furr et al., 2010), although this study uniquely evaluated links between traumatic exposure and co-occurring CPs and PTS. Importantly, when traumatic exposure was broken down into different exposure types, greater direct exposure distinguished youth in the profile showing elevated CPs (Profile 3) from youth in most other profiles. In contrast, relational exposure did not differentiate across profiles. Given that direct exposure involved first-hand experience/observation of violence, our findings may underscore the roles of aggression modeling and social learning in CP development following violent manmade disasters. Further, this pattern may explain why proximal exposure to violent manmade disasters has been associated with CPs (Chemtob et al., 2008; Hoven et al., 2005), whereas distal exposure to violent manmade disasters (Lengua et al., 2005) has not been reliably linked to CPs. Indeed, in this study youth classified in the profile with the most severe PTS, and with elevated CPs, were closest to the events. Given how perceptions of traumatic events greatly impact PTS symptom severity (Green et al., 2000; Pynoos, Steinberg, & Piacentini, 1999), and youth peritraumatic symptoms are related to later PTS symptoms following violent manmade disasters (Pfefferbaum, Stuber, Galea, & Fairbrother, 2006; Pfefferbaum et al., 2002), it is possible that perceived threat associated with closer disaster proximity (rather than increased risk for exposure alone) impacts links between PTS and attack proximity. These effects may be especially pronounced with violent community disasters, given the links between terrorism and political violence and violent behavior (e.g., Dubow et al., 2009) and the potential for socialization of aggression related to these events (e.g., Crum et al., 2017). Future research should explore differential co-presentation of PTS and CPs in youth exposed to a variety of disasters, and consider the role of peritraumatic symptoms and perceived threat in profiles of PTS and CP symptom presentation following violent manmade disasters.

Limitations and Future Research Directions

Several limitations warrant comment. First, findings were based on caregiver-report. Given limits of relying exclusively on a single informant (Comer & Kendall, 2004), future studies should incorporate multiple perspectives. As youth report more severe PTSD symptoms following disasters than parents report (Meiser-Stedman et al., 2007), it is possible our findings underestimated traumatic stress and CP co-presentation. Interestingly, Arman and colleagues (2013) reported no significant differences between SDQ parent- and self-reports in 11–18 year-olds. Accordingly, in the present study we employed parallel assessment

methodology across participants so that differences across age could not be attributed to methodological differences; future research should include self-reports. However, research has shown that youth report higher levels of behavior problems than parents, especially with increasing youth age (e.g., Martin, Ford, Dyer-Friedman, Tang, & Huffman, 2004; van der Ende & Verhulst, 2005), suggesting that caregivers may have underestimated CPs in older youth. This is relevant to a second limitation of the current study—the age range of our sample covers a wide developmental span. While existing studies on natural disasters have shown that PTSD and CPs co-occur at a variety of developmental stages, from preschoolers to high schoolers, without differences by age (e.g., Scheeringa & Zeanah, 2008; Marsee, 2008), CP presentation does vary across age groups, with oppositional behavior and aggression greatest in younger children and adolescents, and status offenses greater in older adolescents (e.g., Maughan, Rowe, Messer, Goodman, & Meltzer, 2004; Lahey et al., 2000). Accordingly, age was included as an LPA model covariate in our analyses to account for developmental influences, and no significant differences emerged between profiles with regard to youth age ($M(SD)_{\text{Profile 1}}=11.01 (3.92)$, $M(SD)_{\text{Profile 2}}=11.33 (3.70)$, $M(SD)_{\text{Profile 3}}=12.61 (4.12)$). Future studies should further explore potential developmental differences in the co-presentation of CPs and specific PTS symptom sets.

Third, evaluating gender-related differences was not possible, as youth gender data were not collected in the present de-identified survey. CPs occur more frequently in males (e.g., Maughan et al., 2004), and CP presentation varies by gender, with aggression and property and status offenses more common among boys (e.g., Lahey et al., 2000). Thus, further research is needed to understand whether patterns of CPs and postdisaster PTS symptom presentation vary by gender—for example, whether boys are more likely to present with more severe symptom profiles, such as Profile 3 in our results. However, previous literature has not found differences by gender when examining co-presentation of PTSD and ODD (Scheeringa & Zeanah, 2008), and in the fit of models linking disaster exposure to aggression through posttraumatic stress symptoms (Marsee, 2008; Scott et al., 2014), lending confidence to our findings.

Fourth, despite broad recruitment efforts, findings may not generalize to the general population of affected youth. This concern is somewhat tempered, however, by the sample's sociodemographic composition, which was roughly comparable to the regions most directly affected (89.4% of Watertown residents and 74.5% of Back Bay residents are Caucasian, and roughly half of families in these areas have annual incomes >\$100,000). Fifth, analyses did not consider whether caregiver CP symptoms influenced relationships between variables. Sixth, the timeframe of the SDQ assesses symptoms over the past 6 months, but the average participant completed their survey only 3.4 months after the bombing (and 73% completed surveys within the first 3 months postbombing). Accordingly, although we found that timing of survey completion did not significantly predict CP scores, it is likely that some reported CPs predated the Marathon events. Results should be interpreted with this consideration in mind; indeed, it is possible that youth with existing CPs may be more likely to develop the most severe PTS. Seventh, and relatedly, the cross-sectional design precludes causal conclusions. With regard to the timing of PTS symptoms, the presence of continued postattack-specific symptoms after the Acute Stress threshold highlights the impact of this disaster on affected youth. However, reports of symptoms at varying times since the attack

may reflect varying points along youth PTS trajectories. While time since the attack was not correlated with PTS symptoms or CPs in our sample, future research should examine symptom profiles across time, to evaluate trajectories of co-occurrence between CPs and PTS symptom sets.

Finally, information on non-participants is not available and the participation rate was somewhat low. As such, the present sample may not be representative of the larger sample of individuals who initially expressed interest in participating. However, our response rate is consistent with rates in other postdisaster research (La Greca et al., 2010; McLaughlin et al., 2009), and may speak to unique obstacles associated with studying postdisaster communities.

Given these limitations, future research should explore factors that influence postdisaster symptom presentation, in order to further clarify links between CPs and PTS following violent community disasters. We encourage other investigators to continue to use LPA to examine co-presentation profiles among traumatized youth, and to consider causal mechanisms that may underlie co-presentation patterns. Moreover, as CPs occur more frequently in males, studies should assess the robustness of findings across genders. Further, although most postdisaster research is initiated after traumatic events occur, future researchers with existing youth data in disaster-affected regions would do well to collect postdisaster data on pre-existing samples to assess issues of temporal precedence among variables. Further, as our findings suggest that differential exposure to violent manmade disasters may be specifically related to the co-occurrence of postdisaster PTS symptoms and CP, future studies should examine perceptions of threat, social learning and aggression modeling, and perceptions of being specifically “targeted” as potential factors influencing PTS and CP symptom co-occurrence following violent manmade disasters.

Additionally, given that parental modeling of coping skills has been linked to youth behavior, future work should examine whether caregiver symptoms moderate links among youth exposure, PTS, and CPs. Parent symptom severity is associated with youth symptom severity postdisaster (e.g., Fairbrother, Stuber, Galea, Fleischman, & Pfefferbaum 2003; Pine & Cohen, 2002), and parental support and positive relationships with youth have been linked to youths’ postdisaster adjustment (Dubow et al., 2012; Pine & Cohen, 2002), as well as youth CPs following violence exposure (e.g., Ozer, Lavi, Douglas, & Wolf, 2017) and in general (e.g., Odgers et al., 2012; Stack, Serbin, Enns, Ruttle, & Barrieau, 2010). Indeed, parental distress is related to youths’ CPs following violent community disasters, with particularly strong associations between youth trauma exposure and CPs among children of highly distressed caregivers (Kerns et al., 2014). Parenting stress has also been shown to mediate relationships between children’s family violence exposure and mental health functioning (Humenay Roberts, Campbell, Ferguson, & Crusto, 2013). Further research is needed to explore relationships between parental traumatic stress, parenting practices and coping modeling, and co-presentation of child PTS and CPs following violent community disasters.

Our findings offer a rare portrait of youth CPs and PTS profiles after a violent disaster. Although most youth did not show CPs, youth who did also showed elevated PTS—

particularly the most elevated hyperarousal and EN—directly witnessed the greatest violence, and were closest to the events. Postdisaster efforts rarely assess or target CPs and may be under-recognizing and under-treating serious clinical needs in affected communities. Youth-focused interventions following violent disasters would do well to augment PTS components with targeted CP prevention modules when working with youth showing the greatest hyperarousal and EN, who have directly witnessed the most violence, and/or who were closest to the disaster.

Acknowledgments

Funding for this work was provided by the Center for Anxiety and Related Disorders (CARD) Research Fund, the Barlow Research Fund, and the Department of Psychology at Boston University, and NIH (K23 MH090247, K01 MH085710).

References

- Allwood MA, Bell DJ, & Horan J. (2011). Posttrauma numbing of fear, detachment, and arousal predict delinquent behaviors in early adolescence. *Journal of Clinical Child & Adolescent Psychology*, 40, 659–667. doi:10.1080/15374416.2011.597081. [PubMed: 21916685]
- Arman S, Amel AK, & Maracy MR. (2013). Comparison of parent adolescent scores on Strengths and Difficulties Questionnaire. *Journal of Research in Medical Sciences*, 18, 501–505. [PubMed: 24250700]
- Au TM, Dickstein BD, Comer JS, Salters-Pedneault K, Litz BT. (2013). Co-occurring posttraumatic stress and depression symptoms after sexual assault: A latent profile analysis. *Journal of Affective Disorders*, 149, 209–216. doi: 10.1016/j.jad.2013.01.026. [PubMed: 23489401]
- Blair RJR, Peschardt KS, Budhani S, Mitchell DGV, & Pine DS. (2006). The development of psychopathy. *Journal of Child Psychology and Psychiatry*, 47, 262–275. doi: 10.1111/j.1469-7610.2006.01596.x. [PubMed: 16492259]
- Blair RJR, Veroude K, & Buitelaar JK. (2018). Neuro-cognitive system dysfunction and symptom sets: A review of fMRI studies in youth with conduct problems. *Neuroscience & Biobehavioral Reviews*, 91, 69–90. doi: 10.1016/j.neubiorev.2016.10.022 [PubMed: 27794436]
- Boer F, Smit C, Morren M, Roorda J, & Yzermans J. (2009). Impact of a technological disaster on young children: A five-year post-disaster multi-informant study. *Journal of Traumatic Stress*, 22, 516–524. doi: 10.1002/jts.20461. [PubMed: 19824065]
- Breslau N, Davis GC, Andreski P, & Peterson E. (1991). Traumatic events and posttraumatic stress disorder in an urban population of young adults. *Archives of General Psychiatry*, 48, 216–222. doi: 10.1001/archpsyc.1991.01810270028003. [PubMed: 1996917]
- Bryushkova L, Zai C, Chen S, Pappa I, Mileva V, Tiemeier H, Bakermans-Kranenburg M, Kennedy JL, & Beitchman JH. (2016). FKBP5 interacts with maltreatment in children with extreme, pervasive, and persistent aggression. *Psychiatry research*, 242, 277–280. doi: 10.1016/j.psychres.2015.09.052 [PubMed: 27315459]
- Chemtob CM, Nomura Y, Abramovitz RA. (2008). Impact of conjoined exposure to the World Trade Center attacks and to other traumatic events on the behavioral problems of preschool children. *Archives of Pediatric and Adolescent Medicine*, 162, 126–133. doi:10.1001/archpediatrics.2007.36.
- Clark SL, & Muthén BO. (2009). Relating latent class analysis results to variables not included in the analysis. Submitted for publication. Available from <http://www.statmodel.com/download/relatinglca.pdf>.
- Comer JS, Bry L, Poznanski B, & Golik AM. (2016). Children's mental health in the context of terrorist attacks, ongoing threats, and possibilities of future terrorism. *Current Psychiatry Reports*, 18, 78. doi: 10.1007/s11920-016-0722-1 [PubMed: 27417512]
- Comer JS, Dantowitz A, Chou T, Edson AL, Elkins RM, Kerns C, Brown B, & Green JG. (2014). Adjustment among area youth after the Boston Marathon bombing and subsequent manhunt. *Pediatrics*, 134, 7–14. doi: 10.1542/peds.2013-4115. [PubMed: 24918223]

- Comer JS, Fan B, Duarte C. et al., (2010). Attack-related life disruption and child psychopathology in New York City public schoolchildren 6-months post-9/11. *Journal of Clinical Child and Adolescent Psychology*, 39, 460–469. doi: 10.1080/15374416.2010.486314. [PubMed: 20589558]
- Comer JS, Golik A, & Martin J. (in press). Learning from the past: Understanding children's mental health after 9/11 and after the Boston Marathon Bombing In Tyano S, Hoven CW, & Amsel L. (Eds.), *Responses to Children's Mental Health Needs after Major Disasters: An International Perspective*. NY: Springer.
- Comer JS, & Kendall PC. (2004). A symptom-level examination of parent-child agreement in the diagnosis of anxious youths. *Journal of the American Academy of Child and Adolescent Psychiatry*, 43, 878–886. doi: 10.1097/01.chi.0000125092.35109.c5. [PubMed: 15213589]
- Comer JS, & Kendall PC. (2007). Terrorism: The psychological impact on youth. *Clinical Psychology: Science and Practice*, 14, 179–212. doi:10.1111/j.1468-2850.2007.00078.x.
- Copeland WE, Keeler G, Angold A, & Costello EJ. (2007). Traumatic events and posttraumatic stress in childhood. *Archives of General Psychiatry*, 64, 577–584. doi: 10.1001/archpsyc.64.5.577. [PubMed: 17485609]
- Cornacchio D, Crum KI, Coxe S, Pincus DB, & Comer JS. (2016). Irritability and severity of anxious symptomatology among youth with anxiety disorders *Journal of the American Academy of Child and Adolescent Psychiatry*, 55, 54–61. doi: 10.1016/j.jaac.2015.10.007 [PubMed: 26703910]
- Crum KI, Cornacchio D, Coxe S, Green JG, & Comer JS. (2017). Conduct problems among Boston-area youth following the 2013 Marathon bombing: The moderating role of prior violent crime exposure. *Journal of Clinical Child and Adolescent Psychology*, 46, 343–352. doi: 10.1080/15374416.2015.1077450. [PubMed: 26630365]
- Donenberg G, & Baker BL. (1993). The impact of young children with externalizing behaviors on their families. *Journal of Abnormal Child Psychology*, 21, 179–198. doi:10.1007/BF00911315. [PubMed: 8491931]
- Dubow EF, Boxer P, Rowell Huesmann L, Shikaki K, Landau S, Dvir Gvirsman S, & Ginges J. (2009). Exposure to conflict and violence across contexts: Relations to adjustment among Palestinian children. *Journal of Clinical Child & Adolescent Psychology*, 39(1), 103–116. doi: 10.1080/15374410903401153
- Dubow EF, Rowell Huesmann L, Boxer P, Landau S, Dvir S, Shikaki K, & Ginges J. (2012). Exposure to political conflict and violence and posttraumatic stress in Middle East youth: Protective factors. *Journal of Clinical Child & Adolescent Psychology*, 41(4), 402–416. doi: 10.1080/15374416.2012.684274 [PubMed: 22594697]
- Eisenberg N, Eggum ND, & Di Giunta L. (2010). Empathy-related responding: Associations with prosocial behavior, aggression, and intergroup relations. *Social Issues and Policy*, 4, 143–18. doi: 10.1111/j.1751-2409.2010.01020.x.
- Fairbrother G, Stuber J, Galea S, Fleischman AR, & Pfefferbaum B. (2003). Posttraumatic stress reactions in New York City children after the September 11, 2001, terrorist attacks. *Ambulatory Pediatrics*, 3(6), 304–311. doi: 10.1367/1539-4409(2003)003<0304:PSRINY>2.0.CO;2 [PubMed: 14616045]
- Frick PJ, & Ellis M. (1999). Callous-unemotional traits and subtypes of conduct disorder. *Clinical Child and Family Psychology Review*, 2, 149–168. doi: 10.1023/A:1021803005547. [PubMed: 11227072]
- Furr JM, Comer JS, Edmunds JM, & Kendall PC. (2010). Disasters and youth: A meta-analytic examination of posttraumatic stress. *Journal of Consulting and Clinical Psychology*, 78, 765–780. doi: 10.1037/a0021482. [PubMed: 21114340]
- Galatzer-Levy IR, & Bryant RA. (2013). 636,120 ways to have posttraumatic stress disorder. *Perspectives on Psychological Science*, 8, 651–662. doi: 10.1177/1745691613504115. [PubMed: 26173229]
- Goodman R. (2001). Psychometric properties of the strengths and difficulties questionnaire. *Journal of the American Academy of Child & Adolescent Psychiatry*, 40, 1337–1345. doi: 10.1097/00004583-200111000-00015. [PubMed: 11699809]
- Graham JW. (2003). Adding missing-data-relevant variables to FIML-based structural equation models. *Structural Equation Modeling*, 10, 80–100. doi: 10.1207/S15328007SEM1001_4.

- Green BL, Goodman LA, Krupnick JL, Corcoran CB, Petty RM, Stockton P, & Stern NM. (2000). Outcomes of single versus multiple trauma exposure in a screening sample. *Journal of Traumatic Stress*, 13, 271–286. doi: 10.1023/A:1007758711939. [PubMed: 10838675]
- He J, Burstein M, Schmitz A, & Merikangas KR. (2013). The strengths and difficulties questionnaire (SDQ): The factor structure and scale validation in U.S. adolescents. *Journal of Abnormal Child Psychology*, 41, 583–595. doi:10.1007/s10802-012-9696-6. [PubMed: 23183936]
- Hoven CW, Duarte CS, Lucas CP, et al. (2005). Psychopathology among New York City Public School children 6 months after September 11. *Archives of General Psychiatry*, 62, 545–552. doi:10.1001/archpsyc.62.5.545. [PubMed: 15867108]
- Humenay Roberts Y, Campbell CA, Ferguson M, & Crusto CA. (2013). The role of parenting stress in youth children's mental health functioning after exposure to family violence. *Journal of Traumatic Stress*, 26, 605–612. doi: 10.1002/jts.21842 [PubMed: 24038613]
- Kerns CE, Elkins RM, Carpenter AL, Chou T, Greif Green J, & Comer JS. (2014). Caregiver distress, shared traumatic exposure, and child adjustment among area youth following the 2013 Boston Marathon bombing. *Journal of Affective Disorders*, 167, 50–55. doi: 10.1016/j.jad.2014.05.040 [PubMed: 25082114]
- Kunimatsu MM, & Marsee MA. (2012). Examining the presence of anxiety in aggressive individuals: The illuminating role of fight-or-flight mechanisms. *Child Youth Care Forum*, 41, 247–258. doi: 10.1007/s10566-012-9178-6.
- La Greca AM, Silverman WK, Lai B, & Jaccard J. (2010). Hurricane-related exposure experiences and stressors, other life events, and social support: Concurrent and prospective impact on children's persistent posttraumatic stress symptoms. *Journal of Consulting and Clinical Psychology*, 78, 794–805. doi:10.1037/a0020775. [PubMed: 20939624]
- Lahey BB, Goodman SH, Canino G, Bird H, Schwab-Stone M, Waldman ID, ... & Jensen PS. (2000). Age and gender differences in oppositional behavior and conduct problems: A cross-sectional household study of middle childhood and adolescence. *Journal of Abnormal Psychology*, 109(3), 488–503. doi: 10.1037//0021-843X.109.3.481 [PubMed: 11016118]
- Lengua LJ, Long AC, Smith KI, & Meltzoff AN. (2005). Pre-attack symptomatology and temperament as predictors of children's responses to the September 11 terrorist attacks. *Journal of Child Psychology and Psychiatry*, 46, 631–645. doi:10.1111/j.1469-7610.2004.00378.x. [PubMed: 15877768]
- Marsee MA. (2008). Reactive aggression and posttraumatic stress in adolescents affected by Hurricane Katrina. *Journal of Clinical Child and Adolescent Psychology*, 37, 519–529. doi: 10.1080/15374410802148152. [PubMed: 18645743]
- Martin J, Ford CB, Dyer-Friedman J, Tang J, & Huffman LC. (2004). Patterns of agreement between parent and child ratings of emotional and behavioral problems in an outpatient clinical setting: When children endorse more problems. *Journal of Developmental & Behavioral Pediatrics*, 25(3), 150–155. doi: 0196-206X/00/2503-0150 [PubMed: 15194898]
- Masten AS, & Narayan AJ. (2012). Child development in the context of disaster, war, and terrorism: Pathways of risk and resilience. *Annual Review of Psychology*, 63, 227–257. doi: 10.1146/annurev-psych-120710-100356.
- Maughan B, Rowe R, Messer J, Goodman R, & Meltzer H. (2004). Conduct Disorder and Oppositional Defiant Disorder in a national sample: Developmental epidemiology. *Journal of Child Psychology and Psychiatry*, 45(3), 609–621. doi: 10.1111/j.1469-7610.2004.00250.x [PubMed: 15055379]
- McCutcheon AJ. (1987). Latent class analysis Sage University Paper series on Quantitative Applications in the Social Sciences, No. 07–064. Newbury Park, CA: Sage Publications.
- McLaughlin KA, Fairbank JA, Gruber MJ, et al. (2009). Serious emotional disturbance among youths exposed to Hurricane Katrina 2 years postdisaster. *Journal of the American Academy of Child and Adolescent Psychiatry*, 48, 1069–78. doi: 10.1097/CHI.0b013e3181b76697. [PubMed: 19797983]
- Meiser-Stedman R, Smith P, Glucksman E, Yule W, & Dalgleish T. (2007). Parent and child agreement for acute stress disorder, post-traumatic stress disorder and other psychopathology in a prospective study of children and adolescents exposed to single-event trauma. *Journal of Abnormal Child Psychology*, 35, 191–201. doi: 10.1007/s10802-006-9068-1. [PubMed: 17219079]

- Mikolajewski AJ, & Scheeringa MS. (2018). Examining the prospective relationship between pre-disaster Respiratory Sinus Arrhythmia and post-disaster Posttraumatic Stress Disorder in children. *Journal of Abnormal Child Psychology* (online ahead of print). doi: 10.1007/s10802-017-0396-0
- Morey RA, Haswell CC, Hooper SR, & De Bellis MD. (2016). Amygdala, hippocampus, and ventral medial prefrontal cortex volumes differ in maltreated youth without and without Posttraumatic Stress Disorder. *Neuropsychopharmacology*, 41, 791–801. doi: 10.1038/npp.2015.205 [PubMed: 26171720]
- Muthén LK, & Muthén BO. (2010). *MPlus User's Guide* (6th ed.). Los Angeles, CA: Muthén & Muthén.
- Nylund KL, Asparouhov T, & Muthén BO. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling*, 14, 535–569. doi: 10.1080/10705510701575396.
- Odgers CL, Caspi A, Russell MA, Sampson RJ, Arseneault L, & Moffit TE. (2012). Supportive parenting mediates neighborhood socioeconomic disparities in children's antisocial behavior from ages 5 to 12. *Development and Psychopathology*, 24, 705–721. doi: 10.1017/S0954579412000326 [PubMed: 22781850]
- Ozer EJ, Lavi I, Douglas L, & Wolf JP. (2017). Protective factors for youth exposed to violence in their communities: A review of family, school, and community moderators. *Journal of Clinical Child & Adolescent Psychology*, 46(3), 353–378. doi: 10.1080/15374416.2015.1046178 [PubMed: 26114611]
- Pfefferbaum B, Doughty DE, Reddy C, Patel N, Gurwitsch RH, Nixon SJ, et al. (2002). Exposure and peritraumatic response as predictors of posttraumatic stress in children following the 1995 Oklahoma City bombing. *Journal of Urban Health*, 79, 354–363. doi: 10.1093/jurban/79.3.354 [PubMed: 12200504]
- Pfefferbaum B, Stuber J, Galea S, & Fairbrother G. (2006). Panic reactions to terrorist attacks and probable Posttraumatic Stress Disorder in adolescents. *Journal of Traumatic Stress*, 19(2), 217–228. doi: 10.1002/jts.20118 [PubMed: 16612814]
- Pine DS, & Cohen JA. (2002). Trauma in children and adolescents: Risk and treatment of psychiatric sequelae. *Biological Psychiatry*, 51(7), 519–531. doi: 10.1016/S0006-3223(01)01352-X [PubMed: 11950454]
- Pynoos RS, Steinberg AM, & Piacentini JC. (1999). A developmental psychopathology model of childhood traumatic stress and intersection with anxiety disorders. *Biological Psychiatry*, 46, 1542–1554. doi: 10.1016/S0006-3223(99)00262-0. [PubMed: 10599482]
- Scott BG, Lapré GE, Marsee MA, & Weems CF. (2014) Aggressive behavior and its associations with posttraumatic stress and academic achievement following a natural disaster. *Journal of Clinical Child & Adolescent Psychology*, 43, 43–50. doi: 10.1080/15374416.2013.807733. [PubMed: 23795776]
- Scheeringa MS & Zeanah CH. (2008). Reconsideration of harm's way: Onsets and comorbidity patterns of disorders in preschool children and their caregivers following Hurricane Katrina. *Journal of Clinical Child and Adolescent Psychology*, 37, 508–518. doi: 10.1080/15374410802148178. [PubMed: 18645742]
- Stack DM, Serbin LA, Enns LN, Ruttle PL, & Barrieau L. (2010). Parental effects on children's emotional development over time and across generations. *Infants & Young Children*, 23, 52–69. doi: 10.1097/IYC.0b013e3181c97606
- Steinberg AM, Brymer MJ, Decker KB, & Pynoos RS. (2004). The University of California at Los Angeles post-traumatic stress disorder reaction index. *Current Psychiatry Reports*. 6, 96–100. doi: 10.1007/s11920-004-0048-2. [PubMed: 15038911]
- Steinberg AM, Brymer MJ, Kim S, et al. (2013). Psychometric Properties of the UCLA PTSD Reaction Index: Part I. *Journal of Traumatic Stress*, 26, 1–9. doi: 10.1002/jts.21780. [PubMed: 23417873]
- Stringaris A, Maughan B, Copeland WS, Costello EJ, & Angold A. (2013). Irritable mood as a symptom of depression in youth: Prevalence, developmental, and clinical correlates in the Great Smoky Mountains Study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 52, 831–840. doi: 10.1016/j.jaac.2013.05.017. [PubMed: 23880493]

- Stone LL, Otten R, Engels RCME, Vermulst AA, & Janssens JMAM. (2010). Psychometric properties of the parent and teacher versions of the Strengths and Difficulties Questionnaire for 4-to 12-year-olds: A review. *Clinical Child and Family Psychology Review*, 13, 254–274. doi: 10.1007/s10567-010-0071-2. [PubMed: 20589428]
- Tein J-Y, Coxe S, & Cham H. (2013). Statistical power to detect the correct number of classes in latent profile analysis. *Structural Equation Modeling*, 20, 640–657. doi: 10.1080/10705511.2013.824781. [PubMed: 24489457]
- van der Ende J, & Verhulst FC. (2005). Informant, gender and age differences in ratings of adolescent problem behaviour. *European Child & Adolescent Psychiatry*, 14(3), 117–126. doi: 10.1007/s00787-005-0438-y [PubMed: 15959657]
- Weems CF, Saltzman KM, Reiss AL, & Carrion VG. (2003). A prospective test of the association between hyperarousal and emotional numbing in youth with a history of traumatic stress. *Journal of Clinical Child and Adolescent Psychology*, 32, 166–171. doi: 10.1207/S15374424JCCP3201_15 [PubMed: 12573941]

Figure 1.

Three identified profiles of posttraumatic stress symptoms and conduct problems among the current subsample of Boston-area youth ($N = 344$) exposed to the Boston marathon bombing events. Average item score (i.e., subscale item averages, not subscale total scores) are presented for reexperiencing/intrusive symptoms, hyperarousal, emotional numbing/avoidance, and conduct problems (scores on the PTS scale items range from 0 to 4 and scores on the CP scale items range from 0 to 2).

Table 1

Correlations of Study Variables

Variable	1	2	3	4	5	6	7	8	9
1. Reexperiencing	-								
2. Hyperarousal	0.79**	-							
3. Numbing	0.74**	0.79**	-						
4. CP	0.27**	0.47**	0.43**	-					
5. Traumatic exposure	0.49**	0.44**	0.55**	0.26**	-				
6. Direct exposure	0.48**	0.42**	0.52**	0.24**	0.99**	-			
7. Relational exposure	0.26**	0.30**	0.40**	0.29**	0.54**	0.42**	-		
8. Proximity to attack	-0.07	-0.06	-0.07	-0.04	-0.002	0.01	-0.06	-	
9. Proximity to final site	0.00	0.03	0.01	0.03	0.11	0.12*	-0.02	0.87**	-
10. Days since attack	0.02	0.04	-0.01	-0.05	-0.02	-0.01	0.01	-0.01	0.02

Note: N = 344; CP = conduct problems.

* = $p < 0.05$

** = $p < 0.01$

Table 2

Descriptive Statistics

Variable	N	<i>M</i>	<i>SD</i>
Reexperiencing	344	2.63	4.03
Hyperarousal	344	4.26	4.27
Numbing	344	2.89	5.53
CP	330	1.32	1.59
Traumatic exposure	340	2.93	2.73
Direct exposure	344	0.73	1.68
Relational exposure	344	0.03	0.23
Proximity to attack	334	8.95	6.77
Proximity to final site	334	7.42	6.70
Days since attack	344	105.21	28.53

Note: CP = conduct problems.

Table 3

Fit Statistics for Six Latent Profiles

Profile Solution	BIC	Entropy	Mean probability for profile membership
1	2410.07	NA	NA
2	1656.50	.98	.98–1.00
3	1402.38	.98	.95–1.00
4	1276.88	.98	.97–1.00
5	1222.68	.88	.82–1.00
6	1150.24	.94	.81–1.00

Note: $N = 344$. Entropy and mean probabilities are not applicable to a 1-profile solution. BIC = Bayesian information criterion.

Table 4

Symptom and exposure comparisons across three identified latent profiles

Variable	Profile 1		Profile 2		Profile 3	
	M	SD	M	SD	M	SD
Reexperiencing	0.52 _a	0.45	1.69 _b	0.61	2.70 _c	0.55
Hyperarousal	0.20 _a	0.28	1.68 _b	0.61	2.48 _c	0.46
Emotional numbing	0.14 _a	0.23	0.77 _b	0.46	2.60 _c	0.57
Conduct problems	0.24 _a	0.30	0.32 _{ab}	0.33	0.48 _b	0.52
Traumatic exposure	0.65 _a	1.7	1.00 _a	1.8	2.28 _b	2.6
Direct	0.62 _a	1.6	0.93 _a	1.8	2.06 _b	2.2
Relational	0.02 _a	0.2	0.03 _a	0.2	0.11 _a	0.3
Proximity to events						
Miles to attack site	9.39 _a	6.8	8.11 _a	6.8	4.18 _b	4.0
Miles to Watertown	7.57 _a	6.9	7.47 _a	6.2	4.85 _b	3.3
Days since attack	105.64 _a	27.8	108.70 _a	31.9	86.28 _b	20.0

Note: N = 344. Within rows, values with different subscript letters are significantly different (post-hoc independent samples *t*-tests assessed symptom differences). For reexperiencing, hyperarousal, emotional numbing, and conduct problems, values reflect average item scores (not total scores); scores on the PTS scale items range from 0 to 4 and scores on the CP scale items range from 0 to 2.