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Conduct Problems among Boston-Area Youth Following the 2013 Marathon Bombing: The moderating Role of Prior Violent Crime Exposure

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Abstract

A large body of work documents the heavy mental health burden of youth exposure to disasters, but the majority of this research has focused on posttraumatic stress and internalizing symptoms. Less is known about associations between disaster exposure and children's conduct problems (CPs), or variables that may moderate such relationships. Given well-documented links between CPs and children's exposure to community violence, youth with greater prior community violence exposure through residence in high-crime areas may be particularly vulnerable to the impacts of disaster exposure on CPs. We surveyed Boston-area caregivers (N=460) in the first 6 months following the 2013 Marathon bombing on their children's event-related exposures, as well as CPs. To estimate prior violent crime exposure, children's neighborhoods were assigned corresponding violent crime rates obtained from the Federal Bureau of Investigation's uniform crime reporting statistics. Almost 1 in 6 Boston-area children assessed in this convenience sample showed clinically elevated CPs in the aftermath of the Boston Marathon bombing and subsequent manhunt. Prior violent crime exposure significantly moderated the link between children's manhunt exposure (but not bombing exposure) and child CPs. Manhunt exposure was related to increased CPs among children living in areas with high and medium (but not low) levels of prior violent crime. Children living in neighborhoods characterized by violent crime may be at particularly increased risk for developing CPs after violent manmade disasters. As most post-disaster child intervention efforts focus on posttraumatic stress, efforts are needed to develop programs targeting child CPs, particularly for youth dwelling in violent neighborhoods.

Keywords

disasters; conduct problems; neighborhood violence; trauma; terrorism

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Over the past decade, several billion people have been directly affected by disaster events and terrorist acts that have collectively cost millions of lives and trillions of dollars (United Nations Office for Disaster Risk Reduction, 2012). Although the number of natural disasters reported worldwide has declined slightly in recent years (Guha-Sapir, Hoyois, & Below, 2013), communities in the United States have been exposed to an increasing number of high-profile incidents of civilian-directed violence and terrorist events, including mass shootings, bombings, and other attacks (e.g., Blair, Martaindale, & Nichols, 2014). A large body of work now documents the very heavy mental health burden of youth exposure to disasters and violent manmade events targeting civilians (e.g., Comer & Kendall, 2007; Furr, Comer, Edmunds, & Kendall, 2010; La Greca, Silverman, Lai, & Jaccard, 2010), but importantly, the vast majority of this research has focused almost exclusively on posttraumatic stress disorder (PTSD) and internalizing symptoms (see Comer & Kendall, 2007; Furr et al., 2010; La Greca, 2007). Much less is known about the potential impact of disaster exposure on children's conduct problems.

Child conduct problems (CPs)—characterized by serious aggression, defiance, and/or rule-breaking behavior—constitute one of the most prevalent classes of problems affecting youth (Costello, Mustillo, Erklani, Keeler, & Angold, 2003). Such difficulties are associated with profound disability and costs to society, interfere with academic functioning, and confer sizable risk for later life psychopathology, family dysfunction, criminality, and justice system involvement (e.g., Donenberg & Baker, 1993; Foster et al., 2005; Greene et al., 2002; Pardini & Fite, 2010; Reef, Diamantopoulou, Van Meurs, Verhulst, & Van Der Ende, 2009; see Loeber, Burke, Lahey, Winters, & Zera, 2000 for a review). Moreover, research has found exposure to violence and traumatic stress to be well-established risk factors for the development of child CPs (see Margolin & Gordis, 2000; Lynch, 2003 for reviews), and youth with CPs and trauma histories show more severe behavioral difficulties and impairments than youth with CPs but no trauma histories (e.g., Kahn et al., 2013). Indeed, the numbing and emotional avoidance symptoms that commonly accompany child trauma exposure have been shown to increase the risk of delinquent behaviors (e.g., Allwood et al., 2011), perhaps related in part to the impact of trauma and numbing symptoms on appropriate empathy and perspective taking (Locher et al., 2014). Moreover, social learning theory underscores the potential role that modeling may play in linking violence exposure to subsequent aggressive behaviors (Bandura, 1978; Tremblay, 2000).

Despite documented links between violence exposure, traumatic stress, and child CPs, very little research has examined CPs in youth exposed to violent disasters. A small but growing body of research suggests that exposure to disasters may be associated with subsequent child CPs, including aggression and rule-breaking behavior (e.g., Chemtob, Namura, & Abramovitz, 2008; Hoven et al., 2005), although findings have been somewhat mixed. With regard to natural disasters, Khoury and colleagues (1997) observed increased antisocial behavior among middle-school students exposed to Hurricane Andrew, even after controlling for pre-trauma antisocial behavior, family support, and race/ethnicity. In addition, indirect links were found between Hurricane Katrina exposure and increased child aggression (Scott, Lapré, Marsee, & Weems, 2014; Marsee, 2008). However, following Hurricane Andrew, Shaw and colleagues (1995) observed a *decrease* in child disruptive behavior in high-impact

areas, and an *increase* in child disruptive behavior in low-impact areas, which dissipated over time.

Similarly discrepant findings have been reported related to child behavior problems following manmade disasters. For example, Hoven and colleagues (2005) reported the rate of likely conduct disorder to be almost 13% in New York City public schoolchildren 6 months following the September 11th attacks, whereas epidemiologic rates of youth conduct disorder in regions unaffected by terrorism fall typically between 1.5 and 3.9% (Feehan et al., 1993; Costello et al., 2003). Chemtob and colleagues (2008) also reported a trending dose-response increase in aggression after the World Trade Center attacks, such that highly exposed children were over three times more likely to exhibit aggressive behavior than unexposed children. In contrast, Lengua and colleagues (2005) observed a *decrease* in externalizing problems following the World Trade Center attacks among youth distally removed from the events, with problem severity eventually returning to pre-attack levels.

Given that some, but not all, youth appear to be at risk for developing CPs in the aftermath of disasters, and given the individual, family, and societal burdens, as well unfavorable life course, associated with child CPs (e.g., Donenberg & Baker, 1993; Reef et al., 2009; Costello et al., 2003), there is a critical need to clarify which youth may be at greatest risk for developing CPs after disaster exposure. As disasters do not impact all children uniformly (see Furr et al., 2010), broad examinations of main effect relationships between exposure and negative outcomes such as child CPs provide limited information. To date, research has not examined potential moderators that can elucidate the heterogeneity of observed child CPs in the aftermath of such events and inform targeted prevention and intervention efforts.

Research is needed on disaster-exposed youth that examines whether children's prior ambient community violence exposure plays a role in determining which youth are most likely to develop post-exposure CPs. Extensive evidence from youth unexposed to disasters supports a link between exposure to community violence and youth CPs (e.g., Margolin & Gordis, 2000, Lynch, 2003). Community violence exposure is associated with a variety of lasting CP-related outcomes, including violence and aggression, as well as substance abuse and involvement with the juvenile justice system (DuRant et al., 1994; Farrell & Bruce, 1997; Gorman-Smith & Tolan, 1998; McGee & Baker, 2002; Miller, Wasserman, Neugebauer, Gorman-Smith, & Kamboukos, 1999; Schwab-Stone et al., 1995; Vermeiren et al., 2003). Importantly, longitudinal work in community samples suggests that prior exposure to community violence has an effect on children's aggressive behavior through both children's imitation of violence and through the development of associated cognitions (Guerra et al., 2003). Specifically, exposure to community violence directly impacts children's social cognition and normative beliefs about aggression, which in turn have significant effects on aggressive child behaviors (Guerra et al., 2003; Schwartz & Proctor, 2000).

Given well-documented links between CPs and children's exposure to chronic community violence, ambient community violence exposure associated with living in high-crime areas may be a critical moderator of the link between disasters and CPs. That is, youth with greater prior doses of community violence exposure—as a function of residence in high-

crime areas—may be particularly vulnerable to the impacts of disaster exposure on the development of CPs. At the same time, youth with very little prior experience with violent crime may have less prior modeling of CPs to serve as a template of coping during times of stress. In fact, for such youth the violence witnessed or experienced in a terrorist event may be so foreign to one's typical realm of experience that they may even show a reduction in CPs following terrorism exposure (e.g., Lengua et al., 2005), as they resort to more familiar non-externalizing coping repertoires during acute stress.

The Boston Marathon bombing and subsequent manhunt offer a unique opportunity to examine whether prior community violence exposure could help clarify which youth are most likely to show elevated CPs after disaster exposure and which youth are most sensitive to CPs. The Marathon bombing in which 3 were killed and 264 were injured, and the subsequent manhunt events, directly impacted a very large and broad urban and suburban population of families of diverse backgrounds dwelling in neighborhoods ranging from very high to very low violent crime. Comer, Dantowitz and colleagues' (2014) initial examination of Boston-area youth found that, on average, CP scores—among a host of other outcomes—were in the normative range following the bombing. However there was considerable heterogeneity in children's CPs, with many children showing clinically elevated problems in the aftermath of events—particularly those highly exposed to the bombing and manhunt. Such work underscores the critical need to systematically understand CP heterogeneity in this child population exposed to these unique events.

The present study examined whether children's prior exposure to ambient violent crime—as measured by the violent crime rate (VCR) of each child's neighborhood in the year prior to the Marathon bombing—moderated links between exposure to potentially traumatic bombing/manhunt events and child CPs among Boston-area youth in the first 6 months following the Marathon bombing. Given observed relationships between ambient violent crime exposure and child CPs (e.g., Lynch, 2003), we hypothesized that youth dwelling in neighborhoods with high versus low violent crime rates would show more severe CPs after the Boston Marathon bombing and manhunt. Additionally, consistent with previous research (Chemtob, Namura, & Abramovitz, 2008; Comer, Dantowitz et al., 2014; Hoven et al., 2005; Khoury et al., 1997) we hypothesized that youth with greater exposure to the bombing and manhunt events would show more severe CPs after the attack. Further, we hypothesized that the VCRs of children's neighborhoods in the year prior to the events would significantly moderate links between bombing/manhunt exposure and youth CPs, such that the association with bombing/manhunt exposure and child CPs would be significantly greater among children dwelling in neighborhoods with high versus low prior violent crime.

Method

Design and Participants

All study procedures were approved by the appropriate Institutional Review Board. In the first two to six months following the 2013 Boston Marathon bombing, English-speaking, Boston-area caregivers (N=460) of at least one child between the ages of 4 and 19, dwelling within 25 miles of the Marathon bombing site and/or Watertown, MA where the manhunt culminated were recruited to participate in a one-time survey assessing child experiences

during the Marathon and its related events, as well as current psychosocial functioning. Recruitment efforts included school-based, pediatrician-based, and media-based outreach, as well as study staff participation at Marathon-related community events such as prayer vigils and “Boston Strong” rallies. Interested caregivers contacted study staff or visited a study website for further study information. 41.6% of a population of 1,105 caregivers who initially contacted study staff or visited the website to consider participation completed the survey (N=460). After providing informed consent, caregivers completed questionnaires via Qualtrics—a data-encrypted Internet-based survey program requiring server authentication—which took roughly 45 minutes to complete. Caregivers with more than one child within the study age range were asked to provide answers on their oldest children within this age range. Following participation, caregivers were compensated \$30, with the opportunity to directly donate their compensation to the One Fund Boston, a relief organization providing aid to attack victims and their families. Table 1 presents the primary demographic characteristics of study participants. Additional demographic information can be found elsewhere (Comer, Dantowitz et al., 2014).

Measures

Boston Marathon bombing- and manhunt-related exposure—Child exposure to potentially traumatic events during the bombing and manhunt were assessed using a checklist created for the purposes of the study asking respondents whether their child: (a) attended the Marathon, (b) was injured in the attack, (c) directly witnessed injured people at the attack, (d) directly witnessed dead bodies at the attack, (e) was evacuated during the attack, (f) knew a person injured in the bombing, (g) knew a person killed in the bombing, (h) was under the subsequent shelter-in-place warning, (i) saw a heavier police presence in their neighborhood during the manhunt, (j) saw uniformed service persons in their neighborhood not typically seen in civilian areas (e.g., National Guard, Homeland Security), (k) saw officers with guns drawn related to the manhunt, (l) heard manhunt-related gunshots or explosions, (m) saw manhunt-related gunshots or explosions, (n) saw manhunt-related blood, (o) had an officer knock on their door related to the manhunt, (p) had an officer enter/search their home as part of the manhunt, (q) knew the slain M.I.T. officer, and/or (r) knew the transit officer injured in the manhunt shootout. Child experiences a-g were tallied to obtain a cumulative *Bombing Exposure Score* ($\alpha = .80$). Child experiences (h) to (r) were tallied to obtain a cumulative *Manhunt Exposure Score* ($\alpha = .77$).

Child Conduct Problems—Caregivers reported on their children’s CPs via the *Strengths and Difficulties Questionnaire* (SDQ; Goodman, 2001), a widely used brief parent-report measure of children’s psychopathology and prosocial behavior. The SDQ measures children’s emotional symptoms, conduct problems, hyperactivity/inattention, peer problems, and prosocial behavior, and has demonstrated strong internal consistency, convergent validity, and predictive validity (Goodman, 2001). In the current study, CP symptom severity was measured using the 5-item Conduct Problems subscale of the SDQ. Scores on the CP subscale range from 0–10, with higher scores indicating greater CP symptom severity. Scores ≥ 3 are classified as being in the slightly elevated range of CP, and scores ≥ 4 are classified as being in the high substantial risk range of CP. The CP subscale has been shown to be predictive of conduct/oppositional defiant disorders in previous adolescent samples

(He et al., 2013). Internal consistency for the SDQ CP subscale was acceptable in the present sample ($\alpha = .60$).

Neighborhood violent crime rate—The VCR for each child's neighborhood in the year prior to the Marathon bombing was used to estimate children's prior ambient violent crime exposure. Caregiver-reported zip codes were assigned corresponding 2012 VCRs obtained from the Federal Bureau of Investigation's uniform crime reporting statistics database (United States Department of Justice, 2012).

Data Analysis

Hierarchical multiple regression examined whether 2012 VCR moderated significant associations between bombing/manhunt exposure and child CPs. For each model predicting continuous child CP symptom severity, covariates (maternal education level, child age, and race/ethnicity) were entered simultaneously with the main effects of bombing/manhunt exposure and 2012 VCR of the child's neighborhood, as well as the product term of bombing/manhunt exposure and 2012 VCR. Separate models were run to examine the effects associated with bombing exposure and manhunt exposure. In addition, hierarchical regression models were run to examine interactions between 2012 VCR and each of the individual exposure types. Significant moderation is identified when an interaction (product) term of the predictor (exposure) and proposed moderator (prior VCR of child's neighborhood) is significant after accounting for main effect predictive contributions and covariates (Baron & Kenny, 1986; Holmbeck, 1997; Kendall & Comer, 2011). Variables were centered prior to entry in analyses. Finally, all models were re-run using Poisson generalized linear models to confirm that the distribution of CP scores in this community sample did not affect outcomes.

Results

As reported elsewhere (Comer, Dantowitz et al., 2014), the most common four bombing exposure items endorsed were: "Child attended the Marathon" (15.4%), "Child evacuated" (6.1%), "Child knew person injured" (5.7%), and "Child saw injured people" (4.1%). The most common four manhunt exposure items endorsed were: "Child under shelter-in-place warning" (51.7%), "Child saw heavier police presence in neighborhood" (33.0%), "Child saw uniformed service persons not typically found in civilian neighborhoods" (32.2%), and "Child saw officers with guns drawn related to the manhunt" (11.5%) (see Comer, Dantowitz et al., for a complete frequency breakdown of all 18 exposure items).

There was considerable variability across youth with regard to Marathon bombing/manhunt exposure. The average child in the sample experienced at least some exposure to potentially traumatic events ($M = 2.19$, $SD = 2.68$), with 23.2% ($N = 107$) of the sample experiencing at least 1 bombing-related exposure and 67.6% ($N = 311$) experiencing at least 1 manhunt-related exposure. Among youth sampled, the number of Marathon bombing-related exposures ranged from 0 to 7, and manhunt-related exposures ranged from 0 to 10.

There was also considerable heterogeneity across children's neighborhoods with regard to VCRs in the year prior to the Marathon bombing and subsequent manhunt. The average

child in the sample resided in a neighborhood with an estimated 282 violent crimes per 100,000 residents, and a standard deviation of nearly 272 highlights substantial variance in VCRs across children's neighborhoods (Mean VCR = 281.97, $SD = 271.84$). Roughly one-sixth of sampled youth (16.7%) were dwelling in communities with at least 835 violent crimes per 100,000 residents, whereas roughly one-tenth (9.8%) were dwelling in communities with fewer than 44.3 violent crimes per 100,000 residents (Minimum violent crime rate = 6.80, Maximum violent crime rate = 835.00).

Similarly, there was considerable heterogeneity across youth CPs. As previously reported (Comer, Dantowitz et al., 2014), children's CP scores were, on average, in the normative range ($M=1.28$, $SD=1.5$, Range: 0–9), although the present analyses found that 16.1% of youth ($N=74$) scored at least in the slightly elevated range of CP (3 on the SDQ CP subscale) and 8.9% ($N=41$) scored in the high substantial risk range of CP (4 on the SDQ CP subscale). Timing since the bombing did not correlate with CP symptom severity ($r = -.05$, $p=.31$) or PTS symptom severity ($r = .03$, $p=.59$).

Table 2 presents results from hierarchical regression analyses examining the main effects of *bombing* exposure and prior neighborhood violent crime rate on child CPs (and demographic covariates), as well as the potentially moderating effect of prior neighborhood violent crime rate on the relationship between bombing exposure and child CPs. This overall model was significant in the prediction of child CPs, $F(6, 425)=5.17$, $p<.001$; Adjusted $R^2 = .055$. Marathon bombing exposure and prior violent crime exposure each significantly predicted child CPs—explaining roughly 3% and 2% of the remaining variance in child CPs after the attack. In this model, the product term examining the interactive effect between bombing exposure and prior violent crime exposure did not significantly predict child CPs.

Table 2 also presents results from hierarchical regression analyses examining the main effects of *manhunt* exposure and prior neighborhood VCR on child CPs (and demographic covariates), as well as the potentially moderating effect of prior neighborhood VCR on the relationship between manhunt exposure and child CPs. This overall model was again significant in the prediction of child CPs, $F(6, 422)=6.26$, $p<.001$; Adjusted $R^2 = .069$. Manhunt exposure and prior violent crime exposure each significantly predicted child CPs—explaining roughly 2.5% and 1% of the remaining variance in child CPs after the attack. In addition, the product term examining the interactive effect between manhunt exposure and prior violent crime exposure contributed additional, unique predictive value ($t(427)=3.12$, $p=.002$), indicating that the association between manhunt exposure and child CPs was not uniform across varying levels of prior violent crime exposure. Overall, the combined contribution of manhunt exposure, 2012 VCR, and the interaction of the two explained 16.6% of the variance in child CPs after accounting for sociodemographic covariates.

Follow-up analyses examined simple slopes associated with high, medium, and low levels of prior violent crime exposure. High was defined as one standard deviation above the mean VCR, medium was defined as within one standard deviation of the mean VCR, and low was defined as one standard deviation below the mean VCR. Analyses revealed that manhunt exposure was significantly predictive of increased CPs among children living in areas with medium and high prior levels of violent crime ($t(426)=3.70$, $p<.001$ and $t(426)=4.97$, $p<.$

001, respectively). In contrast, manhunt exposure was not predictive of increased CPs among children living in areas with low prior levels of violent crime ($t(426)=0.22, p=.83$). In clinically relevant categorical terms, among youth in high VCR areas, the odds of clinically elevated CP were over two and a half times greater among youth with high manhunt exposure than among youth with low manhunt exposure ($OR=2.55$). In contrast, among youth in low VCR areas, the odds of clinically elevated CP were comparable across youth with high and low manhunt exposure ($OR=0.71$).

In an additional follow-up analysis, we evaluated whether child age moderated the significant interaction between VCR and manhunt exposure in the prediction of CP. The three-way interaction of age, VCR, and manhunt exposure did not add to the prediction of CP [Adj. $R^2=.064$, $R^2=.003$, $F_{Change}(2, 420)=0.65, p=.53$], indicating that the interactive relationship between manhunt exposure and VCR in the prediction of CP was robust across the age span of the study sample.

All models were re-run using Poisson generalized linear models to confirm that the distribution of CP scores in this community sample did not affect outcomes. Interpretations of significance were identical in these models. Specifically, in Poisson generalized models examining *bombing* exposure, the main effects of bombing exposure (Wald test = 17.57, $p<.001$) and prior violent crime exposure (Wald test = 13.02, $p<.001$) each significantly predicted child CPs after the attack, whereas the interactive effect between bombing exposure and prior violent crime exposure did not (Wald test = 0.47, $p=.49$). In Poisson generalized models examining *manhunt* exposure, the main effects of manhunt exposure (Wald test = 11.52, $p<.001$) and prior violent crime exposure (Wald test = 6.13, $p=.01$) each significantly predicted child CPs after the attack—and the interactive effect between manhunt exposure and prior violent crime exposure significantly contributed to the prediction of CPs as well (Wald test = 5.17, $p=.02$). Age did not moderate the interactive effect of manhunt exposure and prior violent crime exposure on CP.

Additional hierarchical regression analyses examined whether prior violent crime exposure moderated links between each individual exposure assessed and child CP. Across the 18 exposures assessed, 2012 VCR significantly moderated the relationships between two individual bombing exposures and CP, as well as the relationships between five individual manhunt exposures and CP (i.e., all p 's $<.05$ for the interaction term of exposure item and VCR, after accounting for main effects and covariates). For each of these seven specific events that showed significant interactions with VCR, children exposed to the event and living in areas with high prior rates of violent crime showed greater CP severity than children exposed to that event and living in low-crime areas. Specifically: (1) among youth who saw someone who had been injured during the attack, those who lived in an area with a high VCR showed significantly greater CP symptom severity than similarly exposed children who lived in an area with lower VCR ($d=0.82$). This pattern was similar for: (2) youth who knew someone killed in the attack ($d=1.38$), (3) youth who saw a heavier police presence in their neighborhood related to the manhunt ($d=0.45$), (4) youth who heard gunshots or explosions related to the manhunt ($d=1.09$), (5) youth who had an officer knock on their door related to the manhunt ($d=1.54$), (6) youth who had an officer enter and search their home ($d=0.99$), and (7) youth who knew the Transit Officer who had been injured in

gunfire exchange related to the manhunt ($d=0.95$). Models examining interactions between VCR and individual bombing and manhunt events were re-run using Poisson generalized linear models and interpretations of significance were again identical.

Discussion

Despite considerable evidence that children's disaster exposure is related to posttraumatic stress and internalizing symptoms (e.g., Comer & Kendall, 2007; La Greca, 2007; Furr et al., 2010), relatively limited research has examined child externalizing problems in the aftermath of disasters. The present study adds to a small but growing literature suggesting a link between disaster exposure and child CPs (e.g., Chemtob et al., 2008; Hoven et al., 2005; Khoury et al., 1997). Specifically, almost 1 in 6 Boston-area children assessed in this convenience sample showed clinically elevated CPs in the aftermath of the Boston Marathon bombing and subsequent manhunt. Although support to date for a link between disaster exposure and child CPs has produced somewhat mixed results (e.g., Hoven et al., 2005; Lengua et al., 2005; Chemtob et al., 2008), the present findings suggest that heterogeneity in CP outcomes among disaster-exposed youth may be due in part to variability in children's prior violent crime exposure, which can moderate the extent to which disasters impact child externalizing problems. Indeed, following violent manmade disasters, knowing the extent to which a child's neighborhood has been previously characterized by violent crime may improve the ability to predict which children are most vulnerable to CPs and inform targeted prevention and intervention efforts.

The present findings are somewhat contrary to those of Lengua and colleagues (2005), who reported transient *decreases* in externalizing behavior in children distally exposed to the 9/11 attacks. Importantly, these decreases occurred following *indirect* exposure to the New York City/Washington DC-based events experienced by child residents of Seattle, Washington. As such the impact of disasters on children's conduct problems may vary as a function of proximal versus media-based exposure (see Comer & Kendall, 2007; Comer, Furr et al., 2008). Other studies (including the current study) that have examined disaster effects on proximally exposed youth have provided more consistent evidence of an impact on child CPs, although Shaw and colleagues (1995) did report decreases in behavior problems following proximal exposure to Hurricane Andrew.

The extent to which prior violent crime exposure may account for discrepancies in the literature is unclear, as previous reports have not examined data on VCRs in the neighborhoods they have studied, nor presented data that could serve as potential rough proxies for violent crime exposure. With respect to natural disaster exposure however, Shaw and colleagues (1995) provided the names of the specific schools they sampled, and it was possible to examine pre-event neighborhood VCRs (United States Department of Justice, 1994). In contrast to the current findings, the pattern of disruptive behavior changes and violent crime rates corresponding to sampled high- and low-impact neighborhoods was reversed, such that the high-impact area showing decreased disruptive behavior had a higher 1994 violent crime rate, and the low-impact area showing increased disruptive behavior had a lower violent crime rate. Such inconsistencies may point to an underlying qualitative difference in disaster type. In contrast to a natural disaster, terrorist attacks such as the

Boston Marathon bombing comprise violent, malicious, and manmade disasters specifically targeting civilians, including families and their children. It is possible that the malevolent nature and intent of non-accidental manmade disasters evoke responses that diverge from reactions to natural disasters, particularly with regard to how prior experiences with violence affect clinical outcomes.

The mechanisms through which the complex relationships between violent community disaster exposure, violent crime rate, and CP unfold require further examination, and trauma-related sensitization and social learning theories offer potential explanations. Prior exposure to trauma or stressors enhances subsequent response to other stressors, sensitizing the individual to future trauma (Resnick et al., 1995; Yehuda, Kahana, Schmeidler et al., 1995). A history of exposure to traumatic events increases the likelihood of negative psychological reactions, acting in a dose-response relationship (see Narayan & Masten, 2012). For example, child maltreatment has been associated with reactive aggression (e.g., Shields & Cicchetti, 1998), a behavior pattern often accompanying child CPs. Further, the negative effect of exposure—including indirect exposure through media coverage—may be greatest for children with pre-existing PTSD symptoms (e.g., Weems, Scott, Banks, & Graham, 2012). Similar principles may underlie child CP development in response to distress. Indeed, Chemtob and colleagues (2008) documented a four-fold increase in the likelihood of aggressive behavior in children with a history of trauma who also experienced high-intensity World Trade Center events.

Specifically regarding the link between ambient violent crime exposure and CP behaviors in response to major violent community events, children residing in areas with high VCRs may model negative coping and externalizing behavior, such as aggression, commonly occurring in their environment. The potential for modeling underscores social learning theories of aggression (Bandura, 1978; Tremblay, 2000). In fact, in families living in high-violence areas, caregiver coping mechanisms contribute to the strategies youth employ to cope with community violence (Kliewer et al., 2006). Children exposed to community violence also show specific social-cognitive biases—including positive evaluations of aggressive behavior—that can mediate links between witnessed violence and aggression (Schwartz & Proctor, 2000). Collectively, these findings suggest that children living in high-crime areas may internalize the potential benefits of aggression as a coping strategy and as a conventionally acceptable form of behavior, and employ these maladaptive strategies in response to traumatic events.

Importantly, on average, child CPs following the Boston Marathon and associated manhunt events were in the normative range. Only 16.6% of the variance in child CP was accounted for by manhunt exposure, VCR, and the interaction of the two—with the interaction between VCR and manhunt exposure contributing a small but significant (roughly 1%) percentage of unique explanatory power. These findings underscore the need for future work to identify other key factors—such as caregiver distress (e.g., Kerns et al., 2014), parental roles in the disasters (e.g., Comer, Kerns et al., 2014), disaster-related life disruptions (e.g., Comer et al., 2010), genetic vulnerabilities, and underlying neural mechanisms—that may interact to inform the expression of CPs in a significant minority of terrorism-exposed children.

Interestingly, prior violent crime exposure moderated the effect of *manhunt* exposure on child CPs, whereas it did not moderate the effect of *bombing* exposure on child CPs. The majority of manhunt exposures assessed may be somewhat similar to typical experiences in high-crime neighborhoods (e.g., seeing heavy police presence, hearing gunshots or explosions, having manhunt officers enter and search one's home, knowing someone injured in a gunfire exchange), whereas the bombing exposures are likely more outside of the realm of typical experiences in such neighborhoods (e.g., witnessing a bombing and bombing-related injuries, evacuating a bombing). The specific pattern of moderation presently found may speak to the importance of similar prior experiences and sensitization effects in determining which types of traumatic community events will be most associated with CPs among which groups of youth.

Several limitations of the present work should be considered. First, future work must incorporate the perspectives of multiple informants, including teachers and youth as well as parents, when assessing CPs. Second, despite the advantages of analyzing documented VCRs as an objective index of violent crime in each child's region, it is possible that self-report and subjective measures assessing individual experiences would have more accurately captured prior ambient violent crime exposure. Different children may be subjected to varying doses of violent crime exposure, despite dwelling in regions with similar violent crime rates. Analyzing regional crime data offers incremental advantages over self-report data by ruling out the potential that children or caregivers with various clinical outcomes simply report or recall greater or lesser exposure to violence, but future work should incorporate subjective/perceived exposure to violent crime into broader latent definitions of children's violent crime exposure. On a related note, zip codes can cover broad regions, and it is possible that FBI data on zip codes do not reflect the specific VCR in a given child's immediate neighborhood. Third, data on child gender were not collected in this de-identified survey, restricting our ability to evaluate the impact of gender in the present sample. As boys are at greater risk of developing CPs than girls (Costello et al., 2003), and elevated CPs are more common among boys than girls in post-disaster samples (Hoven et al., 2005), future work clarifying the role of gender in the relationship between violent community disasters, ambient violent crime exposure, and child CPs is needed.

Fourth, the current study's cross-sectional nature precludes causal conclusions and analyses of change in study variables over time. Importantly, pre-attack levels of CPs were not assessed. Moreover, the SDQ assesses child problems that occurred over the past 6 months, and some participants may have been reporting on problems that existed prior to the Marathon events. Fifth, although the SDQ CP scale has demonstrated strong convergent validity in previous research, the internal consistency of the subscale has ranged from weak to strong across previous studies (i.e., .46–.76; see Stone et al., 2010), and was .60 in the present sample. Future work should incorporate additional measures beyond the established SDQ to evaluate CP. Sixth, we did not employ population-based sampling methods, and thus findings may not reflect the general population of the Boston area. As such, findings from the present convenience sample should not be interpreted as reflecting actual rates of CP in Boston-area youth following the Marathon bombing. The present sample was composed of predominantly educated, non-Hispanic Caucasians, of which 50% reported a household income of \$100,000 or greater (although there was considerable economic heterogeneity

among individuals reporting <\$100,000 with many reporting household incomes below the poverty line). Demographics of the sample, however, are largely representative of the population most directly affected by the 2013 Boston Marathon events. Specifically, 89.4% of residents of Watertown (where the greatest manhunt activities occurred), and 74.5% of residents of Back Bay (where the bombing occurred), are Caucasian, and roughly half of families in these two areas report an annual income of over \$100,000 (US Census Bureau, 2010a; 2010b). Finally, the participation rate was somewhat low (42%), although this participation rate may reflect unique challenges of studying post-disaster communities and is consistent with participation rates in related research (e.g., La Greca et al., 2010; McLaughlin et al., 2009).

Despite these limitations, the present study offers compelling evidence underscoring the need for further study of potential moderators that may improve targeted post-disaster intervention efforts addressing child CPs, particularly among youth dwelling in neighborhood characterized by high violent crime. The small body of evidence-based post-disaster child intervention options (see La Greca & Silverman, 2012) has focused predominantly on traumatic stress reactions and related internalizing problems and has largely neglected child externalizing problems. Given that the interaction effect found between VCR and exposure to the Marathon bombing manhunt events was significant but small in magnitude, future work should identify contextual factors, genetic vulnerabilities, and underlying neural mechanisms that may interact to help identify youth at greatest risk for CPs following terrorism exposure.

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Table 1

Demographic characteristics of Boston-area youth sampled in the 6 months following the 2013 Marathon bombing (N=460)

	N	%	M	SD
Child age, years			11.8	3.8
Race/ethnicity				
Non-Hispanic White	374	81.1		
Minority	86	18.7		
Participating caregiver				
Biological mother	351	76.4		
Biological father	78	16.9		
Adoptive mother	18	3.9		
Relative/guardian	7	1.5		
Adoptive father	4	0.9		
Foster mother	2	0.4		
Household income, USD				
< 50,000	71	15.4		
50,000–74,999	45	9.8		
75,000–99,999	99	21.5		
100,000–199,999	184	40.0		
200,000	61	13.3		
Mother Education				
College Completed	374	81.3		
No College Completed	86	18.7		

Table 2

Results of hierarchical regression examining whether prior violent crime exposure moderates link between Marathon bombing/manhunt exposure and child conduct problems.

Predictor	<i>B</i>	<i>SE_b</i>	β	<i>p</i> -value
Bombing Exposure				
Race/Ethnicity	0.155	0.182	.041	.395
Maternal education	0.149	0.145	.048	.307
Age	0.002	0.019	.005	.920
VCR	0.001	0.0003	.135	.006
Bombing exposure	0.227	0.067	.179	.001
VCR $\times$ Bombing exposure	0.00006	0.0002	.016	.759
Manhunt Exposure				
Race/Ethnicity	0.135	0.180	.036	.454
Maternal education	0.094	0.144	.031	.515
Age	−0.004	0.019	−.009	.847
VCR	0.001	0.0003	.102	.038
Manhunt exposure	0.117	0.037	.155	.002
VCR $\times$ Manhunt exposure	0.0004	0.0001	.150	.002

Note: *b*=unstandardized regression coefficient; *SE_b*=standard error of the regression coefficient; β =standardized regression coefficient; VCR=violent crime rate of child's zip code in year prior to bombing.