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Research paper

Trauma-informed schools: Child disaster exposure, community violence and somatic symptoms

Betty S. Lai[a,*], Melissa C. Osborne[b], NaeHyung Lee[b], Shannon Self-Brown[b], Ann-Margaret Esnard[c], Mary Lou Kelley[d]

[a] Department of Counseling, Developmental, and Educational Psychology, Boston College, United States
[b] School of Public Health, Georgia State University, United States
[c] Andrew Young School of Policy Studies, Georgia State University, United States
[d] Department of Psychology, Louisiana State University, United States

ABSTRACT

Background: Given the increasing prevalence of natural disasters, trauma-informed school settings should include efficient methods for assessing child health and mental health in post-disaster environments. To develop such methods, factors that contribute to children's vulnerability and key signs of distress reactions after disasters need to be understood. To address these issues, we evaluated pre-disaster community violence exposure as a vulnerability factor for children's post-disaster reactions and somatic symptoms as a key post-disaster outcome.
Methods: We evaluated 426 children exposed to Hurricane Katrina at two timepoints (3–7 months and 13–17 months post-disaster). Structural equation models evaluated community violence exposure, hurricane exposure, and posttraumatic stress and somatic symptoms.
Results: Community violence exposure was associated with increased levels of posttraumatic stress symptoms among disaster-impacted youth, and did not moderate the relationship between disaster exposure and posttraumatic stress symptoms. Posttraumatic stress symptoms were associated with somatic symptoms in the short-term recovery period (3–7 months), but not associated with somatic symptoms during the longer-term recovery period (13–17 months).
Limitations: This study did not include school-level factors, and somatic symptoms were based on parent reports. The study did not include parent functioning information or distinguish between whether somatic symptoms were medical or functional in nature.
Conclusions: Post-disaster school-based screeners may need to incorporate questions related to children's past exposure to community violence and their somatic symptoms to provide trauma-informed care for children.

1. Introduction

Schools and school staff members are uniquely positioned to help the roughly 100 million children around the world who are exposed to disasters every year (Robinson, 2012; Save the Children, 2007; UNISDR, 2015). In the United States alone, over 55.64 million children attend public and private elementary and secondary schools (National Center for Education Statistics, 2017). The National Child Traumatic Stress Network highlights the fact that school administrators, staff, and teachers may help reduce the impact of trauma on children by recognizing trauma, responding to children's needs in the classroom, and through referring children to resources when appropriate (National Child Traumatic Stress Network Schools Committee, 2008). In order to do so, school-based screeners are needed to assess children earlier and more effectively post-disaster (Hanson and Lang, 2014; Lai et al., 2016).

To date, it is clear that mental health symptoms are a key post-disaster screening target. Abundant evidence links disaster exposure with mental health symptoms, including posttraumatic stress symptoms (PTSS), anxiety, and depressive symptoms (Kumar, 2013; Lai et al., 2015, 2014b; Navarro et al., 2016). Importantly, PTSS are the primary presenting problem among youth who have been exposed to a disaster with the prevalence rate of 8.4%–32.9% (La Greca et al., 2013; Osofsky et al., 2015; Shi et al., 2018; Wang et al., 2014). If chronic PTSS remains untreated, it can lead to long-term effects on physical and mental health (Shi et al., 2018; Xie et al., 2018).

However, in order to develop effective post-disaster school screening protocols, we need information regarding *additional* key

* Corresponding author.
E-mail address: betty.lai@bc.edu (B.S. Lai).

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targets for school screenings. The presence of comorbid symptoms in youth are associated with greater severity of symptoms and a prolonged course of symptoms post-disaster (Lai et al., 2013). Emerging evidence indicates that the effects of disasters on children's functioning are myriad, and include conduct problems, substance use problems, effects on physical functioning, and suicidal ideation and attempts (Crum et al., 2017; Danielson et al., 2017; Lai et al., 2014a; Shi et al., 2018). To better understand how trauma influences developmental processes, the field needs to develop more comprehensive models of children's functioning after disasters (Self-Brown et al., 2017). In particular, we need to understand factors that contribute to children's vulnerability to developing distress after a disaster, and we need to understand other symptoms that may be key signs of children's distress reactions after a disaster. To address these issues, we evaluated pre-disaster community violence exposure as a vulnerability factor for children's post-disaster reactions and somatic symptoms as a key post-disaster outcome.

1.1. Community violence

Our first study aim was to test community violence as a contributor to PTSS among youth after a disaster. When considering school screenings in a disaster context, it is important to appreciate how children's past experiences may contribute to their reactions to disasters. Cumulative stress and additive burden models (Lin and Ensel, 1989) posit that earlier life stressors predispose individuals to later trauma and higher risk for PTSS. Thus, community violence exposure likely contributes to poor post-disaster functioning among youth. Evidence links community violence exposure with PTSS, outside of disaster contexts (McGill et al., 2014). Further, children who are exposed to community violence are more likely to report poor outcomes over time (Foster and Brooks-Gunn, 2015; McDonald and Richmond, 2008). In general, children who are more vulnerable prior to a disaster are also most likely to be vulnerable post-disaster (Cope and Slack, 2017; Resnick and Zuromski, 2017).

Our second study aim was to evaluate whether community violence moderates the relationship between disaster exposure and distress. Initial evidence suggests that community violence may be a moderator of this relationship. Salloum et al. (2011) first posed this question in their examination of 122 children exposed to Hurricanes Katrina and Gustav. In that study, community violence exposure amplified the relationship between disaster exposure and distress. If community violence is a moderator, it would suggest that children with high levels of community violence exposure would experience greater risk for developing distress when exposed to disasters, and thus should be more intensively screened and monitored.

1.2. Somatic symptoms

Our third study aim was to examine the association between PTSS and somatic symptoms among youth after Hurricane Katrina. Testing these relationships provides information about optimal intervention points. Further, the presence of elevated somatic symptoms may indicate negative social, emotional, and academic consequences for children. Somatic symptoms are associated with greater impairment in activities at home and in relationships with peers (Zolog et al., 2011). Such functional impairment has been observed among those with high levels of persistent distressing somatic symptoms and psychological concerns (van Geelen et al., 2015).

Elevated levels of somatic symptoms are common after other forms of trauma exposure. This includes abuse and parent death (Bonvanie et al., 2015; Scott et al., 2012; van Gils et al., 2014). Somatic symptoms are also associated with community violence exposure, school stress, and peer stress (Hart et al., 2013).

Initial evidence links psychological distress with somatic symptoms in youth after disasters (Brown et al., 2011; Dirkzwager et al., 2006; Dorn et al., 2008). For example, Sun et al. (2014) assessed 1828 youth after the Sichuan Earthquake of 2008 (842 from affected areas and 986 from non-affected areas). Psychological problems and somatic symptoms were correlated among youth in that study. Hensley and Varela (2008) found that disaster exposure led to the development of PTSS and somatic symptoms among 302 sixth and seventh graders assessed at one timepoint, 5–8 months after Hurricane Katrina.

Despite evidence indicating that somatic symptoms may be a key area to screen after disasters, there is limited prospective information on children's somatic symptoms after disasters. To date, the majority of studies in this area have been cross-sectional. Thus, it is not clear when and how somatic symptoms may unfold post-disaster. To our knowledge, Zhang et al. (2015) have conducted the only longitudinal study examining somatic symptoms among youth over time after a disaster. They assessed 2299 children 3 and 6 months after the Lushan earthquake of 2013, a 7.0 Richter scale rated earthquake. Children were from areas directly affected by the earthquake. Zhang et al. (2015) observed that PTSS at three months predicted somatic symptoms at 6 months post-disaster. However, it is not clear whether this may be true in a U.S. context. In addition, it is not clear whether the relationship between PTSS and somatic symptoms extends beyond the first year post-disaster. Thus, in this study we tested the relationship between PTSS and somatic symptoms over time among youth exposed to Hurricane Katrina.

The goal of these three aims was to better inform the field about best practices for trauma-informed school systems. This study will directly inform us about whether community violence, PTSS, and somatic symptoms are critically important components of a post-disaster school screener. In addition to the screening context, this study will assist in the development of training for school staff to better understand the struggles that youth are experiencing post-disaster that may ultimately impact academic performance and overall school functioning. To our knowledge, this study is the first to evaluate the relationship between PTSS and somatic symptoms beyond six months post-disaster.

2. Methods

2.1. Participants

Data from this study are from a larger longitudinal study following mothers and their children after Hurricane Katrina (e.g., Lai et al., 2015a,b,c; Self-Brown et al., 2014). Participants in this study included 426 children living in New Orleans and the surrounding area when Hurricane Katrina made landfall. This paper evaluated participants 3–7 months (Time 1) and 13–17 months after Hurricane Katrina (Time 2).

A large majority (75%) of participants at Time 1 were displaced from their homes during Hurricane Katrina. At Time 1, children's ages ranged from 8 to 16 years old with mean of 11.62 and standard deviation of 1.56. Almost half (48%) of children were female. Child participants were in grade 3 to grade 8 at Time 1. Parent ages ranged from 23 to 67 years old with mean of 38.73 and standard deviation of 7.49 at Time 1. The racial makeup of participants at Time 1 was as follows: African American (68%), Caucasian (24%), and other ethnicities (8%). Thus, approximately three-quarters of participants were ethnic/racial minorities. The median income of participants' households prior to the hurricane was less than $25,000 annually. Lastly, about half (49%) of participant homes were headed by single-parents.

2.2. Procedures

Louisiana State University's Institutional Review Board approved the larger longitudinal study, and source of our data. Six schools were approached to be part of the study. Interested parents received an envelope containing the study information, consent and assent forms, and self-report questionnaires. When parents completed and submitted consent forms to the schools, the parents received study questionnaires via mail. Then, parents completed questionnaires and submitted their

responses with provided pre-paid envelopes. Children who assented and received their parents' consent completed questionnaires at school in small groups. Overall, about 35% of contacted families participated in the study (Self-Brown et al., 2013).

Data collection was conducted by graduate students and research assistants, who were trained in data collection procedures. Research assistants were available to help children with reading difficulties. Participants received incentives for partaking in the study. At Time 1, children received incentives in the form of entering into one of several $5.00 drawings or a class pizza party. For Time 2, parents received compensation of $25.00 to $50.00, and children received office supplies, such as pencils or stickers (Self-Brown et al., 2013).

2.3. Measures

All measures were child-self report measures, with the exception of somatic symptoms (parent self-report). Independent variables were measured at Time 1. Dependent variables were measured at Times 1 and 2 (i.e., 3–7 months and 13–17 months after Hurricane Katrina, respectively).

2.3.1. Independent variables

2.3.1.1. Community violence. The Screen for Adolescent Violence Exposure (SAVE; Hastings and Kelley, 1997) contains 32 items to assess violence exposure among youth aged 11–16 years old. Among the three domains of violence measures related to home, school, and community violence, this study evaluated community violence only. Example items include: "I have seen someone carry a gun," "someone my age has threatened to kill me," "I have seen a grownup hit a kid," and "I have heard about someone getting attacked with a knife." Each item measured two aspects – i.e., "how often it happens" (scale of five: from 0 = never to 4 = almost always) and "how much it bothers me" (scale of five: from 0 = not at all to 4 = very, very much). Internal consistency for Time 1 was $\alpha = 0.96$.

The KID-SAVE (Flowers et al., 2000) measures violence exposure for younger participants (8–11 years old). The KID-SAVE contains 35 items, which include: "I have seen someone carry a gun" and "someone has threatened to beat me up." It has three subscales: home, school, and community violence. The community violence subscale was used in this study. Each item measured two aspects: "how often it happens" (three response options: 0 = never, 1 = sometimes, 2 = a lot) and "how upsetting it was" (three response options: 0 = not at all, 1 = somewhat, 2 = very). As with the SAVE, participants were considered to have reported high levels of community violence if they were in the upper quartile, per the recommendations of Hastings and Kelley (1997). Internal consistency for the KID-SAVE at Time 1 was $\alpha = 0.93$. In order to analyze the data on the same scale, children's scores from the SAVE and KID-SAVE were standardized (z-scores).

2.3.1.2. Hurricane exposure. Hurricane exposure was measured using the Hurricane Related Traumatic Experiences (HURTE) measure (La Greca et al., 1996). The HURTE contains 15 items in which children responded either "yes" or "no" to questions about their exposure to certain experiences. The measure captures actual life threat, perceived life threat, and immediate loss and disruption. Actual life threat (the sum of six items) and perceived life threat (one item) were used to measure exposure in this study. Example items include: "Did windows or doors break in the place you stayed during the hurricane" and "Were your toys or clothes ruined by the hurricane?" HURTE data collected at Time 1 were used in this study. Given that items were not expected to exhibit internal consistency, alpha coefficients were not calculated for the HURTE.

2.3.2. Dependent variables

2.3.2.1. Posttraumatic stress symptoms (PTSS). PTSS at Times 1 and 2 were assessed using the UCLA Posttraumatic Stress Disorder Reaction Index – Revision 1 (UCLA-PTSD-Reaction Index-Revised; Steinberg et al., 2004). The index has 18 items, assessing 17 symptoms on a 5-point scale (from "none" to "most of the time"). Youth were asked to think about Hurricane Katrina while rating symptoms. The re-experiencing cluster contains 5 items, examples of which include: "I have dreams about what happened or other bad dreams" and "I feel like I am back at the time when the bad thing happened, living through it again." The avoidance cluster contains 8 items, examples of which include: "I try to stay away from people, places, or things that make me remember what happened" and "I have trouble feeling sadness or anger." The arousal cluster is made up of 5 items, examples of which include: "I feel grouchy, angry, or mad" and "I watch out for danger or things that I am afraid of." PTSS scores of 38 or higher are considered clinically significant (Steinberg et al., 2004). Internal consistency at Time 1 was $\alpha = 0.85$ for the Re-experiencing subscale; $\alpha = 0.82$ for the Avoidance subscale; and $\alpha = 0.69$ for the Arousal subscale.

2.3.2.2. Somatic symptoms. The Behavioral Assessment System for Children, Second Edition (BASC-2) Parent Ratings Scales (PRS) *t*-scores were used to assess the somatic symptoms of children in the study (Reynolds and Kamphaus, 2004) at Times 1 and 2. The PRS contains 12 items rated on a 4 point scale (i.e., "Never," "Sometimes," "Often," "Almost Always"). Examples include complaints of pain, stomach pain, headaches, and fevers. A *t*-score of 70 or above is considered clinically significant.

3. Results

Descriptive analyses were conducted using SPSS version 23 (IBM Corp, 2015) and SAS software version 9.4 (SAS Institute, 2013). All summary scores used in analysis were calculated such that participants missing more than 5% of items were coded as missing. Based on the HURTE, in response to the perceived life-threatening experience item, 26% of participants indicated that they thought they might die. Regarding actual life threatening experiences, the median summary score was 0 (IQR = 1). With regard to community violence, among those completing the SAVE ($n = 171$), 14% ($n = 23$) reported that they hear gunshots "a lot" or "almost always;" 17% ($n = 24$) of those completing the KID-SAVE ($n = 142$) reported that they hear gunshots in their neighborhood "a lot."

In this sample, the mean UCLA-PTSD Reaction Index PTSS total score for youth was 18.53 ($SD = 14.50$) at Time 1 and 14.68 ($SD = 13.00$) at Time 2. We examined the number of children that met DSM-IV-TR criteria for criteria B, C, and D. At Time 1, 18% of the sample met the diagnostic criteria; at Time 2, 13% met criteria. The mean BASC somatic *t*-score was 51.27 ($SD = 12.77$), and 9% ($n = 25$) of participants met the cutoff for clinically significant symptoms at Time 1. The mean BASC somatic *t*-score was 53.22 ($SD = 13.99$), and approximately 13% ($n = 31$) of participants met the cutoff for clinically significant symptoms at Time 2.

3.1. Overlap between PTSS and community violence

We first examined community violence and PTSS levels in our sample. To understand community violence severity, participants were considered to have reported high levels of community violence if they were in the upper quartile, per the recommendations of Hastings and Kelley (1997). To understand PTSS severity in our sample, we created PTSS severity groups based on guidelines used in prior research (La Greca et al., 2010). Specifically, the following categories were created: Doubtful (UCLA Reaction Index-Revised PTSS summary scores of 0–10), Mild (11–22), Moderate (23–37), Severe (38–53), and Very Severe (54–68). See Table 1 for information on the distribution of participants among these categories at Time 1 and Time 2.

To understand the overlap between PTSS and community violence

Table 1
Posttraumatic Stress Symptoms (PTSS) at Time 1 (n = 339) and Time 2 (n = 346).

Level of PTSS	Time 1 *n* (% of Time 1 *n of 339*)	Time 2 *n* (% of Time 2 *n of 346*)
Doubtful	125 (37)	168 (49)
Mild	96 (28)	92 (27)
Moderate	78 (23)	63 (18)
Severe	33 (10)	18 (5)
Very Severe	7 (2)	5 (1)

Table 2
Posttraumatic Stress Symptoms (PTSS) and Community Violence (CV) Groups at Time 1.

		n (%)	Demographic characteristics
Full Sample		308 (100.00)	*M(SD)* age: 11.59 (1.56); 51% female; 77% minority
PTSS and CV Group	Group 1: PTSS and CV	21 (7)	*M(SD)* age: 11.25 (1.33); 43% female; 92% minority
	Group 2: PTSS Only	13 (4)	*M(SD)* age: 11.33 (2.02); 54% female; 69% minority
	Group 3: CV Only	56 (18)	*M(SD)* age: 11.66 (1.71); 68% female; 93% minority
	Group 4: No PTSS or CV	218 (71)	*M(SD)* age: 11.62 (1.52); 48% female; 72% minority

Note. Only those with data for both PTSS and CV at Time 1 (n = 308) were included in the table.

at Time 1 and how this overlap might influence Time 2 outcomes for PTSS and somatic symptoms, we created four groups. Participants were considered to have clinically significant PTSS if their PTSS summary score was at least 38, and participants were considered to have reported high community violence if their scores were in the upper quartile. **Group 1** participants ("PTSS and CV") reported clinically significant PTSS and high levels of community violence. **Group 2** participants ("PTSS Only") had clinically significant PTSS but did not report high community violence. **Group 3** participants ("CV Only") did not report clinically significant PTSS, but they did report high community violence. Finally, **Group 4** ("No PTSS or CV") participants did not report clinically significant PTSS and they did not report high community violence. Only participants with Time 1 data for PTSS and CV (n = 308) were included in these groups. Descriptive information for these four Time 1 groups are listed in Table 2.

Next, we examined how these four Time 1 groups related to Time 2 PTSS outcomes for participants (see Fig. 1). Group 1 participants (PTSS and CV) had the highest mean PTSS scores at Time 2 (M = 32.47, SD = 17.42), which falls in the Moderate range. Group 2 participants (PTSS Only) had the next highest mean PTSS scores at Time 2 (M = 26.50, SD = 22.06), which also fell in the Moderate range. Next, Group 3 participants (CV Only) reported lower mean PTSS scores at Time 2 (M = 15.62, SD = 10.13); these scores fell in the Mild range. Group 4 (No PTSS or CV) participants reported the lowest mean PTSS scores at Time 2 (M = 11.76, SD = 10.95); these scores fell in the Mild range. A one-way ANOVA test found that the groups were statistically significantly different with regard to Time 2 PTSS, F (3, 248) = 17.93, $p < .0001$. Post hoc tests (REGWQ) revealed that the differences were statistically significant between Group 1 (PTSS and CV) and Group 3 (CV Only; $p < .05$); between Group 1 and Group 4 (No PTSS or CV; $p < .05$); and between Group 2 (PTSS Only) and Group 4 ($p < .05$). A Chi-square test indicated a statistically significant difference between the groups with regard to minority status (χ^2 = 12.26[3], p = .01).

3.2. Testing community violence as a moderator and the relationship between PTSS and somatic symptoms

Hypotheses were evaluated with structural equation modeling (see Fig. 2), using Mplus version 8 (Muthen and Muthen, 1998–2017). Based on theory and past research, child age, gender, and minority status were control variables. They were controlled for at exposure variables and community violence, as well as with PTSS and somatic symptoms at Time 1. PTSS was modeled as a latent factor with total re-experiencing, avoidance, and arousal subscale scores as indicators. The final model was determined by assessing global fit statistics (chi-square test of model fit, Root Mean Square Error of Approximation, Comparative Fit Index, and Standardized Root Mean Square Residual) and examining modification indices and standardized residuals. Missing data were treated using full information maximum likelihood (FIML).

The final model (see Fig. 2) showed good fit according to the global fit indices. Global fit indices were as follows: $\chi^2(29) = 40.68$, $p = .07$; RMSEA = 0.03 (90% confidence interval = 0, 0.05); CFI = 0.99; SRMR = 0.02. Community violence did not act as a moderator between disaster exposure and PTSS, as the interaction terms for actual life threatening experience (standardized estimate = 0.03, 95% CI: −0.11, 0.18, $p = .73$) and perceived life threatening experience (standardized estimate = −0.11, 95% CI: −0.27, 0.06, $p = .16$) were not significant.

The effect of PTSS on child somatic symptoms was statistically significant at Time 1 (standardized estimate = 0.17, 95% CI: 0.02, 0.31, $p = .03$) but not at Time 2 (standardized estimate = 0.13, 95% CI: −0.01, 0.29, $p = .08$), controlling for child age, gender, and minority status. Time 1 somatic symptoms were significantly related to Time 2 symptoms (standardized estimate = 0.50, 95% CI: 0.33, 0.64, $p < .0001$). The total indirect effects of community violence on Time 1 somatic symptoms were statistically significant (standardized estimate = 0.08, 95% CI: 0.01, 0.17, $p = .04$) as were the total indirect effects on Time 2 symptoms (standardized estimate = 0.11, 95% CI: 0.03, 0.21, $p = .02$).

4. Discussion

In order to screen the large numbers of children exposed to disasters, trauma-informed schools systems need to address factors that increase risk for distress and symptoms associated with distress. In addition, information on such factors to attend to among students in post-disaster circumstances should be included in trauma-informed training for school professionals. This study indicates that community violence and somatic symptoms are two key areas to assess in school-based screeners. Below, we discuss study findings in detail.

When we examined the overlap between PTSS and community violence at Time 1, children who had clinically significant PTSS and past exposure to community violence reported persistent PTSS that remained in the higher end of the Moderate range a full year after Katrina (i.e., 13–17 months post-disaster). This is important, given that symptoms for this group were more severe than those of children who reported clinically significant PTSS at Time 1 who did not have high levels of exposure to community violence (i.e., Group 2). Thus, it appears that the presence of community violence exposure may exacerbate the course of PTSS for children after disasters. However, most children in our sample reported both lower levels of PTSS and lower exposure to community violence (i.e., Group 4). Some children reported high community violence at Time 1 but not clinically significant PTSS (Group 3), and, on average, these children experienced lower levels of PTSS at Time 2 compared to those experiencing high levels of PTSS and community violence (Group 1) and those experiencing high levels of PTSS but no community violence (Group 2). It may be the case that these children have developed resilience based on their community violence exposure that helped protect them against post-disaster PTSS at Time 2. We also found differences between these groups with regard to minority status, with children in a racial minority reporting PTSS and high community violence in greater proportion than non-minority children. Practitioners should be aware of these distinctions in experiences when developing programs or interventions.

Children's community violence exposure was directly related to

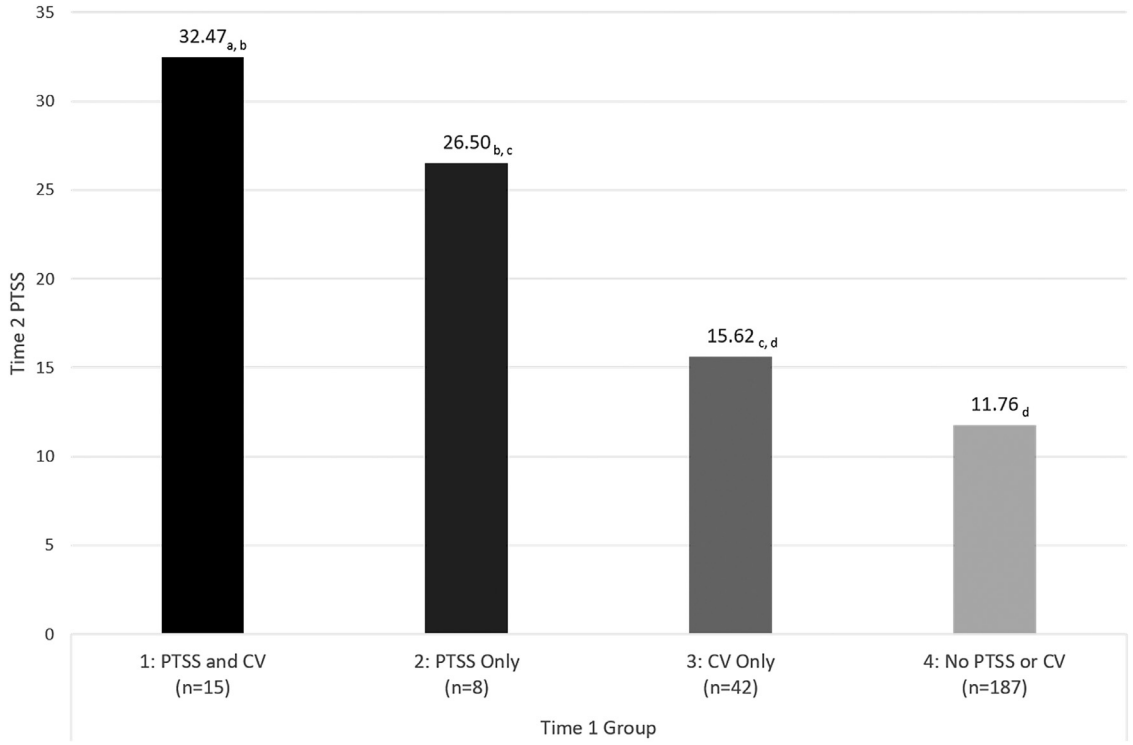

Fig. 1. Time 2 PTSS outcomes for Time 1 PTSS and CV groups. PTSS = Posttraumatic Stress Symptoms. CV = Community Violence. Possible PTSS scores range from 0 to 68. Scores of 38 and above are considered clinically significant. Differing subscripts indicate significantly different groups, based on post-hoc analyses.

their PTSS 3–7 months post-disaster. This finding is not surprising, given that children with high levels of community violence exposure are already vulnerable to developing distress reactions (McGill et al., 2014). However, community violence is not regularly screened in research on children who have been exposed to disasters. In the future, post-disaster screening should include items related to community violence exposure.

Community violence did not moderate the relationship between disaster exposure and PTSS. This is surprising, given that Salloum et al. (2011), in their study of 122 children (aged 7–12 years) exposed to Hurricane Gustav, found that exposure to community violence moderated the relationship between Hurricane Gustav exposure and PTSS. However, this effect was found only when considering community violence in the context of exposure to Gustav as well as *past exposure* to Hurricane Katrina. Community violence was not a moderator of the relationship between exposure and PTSS symptoms when exposure to one disaster alone was considered. Combined with our findings, this suggests that community violence may be a moderator of the relationship between exposure and PTSS, but only in the context of a child experiencing multiple types of trauma. This is in line with work on adverse childhood experiences, which suggests that the accumulation of stress may be toxic (Davis et al., 2017; Nemeroff, 2016; Richter

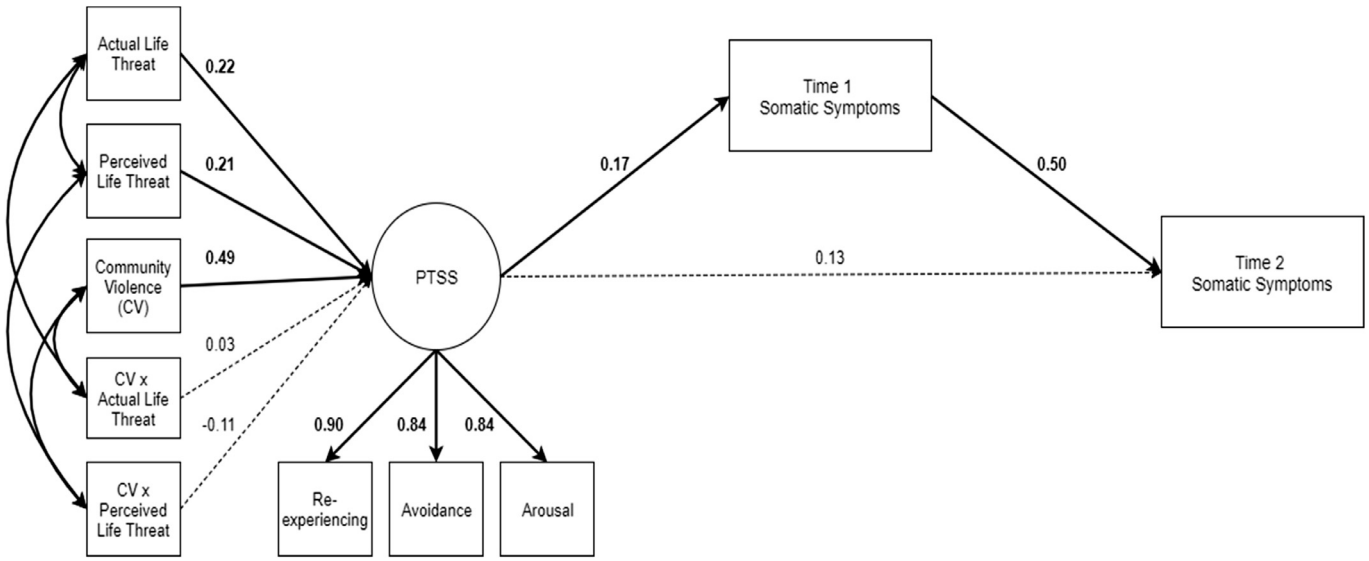

Fig. 2. Model examining community violence as a moderator between disaster exposure (actual and perceived life threat) and post-traumatic stress symptoms (PTSS) at Time 1, and the effect of PTSS at Time 1 on child somatic symptoms ($N = 426$). Standardized estimates are shown. The analysis controlled for child age, gender, and minority status. Statistically significant paths ($p < .05$) are indicated in bold, and non-significant paths are indicated with a dashed line.

et al., 2017). Thus, it may be the case that the hypothesis in this study was not verified because this study only looked at exposure to one traumatic episode rather than multiple experiences. Future research should assess community violence as a moderator between exposure to *multiple* traumatic experiences and PTSS.

PTSS predicted somatic symptoms 3–7 months post-disaster, but PTSS were not directly related to somatic symptoms 13–17 months post-disaster. Our findings indicate that PTSS may be predictive of somatic symptoms in the short-term recovery period, but this direct relationship did not extend beyond one year post-disaster, into the long-term recovery phase. This is an important finding, providing new information about the potential course of somatic symptoms among youth post-disaster. The only known study, by Zhang et al. (2015), to examine somatic symptoms longitudinally among children post-disaster followed children to six months (after the Lushan earthquake of 2013). Our findings suggest that somatic symptoms may appear secondary to PTSS, but primarily in the shorter-term recovery period. Thus, these symptoms may warrant early screening in a post-disaster context.

Several limitations should be considered when evaluating study findings. This study did not include school-level factors. This information should be collected in future studies to help understand how schools may become more trauma-informed in post-disaster situations. In addition, this study was limited to two assessments timepoints. Further, our study was limited to two timepoints. Research is needed evaluating somatic symptoms over additional timepoints and timepoints further in time from a disaster event. Also, this study did not include information about parent functioning. Parent pain (Wilson et al., 2014) and parent criticism (Horwitz et al., 2015) can increase somatic symptoms in children. Further, it is not clear from this study whether somatic symptoms may be medical in nature. Thus, we were not able to distinguish between medical somatic symptoms versus functional somatic symptoms. Functional somatic symptoms are physical symptoms that cannot be fully explained by pathology (van Gils et al., 2014). Finally, our study consisted primarily of ethnic/racial minority youth. This is an important strength of our study, given the evidence linking social vulnerability to amplified negative outcomes for children after disasters (e.g., Peek, 2008; Fothergill and Peek, 2015). However, findings may not be generalizable to other populations with fewer minority youth.

In conclusion, policies are needed that integrate that more comprehensive screenings for youth in disaster affected areas. Youth in disaster prone areas may be more vulnerable to experiencing community violence. Disaster-prone communities like New Orleans have higher rates of violence (Ogunsakin, 2013). For example, New Orleans is the third most homicide-prone city in the United States (Litten, 2017). Related to our results, school-based screeners should include questions assessing children's past exposure to community violence as well as children's somatic symptoms. These data will help school professionals be more aware, sensitive, and responsive to the potential impact of disasters on children, a key goal of trauma-informed care (Hanson and Lang, 2014). Further research is needed to better understand which children are at risk for prolonged distress after disasters.

Conflict of interest

The authors declare that they have no conflicts of interest to disclose.

Contributors

Shannon Self-Brown and Mary Lou Kelley conceptualized and ran the study. Betty S. Lai conceptualized the paper and designed the statistical models. Melissa C. Osborne conducted the statistical analyses. Betty S. Lai, Melissa C. Osborne, and NaeHyung Lee wrote the manuscript. Shannon Self-Brown, Ann-Margaret Esnard, and Mary Lou Kelley reviewed the manuscript and participated in the manuscript revision and editing. All authors contributed to and approved the final manuscript.

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