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Prior Interpersonal Violence Exposure and Experiences During and After a Disaster as Predictors of Posttraumatic Stress Disorder and Depression Among Adolescent Victims of the Spring 2011 Tornadoes

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Abstract

The purpose of the current report was to examine prior history of exposure to interpersonal violence (IPV), as compared with prior accident or prior disaster exposure, experiences during and after a disaster, and demographic variables as predictors of past month posttraumatic stress disorder (PTSD) and depression severity among adolescents exposed to the tornadoes in Alabama and Missouri. IPV exposure has been consistently identified as a unique category of potentially traumatic events (PTE) that significantly increases risk for development of PTSD and other difficulties relative to other event types among adolescents. A population-based sample of adolescents and caregivers ($N = 2,000$) were recruited randomly from tornado-affected communities in Alabama and Joplin, Missouri. Participants completed structured telephone interviews on an average of 8.8 months posttornado. Prior history of IPV was prevalent (36.5%), as was reported history of accidents (25.9%) and prior disaster exposure (26.9%). Negative binomial regression analyses with PTSD and depression symptom counts for past month as outcome variables indicated that history of predisaster IPV was most robustly related to PTSD and depression symptoms, such that those with a history of IPV endorsed over 3 times the number of symptoms than those without IPV history. Final model statistics indicated that female gender, physical injury to caregiver, concern about others' safety, prior disaster, prior accident, and prior IPV exposure were also related to PTSD. Predictors of depression symptoms were similar with the exception that concern about others' safety was not a predictor and age was a predictor in the final model. It is important to evaluate potential additive effects of IPV history in addition to recent disaster exposure variables and to consider such history when developing interventions aimed to

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reduce or prevent symptoms of PTSD and depression among adolescents recently exposed to disaster.

Keywords

disaster exposure; interpersonal violence; adolescents; mental health

It is important to understand the prevalence and predictive factors related to postdisaster mental health problems among adolescents to deliver optimal secondary or tertiary intervention strategies if indicated. As reviewed by Norris et al. (2002), the most frequently studied mental health correlates of all types of disaster include posttraumatic stress disorder (PTSD) and depression. In addition, Norris and colleagues (2002) noted that samples comprising children or adolescents may include greater proportions exhibiting higher levels of distress relative to adult samples. Identified risk factors for mental health problems across extant studies have included severity of exposure to disaster, community disruption, and ensuing stressors as well as individual characteristics such as demographics, prior difficulties in functioning, and poorer social resources (Norris et al., 2002). As reviewed by Pfefferbaum, Noffsinger, Wind, and Allen (2014), there appears to be disagreement across the literature in terms of the severity of impact of disaster on children's functioning, and PTSD, with some studies indicating lack of diagnostic-level problems. Pfefferbaum and colleagues identified disaster exposure, child characteristics including developmental factors, as well as family and social factors as important to examine in terms of child functioning postdisaster. Furr, Comer, Edmunds, and Kendall (2010) conducted a meta-analysis of 96 studies of PTSD related to either natural or man-made disasters that included children or adolescents and evaluated predictors that included demographics, disaster type and exposure variables, and methodological factors. Small to medium effects of experiences during and after a disaster on PTSD symptoms or diagnosis were observed. Results indicated that female gender and several disaster exposure variables (death toll, proximity, death-related loss, perceived life threat, and acute distress) were significant positive predictors of PTSD. In addition, studies that included robust measures and that were conducted within 1 year postdisaster were more likely to observe effects. Furr and colleagues suggested that additional factors including prior functioning and prior traumatic event exposure remain under explored.

The goal of this study was to examine the relative roles of demographics, disaster exposure, and specific prior classes of traumatic events (disaster, accident, and interpersonal violence [IPV]) as predictors of current symptoms of PTSD and depression postdisaster among a large sample of adolescents who were exposed to severe tornadoes that struck Alabama and Joplin, Missouri, on an average of 8.8 months prior to assessment.

The spring 2011 tornadoes in the United States were historic in terms of levels of tornadic activity, property damage, and associated death toll, resulting in at least 552 fatalities (National Oceanic and Atmospheric Administration, [NOAA], 2011a, 2011b). The single deadliest tornado since 1950 affected Joplin, Missouri, in May 2011, with 158 associated deaths, whereas the tornadoes affecting Alabama and other Southeastern states in

April 2011 are ranked among the deadliest on record (NOAA, 2011). Consistent with meta-analytic and previous review findings (Furr et al., 2010; Norris, Friedman, & Watson, 2002), tornadoes and hurricanes generally, and the 2011 tornadoes specifically, have been associated with significant prevalence of PTSD and depression. For example, among adolescents exposed to severe tornadoes in rural Minnesota, Polusny and colleagues (2011) found that 22% reported fear of being killed in the storm and 13% had scores indicative of PTSD on a standardized measure. Furthermore, PTSD symptom severity was significantly positively correlated with perceived life threat. Lower 6-month PTSD prevalence (3% of boys and 9% of girls) was reported by Garrison and colleagues following hurricane Andrew (Garrison et al., 1995). Predictors of PTSD in multivariate analyses included older age and a greater number of undesirable life events posthurricane. Similar findings have been reported for younger children affected by tornado (Evans & Oehler-Stinnett, 2006), and hurricane events (La Greca, Silverman, Lai, & Jaccard, 2010; Lai, La Greca, Auslander, & Short, 2013; Vernberg, La Greca, Silverman, & Prinstein, 1996) in terms of disaster exposure variables positively predicting PTSD and/or depression symptoms. Additional predictors of PTSD included gender and social support (Vernberg et al., 1996), parent functioning (Polusny et al., 2011), ongoing loss or disruption, and number of other life events since disaster (La Greca et al., 2010), while comorbid PTSD and depression among children were predicted by greater hurricane exposure and more stressors postdisaster (Lai et al., 2013).

As noted in the report of the meta-analysis of disaster-related findings among children and adolescents conducted by Furr and colleagues (2010), the role of “other” traumatic events has been understudied. It is important to examine the potential role of IPV events in particular apart from prior disaster, accidents, or other traumatic events, given that IPV events have consistently been found to increase risk of PTSD and other difficulties relative to other types of events including disaster specifically (Breslau et al., 1998; Briere & Elliott, 2000; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Kilpatrick et al., 2013; Norris, 1992; Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993). This pattern has also been consistently observed among samples of adolescents that included assessment of a wide range of traumatic events. A recent meta-analysis examining studies of children and adolescents (Alisic et al., 2014) that included data based on 43 samples and used structured diagnostic interview assessment of PTSD indicated that children or adolescents exposed to interpersonal trauma, defined as events including violence, war, or terrorism, were significantly more likely to meet criteria for PTSD relative to those exposed to non-IPV. The authors concluded that the pattern of findings among children was similar to findings in the adult literature related to violence exposure and increased risk of PTSD. Similarly, findings from Cisler and colleagues (2012) indicated that cumulative exposure to IPV events (including direct physical or sexual assault, witnessed family, and witnessed community violence) reported as occurring prior to first assessment was significantly associated with PTSD symptoms, delinquent behaviors, and binge drinking in a large telephone household sample of adolescents assessed longitudinally over the course of 2 years. In contrast, non-IPV event exposure (disaster, accident, or other events) was only weakly related to subsequent PTSD symptoms and not to other outcomes assessed. Data from studies finding a unique role of IPV in the onset or course/prevalence of PTSD also emphasize the importance

of cumulative or prior history of events that may increase risk of PTSD or other difficulties following a new event (e.g., Copeland, Keeler, Angold, & Costello, 2007).

Previously, our research group (i.e., Adams et al., 2015) reported on prevalence and predictors of meeting diagnostic-level PTSD and depression occurring at any point since the disaster among a sample of 2,000 adolescents who were from the Alabama or Joplin, Missouri, communities affected by the 2011 tornadoes and who were assessed on average 8.8 months postincident. Prior nondisaster traumatic event exposure was assessed using an index that combined accident and IPV exposure rather than evaluating the unique role of IPV. The current report addressed the following questions with regard to IPV exposure and its association with PTSD and depression symptoms: (a) what is the prevalence of exposure to IPV among adolescents; (b) what is the association between IPV specifically, relative to prior disaster and prior accident exposure and outcomes of current PTSD and depression symptom severity after controlling for experiences during and after a disaster as well as demographic characteristics; (c) are specific experiences during and after a disaster and demographic factors predictive of PTSD and depression after controlling for IPV specifically; (d) what is the relative magnitude of IPV as a predictor of symptom severity relative to other predictors; and (e) what is the prevalence of past month PTSD and major depressive episode (MDE) diagnoses.

Method

Procedure

Study design and procedures are provided in detail in Ruggiero et al. (2015) and Adams et al. (2015). Two thousand families with adolescents (12- to 17-year-olds) were recruited from areas affected by the tornadoes in Alabama on April 25 to 28 and Joplin, Missouri, on May 22, 2011. Tornado track latitude/longitude coordinates obtained from NOAA tornado track incident reports (NOAA, 2011) were used to obtain mailing addresses for households within a 5-mile radius of impact areas. Eligibility criteria included (a) family residing at their address at time of tornado, (b) an adolescent aged 12 to 17 years and legal guardian, and (c) reliable home Internet access. Reliable Internet access was required because in addition to telephone interview, data were collected for a randomized controlled trial evaluating a web-based intervention for disaster-related mental health problem (Ruggiero et al., 2015). Addresses matched to a published phone number were contacted and screened by telephone. Addresses unmatched to a phone number were sent a letter about the study and a screening questionnaire to assess inclusion criteria and obtain telephone contacts. Adolescent-parent dyads independently completed structured standardized computer-assisted telephone interviews in a single session by trained professional interviewers. The baseline telephone interview was conducted between September 2011 and June 2012, on average 8.7 months after tornado exposure (standard deviation [*SD*] = 2.6; range = 4–13.5). Interviews averaged approximately 25 min. The overall cooperation rate (i.e., number screened/number screened + screen-outs + unknown eligibility) was 61%. Informed consent was obtained from participating parents and adolescents. Households that completed the baseline interview were mailed a US\$15 incentive. The study was approved by a university Institutional Review Board.

Participants

The sample included 2,000 adolescents (mean age = 14.54 years, $SD = 1.73$) with approximately equal gender distribution (boys: $n = 981$, 49.0%; girls: $n = 1,019$, 51.0%). Race was 62.5% ($n = 1,250$) White, 22.6% ($n = 451$) Black, and 6.5% ($n = 129$) Hispanic/other race or ethnicity. A total of 8.5% ($n = 169$) declined to specify race/ethnicity. Categories included in the analyses were Black non-Hispanic (1 = *yes*, 0 = *no*), and Hispanic or Other (1 = *yes*, 0 = *no*), with White race serving as the reference category. One-fifth (21.8%; $n = 436$) reported a household annual income of less than US\$20,000, while 69.1% ($n = 1,383$) reported income US\$20,000 or above and 9.10% ($n = 182$) did not provide information about household income. Income was dichotomized as in the Adams and colleagues (2015) report to approximate being below or above poverty-level income for a family of four in 2011. Data were weighted to enhance the generalizability of the sample to the larger population of the communities from which they were recruited.

Measures

Experiences during and after a disaster—Caregivers were asked several questions about the family's experiences during and after the tornado, including whether they sustained any physical injuries or were concerned about the safety or whereabouts of loved ones. Caregivers were also asked whether they were without basic services (i.e., water, electricity, clean clothing, food, shelter, transportation, and spending money) for a period of greater than 1 week. A loss of services scale representing a count of how many basic services were lost was used as a predictor in analyses (Cronbach's $\alpha = .67$). Inclusion of these tornado experience variables was based on identification of key disaster and immediate postdisaster risk factors based on previous literature as well as prior findings by Adams et al. (2014) regarding factors that were predictive of ever developing PTSD or depression since the tornadoes.

Prior exposure to natural disasters—Adolescents were asked whether they had ever experienced another natural disaster prior to the most recent tornado, including a hurricane, flood, mudslide, or earthquake, or another tornado. Responses were dichotomized (1 = *yes*, 0 = *no*).

Prior exposure to accidents—Adolescents were asked whether they had ever been in a serious accident, such as a house fire, a car accident or other serious accident at home, school, or in your community. Responses were dichotomized (1 = *yes*, 0 = *no*).

Prior exposure to IPV—Three questions asked about IPV exposure (i.e., "Have you ever been beaten up, hit, punched, shot at, or threatened to be hurt badly?" "Have you ever seen a family member being hit, punched, or kicked very hard at home, not including ordinary fights between brothers and sisters?" and "Have you ever seen someone in your town being beaten up, shot at, or killed?"). Responses were dichotomized (1 = *yes*, 0 = *no*) such that participants who experienced any history of IPV (i.e., responded yes to history of physical/aggravated assault, witnessed family, or witnessed community IPV described above) were coded as 1. Those who responded no to all IPV items were coded 0.

PTSD—Adolescent PTSD was assessed using the PTSD module from the National Survey of Adolescents (NSA) and other large-scale epidemiologic surveys developed by our team with demonstrated support for reliability and concurrent validity (Kilpatrick et al., 2003; Resnick et al., 1993). This structured interview assessed for the presence of each of the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association [APA], 2000) symptom criteria for PTSD during any of three time periods: lifetime, since the tornado, or during the past 4 weeks. In recognition of the potential complexity of traumatic event histories, the interview asks about symptoms occurring for a period of 2 weeks or more, without restricting report to a specific traumatic event (e.g., “Next, I will ask you about moods and feelings that people sometimes experience. Has there ever been a period of 2 weeks or more during which you deliberately tried very hard not to think about, have feelings about, or talk about something bad that had happened to you?”). In this way, participants who may have experienced multiple traumatic events may report symptoms that relate to experiences during and after the disaster or a prior traumatic event. Participants who reported yes to symptom questions were asked to report the most recent occurrence including within the past 4 weeks, since the tornado but longer than 4 weeks ago, or before the tornado.

A total score was derived from this interview as an index of PTSD symptom experience during the past 4 weeks for use in analyses (Cronbach’s $\alpha = .82$). Past month PTSD diagnosis was computed based on meeting *DSM-IV-TR* symptom criteria (APA, 2000) within the 4 weeks prior to assessment and report of functional impairment (i.e., saying yes to a question asking whether these symptoms had caused problems with school, relationships, or ability to live a normal life or report that the experience of the symptoms had been very or moderately distressing).

MDE—Adolescent MDE was assessed using the NSA Depression module. This structured diagnostic interview assessed for the presence of each of the *DSM-IV-TR* symptom criteria for an MDE during any of three time periods: lifetime, since the tornado, or during the past 4 weeks. As with PTSD, a total score was derived from this interview as an index of participants’ MDE symptom experience during the past 4 weeks for use in analyses. Psychometric data support internal consistency (Kilpatrick et al., 2003) and convergent validity (Adams, Boscarino, & Galea, 2006). Cronbach’s alpha for the nine-item depression scale within this sample was .73. Those who reported lifetime occurrence of each symptom were asked to indicate whether the symptom occurred most recently in the past 4 weeks, since the tornado but longer than 4 weeks ago, or before the tornado. Past month MDE diagnosis was computed based on meeting *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association, 1994) symptom criteria within the 4 weeks prior to assessment and also required report of ever having had impairment due to symptoms in school, relationships, or normal life or report that symptoms had been very or moderately distressing.

Statistical Procedure

We used SPSS (Version 22) for all analyses. Missing data across variables ranged from 0% to 9.30% and were handled using pairwise deletion. Because both the outcome variables of

interest (i.e., PTSD and major depressive disorder [MDD] symptoms) were count variables, we used two negative binomial regressions to investigate the relationship between predictor variables of interest and these outcomes. We used multiple regression in both cases, entering our predictor variables (i.e., demographics, experiences during and after a disaster, past disaster or accident exposure, and past IPV exposure) in a single step. We also ran several chi-square analyses to investigate group-level differences in symptoms among those with and without IPV history, which were also conducted in SPSS.

Results

Sample Characteristics

Descriptive statistics on study variables can be found in Table 1. Over one fourth of adolescents reported lifetime exposure to a prior natural disaster (Table 1). A similar percentage reported prior exposure to accidents, while over one-third reported history of exposure of any type of IPV. As previously reported (Adams et al., 2015), the majority (90.6%) of participants were present in the affected area when the tornadoes struck. As can be seen in Table 1, on average, participants reported some loss of services for 1 week or longer. Physical injury was uncommon (2.7%). Almost 75% of caregivers experienced concern about the safety or location of their loved ones as a result of the tornadoes. Average past month symptom counts for PTSD and MDE were relatively low, as was prevalence of past month PTSD and depression diagnosis (2.4% and 2.8%, respectively).

Predictors of Posttornado PTSD and MDE

Results of negative binomial regression analyses to examine risk and protective factors for posttornado PTSD and MDE are summarized in Tables 2 and 3. The coefficients in negative binomial regression are in log scale, which can be translated into incidence rate ratios (IRRs) by exponentiating e by the coefficient to more easily interpret magnitude of effect, which are also provided in Tables 2 and 3. As shown in these tables, several variables emerged as related to both PTSD and MDE symptoms. The only demographic variable that emerged as significantly related to both symptoms was gender. Specifically, gender was negatively associated with both PTSD and MDD, such that males had roughly half the number of PTSD and MDD symptoms than did females. Age also emerged as significantly positively related to MDD symptoms only, though this effect was small (IRR 1.07, 95% confidence interval [CI] = [1.01, 1.12]).

In terms of experiences during and after a disaster, sustaining physical injury during the tornadoes was significantly positively related to both PTSD and MDD symptoms, such that individuals who experienced physical injury during the tornadoes had nearly double the number of PTSD and MDD symptoms endorsed compared with those who did not experience physical injury. Concern about others during the tornadoes also emerged as significantly positively related to PTSD symptoms only (IRR = 1.40, 95% CI = [1.14, 1.72]). Finally, all three types of prior trauma were significantly associated with PTSD and MDD symptoms, such that prior experience of any of these events predicted higher symptoms counts. Notably, people with a history of IPV exposure had over 3 times as many PTSD and MDD symptoms as those without an IPV history, which represents the highest IRR observed

compared with both prior disaster and accident exposure, and the highest IRR observed among all predictor variables in our models generally.

Descriptive Data Regarding Diagnostic Prevalence Associated With Prior History of IPV

Prevalence of past month PTSD was significantly higher among those reporting history of IPV (5.50% vs. 0.60%), $\chi^2(1, N = 1,926) = 47.14, p < .001$, as was prevalence of past month depression (6.30% vs. 0.60%), $\chi^2(1, N = 1,978) = 56.32, p < .001$. The prevalence of IPV history among those meeting PTSD criteria and MDE criteria was 84.8% and 85.2%, respectively. Prevalence of IPV among those not meeting criteria for PTSD was 35.4% and among those not meeting MDE criteria was 35.3%.

Discussion

The primary goals of this report were (a) to provide more information about prevalence of exposure to IPV among a large sample of adolescents who were exposed to severe tornadoes in the Midwestern and Southeastern United States in the 9 months prior to assessment; (b) to evaluate the role of IPV specifically, apart from prior history of accident events and other disaster events as a predictor of the presence of PTSD and depression symptoms in the past month after a tornado, and to observe differences in the pattern of findings compared with previous report (Adams et al., 2015) for other predictors when separately considering IPV; (c) to evaluate the role of index tornado experiences and demographics as predictors of postdisaster functioning after controlling for IPV history.

Prevalence of past month PTSD and MDE were relatively low (2.4% and 2.8%, respectively), as were corresponding symptom counts, with an average of 1.22 symptoms for PTSD and 0.71 for depression. These findings are somewhat consistent with those reported by Garrison and colleagues (1995) in the aftermath of Hurricane Andrew, with 3% of boys and 9% of girls meeting past 6-month PTSD criteria. The discrepancy in prevalence rates may be due to time frame used to define current PTSD prevalence, for example, Garrison and colleagues used a longer time frame than the current study. Results indicated that prior IPV history was prevalent with 36.7% overall reporting one or more direct physical assault or witnessed family or community violence incidents. Findings of regression analyses indicated that prior exposure to IPV was the most robustly related to postdisaster PTSD, with people endorsing an IPV history endorsing over 3 times the number of PTSD and MDD symptoms than individuals without an IPV history. Both prior disaster and prior accident exposure were also positively associated with PTSD and MDD symptoms but to a lesser degree. Thus, previous analyses that included a cumulative index of accidents or IPV incidents and indicated a much smaller association between prior nondisaster events and PTSD (Adams et al., 2015) appeared to underestimate the potential role of IPV history specifically.

The finding that IPV was more robustly related than other prior traumatic events is consistent with results of meta-analytic, cross-sectional, and longitudinal studies (Alisic et al., 2014; Breslau et al., 1998; Briere & Elliott, 2000; Cisler et al., 2012; Copeland et al., 2007; Kessler et al., 1995; Kilpatrick et al., 2013; Norris, 1992; Resnick et al., 1993). The current study demonstrates the greater predictive utility of IPV in the context of recent

tornado experiences. An important finding of the current study is that experiences during and after a disaster were predictive of current PTSD symptom counts even after controlling for IPV and other traumatic event history. Specifically, concern for others was significantly associated with past month PTSD symptom count, and injury to a family member was associated with both PTSD and depressive symptom counts, whereas loss of services did not emerge as significantly related to either PTSD or MDD symptoms. Results indicating female gender as conferring risk for higher PTSD and depression symptoms after controlling for experiences during and after the disaster and prior traumatic event exposure are consistent with findings indicating greater risk of PTSD among women controlling for traumatic event exposure (Tolin & Foa, 2006). Furthermore, this finding is consistent with previous literature suggesting that girls and women experience more mental health symptoms following exposure to a disaster compared with men (Adams & Boscarino, 2006; Adams et al., 2015; Aksaray, Kortan, Erkaya, Yenilmez, & Kaptano lu, 2006). Although this finding is consistent with previous literature, future work should examine why disaster leads to more PTSD and MDE symptoms among girls compared with boys to prevent or reduce mental health symptoms among this population.

Generally, findings are consistent with resilience among adolescents following tornado exposure. However, it is striking that similar predictors of diagnostic levels of PTSD and depression that developed at any point posttornado exposure (Adams et al., 2015) were still predictors of current measures of symptom counts almost 9 months postevent. It was clear that both prior history of IPV exposure and tornado-related experiences were predictive of current distress. Recent disaster experiences and prior IPV or other trauma exposure could be sole causal factors for some adolescents exposed to both, and in other cases, effects might be additive or interactive. With regard to prior IPV, it is possible that PTSD symptoms predated the tornado, developed only after the tornadoes or were consistent with relapse of symptoms that had not been active acutely predisaster. Tornado experience factors might then lead to new development or reactivation of symptoms among those with noncurrent PTSD at the time of disaster or worsening of symptoms among those with active preexisting PTSD due to IPV or other prior event exposure. Among those with histories of IPV and/or other traumatic events who also experienced tornado-related factors that included injury and/or concerns for the safety of others, it is possible that symptoms might be attributable to multiple events. Kilpatrick and colleagues (2013), for example, described the concept of “composite PTSD” in which individuals exposed to complex histories of potentially traumatic events may have symptoms in reference to more than one such event.

Prevalence of PTSD and depression was more than doubled among those with prior history of IPV (5.50% and 6.30%, respectively), as compared with base rates of 2.40% and 2.80%. Conversely, history of IPV was reported by the majority of those who met past month symptom criteria. Thus, while experiences during and after the disaster were significant long-term predictors of mental health functioning postdisaster, IPV exposure appeared to be a very salient and prevalent predictor relative to some powerful but relatively lower frequency disaster characteristics such as injury to a caregiver. The inclusion of IPV history within the current study contributes to the literature on disaster exposure and risk factors for mental health outcomes among youth and indicates the importance of considering this specific history when conducting assessment of disaster mental health effects and potentially

when developing interventions targeting postdisaster distress. With regard to interventions it is important to recognize that postdisaster mental health difficulties may relate to both disaster exposure and prior traumatic event history and IPV history in particular.

Furthermore, there were no racial/ethnic differences in PTSD and MDE symptoms after controlling for other predictors in the current study. This finding does not mean that race is not a potentially important factor and in fact, race/ethnicity may relate to other predictors such as injury, loss of services, or resources postdisaster or posttrauma that may mediate effects of race/ethnicity (Kilpatrick, Badour, & Resnick, 2017). It is also possible that no differences emerged due to the study only comparing Black non-Hispanic and Hispanic or Other adolescents with adolescents who identify as White and to a lack of assessment of any racial/ethnic-specific variables including minority stress and acculturation. Therefore, future work should include an examination of minority stress and acculturation to determine whether these racial/ethnic-specific variables are unique predictors of postdisaster mental health symptoms. It would also be helpful to study larger samples with greater diversity in terms of race/ethnicity.

Limitations of the study include the use of only physical assault or witnessed physical assault in the measurement of IPV exposure. For example, sexual assault is a Criterion A event that can significantly increase PTSD and other difficulties (e.g., Kessler et al., 1995; Kilpatrick et al., 2013). Similarly, violent or accidental death of a loved one is a risk factor for disaster-related PTSD (Furr et al., 2010) and may also have occurred in other nondisaster contexts within a child's life, for example, as a result of criminal or vehicular homicide or suicide (APA, 2000; Kilpatrick et al., 2013). However, the use of three behaviorally specific questions to assess direct physical assault, witnessed family, and witnessed community violence within a study of relatively recent disaster survivors exposed to a severe disaster provides a valuable addition to the literature. Thus, this report contributes uniquely to the literature on the effects of disaster among adolescents and indicates that it is important to evaluate and understand the potential role of IPV specifically as it relates to postdisaster mental health outcomes and to evaluate disaster exposure factors controlling for such history. Future research should include more comprehensive assessment of other Criterion A stressor events that may increase risk of PTSD. Finally, although the temporal order of the disaster experience and the timing of the mental health symptom questions suggest that PTSD and MDE occur after the disaster, it is possible that PTSD and MDE predated the disaster. It is possible that prior PTSD and MDE may be associated with current PTSD and MDE irrespective of the disaster. Therefore, future work should control for PTSD and MDE symptoms before disaster exposure if possible.

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Biographies

Heidi Resnick, PhD, is a professor at the National Crime Victims Research and Treatment Center within the Department of Psychiatry at the Medical University of South Carolina. Dr. Resnick has led or served as a co-investigator on federally funded research investigating prevalence and risk factors for PTSD and other adaptations following exposure to traumatic events, with an emphasis on sexual assault. She and colleagues have conducted research to develop and evaluate secondary prevention approaches that might reduce PTSD or other difficulties following exposure to traumatic events.

Kelly L. Zuromski, MS, is a graduate student at Auburn University currently, completing her predoctoral internship in clinical psychology at the Charleston Consortium Psychology Internship Training program at the Medical University of South Carolina. Her research is broadly focused on suicide prevention, with a focus on risk factors (e.g., trauma/PTSD, sleep disturbances) and theoretical mechanisms underlying suicide risk.

Sandro Galea, MD, PhD, is a physician and an epidemiologist. He is the Robert A. Knox professor and dean at the Boston University School of Public Health. He has long had a particular interest in the consequences of mass trauma and conflict worldwide, including as a result of the September 11 attacks, Hurricane Katrina, conflicts in sub-Saharan Africa, and the American wars in Iraq and Afghanistan. This work has been principally funded by the National Institutes of Health, Centers for Disease Control and Prevention, and several foundations.

Matthew Price, PhD, is an assistant professor and director of the Center for Research on Emotion Stress and Technology at the University of Vermont. His research focuses on developing innovative methods for delivering mental health treatment to victims of stressful and traumatic events.

Amanda K. Gilmore, PhD, is an assistant professor at the National Crime Victims Research and Treatment Center within the Department of Psychiatry at the Medical University of South Carolina. Dr. Gilmore has led or served as a co-investigator on federally funded research investigating the role of alcohol use in sexual assault and sexual behaviors, examining the efficacy of prevention programs targeting alcohol use and sexual assault risk, and assessing the efficacy of treatment for co-occurring substance use and PTSD. Dr. Gilmore is also the director of several grant-funded clinics providing mental health treatment to individuals who have experienced sexual assault or who engage in suicidal and non-suicidal self-injurious behavior.

Dean G. Kilpatrick, PhD, is a Distinguished University professor of Clinical Psychology and Director of the National Crime Victims Research and Treatment Center at the Medical University of South Carolina in Charleston, SC. His primary research interests include measuring the prevalence of rape, other violent crimes, and other types of potentially traumatic events as well as assessing the mental health impact of such events. Dr. Kilpatrick and his colleagues at the NCVC have conducted several extramurally funded studies investigating these topics using national household probability samples of adults and adolescents.

Kenneth Ruggiero, PhD, is a clinical psychologist, professor with the College of Nursing, and co-director of the Technology Applications Center for Healthful Lifestyles (TACHL), as well as director of the Telehealth Resilience and Recovery Program at the Medical University of South Carolina. His research centers on the development and evaluation of technology-based interventions, including brief self-help interventions designed for disaster victims and OEF/OIF Veterans. This work evolved into the use and evaluation of wholly technology based stepped care approaches for victims of disaster and serious injury. Dr. Ruggiero has conducted this research with funding from NIH and other federal agencies.

Table 1

Prior Exposure to Potentially Traumatic Events and Index Tornado Exposure Variables.

Variable	<i>n</i>	Validity %	<i>M (SD)</i>	Range
Prior disaster exposure	1,985	26.90		
Prior accident exposure	1,988	25.90		
Prior IPV exposure	1,985	36.70		
Physical injury	1,999	2.70		
Concerned about safety of loved ones	1,999	74.80		
Loss of services	1,888		0.56 (1.10)	0–7
PTSD total score	1,999		1.22 (2.20)	0–17
Depression total score	1,998		0.71 (1.35)	0–9
PTSD diagnosis	1,939	2.40		
MDE diagnosis	1,994	2.80		

Note. IPV = interpersonal violence; PTSD = posttraumatic stress disorder; MDE = major depressive episode.

Table 2

Negative Binomial Regression Results With PTSD Symptoms as Outcome Variable.

Predictor	<i>B</i>	<i>SE</i>	IRR (95% CI)	<i>p</i>
Gender	−0.57	0.09	0.57 [0.48, .68]	<.001
Race	0.06	0.11	1.06 [0.86, 1.30]	.60
Other race	0.27	0.17	1.30 [0.94, 1.81]	.11
Household income	0.08	0.11	1.08 [0.87, 1.34]	.49
Age	0.03	0.02	1.03 [0.98, 1.08]	.24
Physical injury	0.67	0.25	1.96 [1.20, 3.21]	<.01
Concerned about others	0.34	0.10	1.40 [1.14, 1.72]	<.01
Loss of services	−0.03	0.04	0.98 [0.90, 1.06]	.56
Past disaster	0.27	0.09	1.31 [1.09, 1.58]	<.01
Past accident	0.46	0.10	1.58 [1.31, 1.92]	<.001
Past IPV exposure	1.20	0.09	3.33 [2.79, 3.98]	<.001

Note. Bold *p* values indicate statistical significance. Gender coded male = 1, female = 0; race coded African American = 1, White = 0; other race coded endorsement of other races besides White and African American = 1, White = 0; household income coded >US\$20,000 annually = 1, <US\$20,000 = 0; Physical injury coded present = 1, not present = 0; concerned about others coded present = 1, not present = 0; past disaster, accident, and IPV exposure coded present = 1, not present = 0. IRR = incidence rate ratio; CI = confidence interval; PTSD = posttraumatic stress disorder; IPV = interpersonal violence.

Table 3

Negative Binomial Regression Results With MDD Symptoms as Outcome Variable.

Predictor	<i>B</i>	<i>SE</i>	IRR (95% CI)	<i>p</i>
Gender	−0.38	0.41	0.69 [.57, 0.82]	<.001
Race	0.09	0.11	1.10 [.89, 1.36]	.39
Other race	0.10	0.18	1.11 [.79, 1.57]	.56
Household income	0.04	0.11	1.04 [.83, 1.30]	.74
Age	0.06	0.03	1.07 [1.01, 1.12]	.02
Physical injury	0.62	0.26	1.90 [1.11, 3.12]	.02
Concerned about others	0.16	0.11	1.17 [.95, 1.45]	.15
Loss of services	0.01	0.04	1.01 [.93, 1.10]	.75
Past disaster	0.35	0.10	1.42 [1.17, 1.73]	<.001
Past accident	0.35	0.10	1.42 [1.17, 1.74]	<.01
Past IPV exposure	1.20	0.10	3.30 [2.74, 3.98]	<.001

Note. Bold *p* values indicate statistical significance. Gender coded male = 1, female = 0; race coded African American = 1, White = 0; other race coded endorsement of other races besides White and African American = 1, White = 0; Household income coded >US\$20,000 annually = 1, <US\$20,000 = 0; physical injury coded present = 1, not present = 0; concerned about others coded present = 1, not present = 0; past disaster, accident, and IPV exposure coded present = 1, not present = 0. MDD = major depressive disorder; IRR = incidence rate ratio; CI = confidence interval; IPV = interpersonal violence.