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Untangling Psychiatric Comorbidity in Young Children Who Experienced Single, Repeated, or Hurricane Katrina Traumatic Events

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Abstract

Background—In individuals with posttraumatic stress disorder (PTSD), 70%-90% have at least one comorbid non-PTSD disorder.

Objective—This study tested several hypotheses to untangle comorbidity issues. Following McMillen et al. (2002), we hypothesized that few non-PTSD disorders would arise following traumatic events in children with substantial PTSD symptoms. Second, Repeated Events victims would show more internalizing and externalizing problems compared to Single Event and Hurricane Katrina victims. Third, we aimed to replicate in young children the finding from older populations that exposure to multiple events, not the type of event, would predict severity of symptoms. These results would inform speculations that repeated and prolonged traumas produce greater symptom complexity.

Methods—Children 3-6 years of age were recruited for three types of trauma: Single (n=62), Hurricane Katrina (n=85), and Repeated Events (n=137), and assessed with caregiver reports from a diagnostic interview.

Results—Overall, 95% of children who developed new non-PTSD disorders following traumas also had substantial PTSD symptoms. The Katrina and Repeated Events groups showed more diagnoses of oppositional defiant disorder compared to the Single Event group, but groups did not differ on PTSD, depression, anxiety, or attention-deficit/hyperactivity disorder. Cumulative number of events was the only significant predictor of PTSD symptoms, while type of trauma and total occurrences of traumas did not predict additional variance.

Conclusion—These data provide empirical support for targeting interventions on PTSD following traumas and disasters. The homogeneity of outcomes across types of traumas provides little empirical support for speculations that repeated and prolonged traumas produce greater symptom complexity.

Keywords

trauma; comorbidity; disaster; post-traumatic

Conflict of Interest

The author declares that he has no conflict of interest.

Introduction

Community-representative surveys have demonstrated that the majority of youth are exposed to life-threatening traumatic events (Copeland et al. 2007), and many of them suffer from long-lasting and impairing emotional and behavioral disorders such as posttraumatic stress disorder (PTSD). The presence of PTSD is known to be comorbid with at least one other psychiatric disorder 70% to 90% of the time in adults (Brown et al. 2001), adolescents (Fan et al. 2011), and young children (Scheeringa et al. 2003). Increased speculation has turned to understanding the causes of this comorbidity (McMillen et al. 2002) and alternative proposals for new disorders (Herman 1992; van der Kolk 2005) although there have been few empirical tests on key aspects of these speculations (McMillen et al. 2002). Key aspects to focus on include the timing and onsets of co-occurring disorders, the conceptualization and measurement of the type of trauma, and the symptom complexity, or pattern of comorbid problems, that follow events (Cloitre et al. 2009; Hodges et al. 2013).

Methodological issues of onset and co-occurrence

Since the Diagnostic and Statistical Manual, 3rd edition, revised (DSM-III-R) (American Psychiatric Association 1987), the definition of trauma for PTSD has been clearly operationalized as life-threatening. This clarity was maintained through the fourth and fifth editions of the DSM. Limiting consideration to truly life-threatening events, McMillen et al. (2002) considered four possible models of comorbidity following trauma: (A) PTSD leads to other psychiatric disorders (e.g., people become depressed as a result of their PTSD symptoms), (B) non-PTSD disorders arise following trauma in the absence of PTSD, (C) symptom overlap (depression and generalized anxiety are most often cited because some symptoms are shared with PTSD), and (D) prior disorders create vulnerability to develop PTSD. McMillen et al. noted that most prior studies failed to collect onset dates of the non-PTSD disorders, and all prior studies only considered comorbid non-PTSD disorders in combination with full PTSD, which failed to consider that many people develop substantial PTSD but do not meet all three symptom clusters for the full diagnosis. They addressed these gaps by studying 162 adult flood survivors and carefully tracked the onsets of all symptoms. Of all individuals that developed new non-PTSD disorders following the flood, 100% had substantial PTSD symptoms (53% had full PTSD and 47% had three to 10 PTSD symptoms) (McMillen et al. 2002). McMillen et al. concluded that only model A was supported in which PTSD leads to other psychiatric disorders. This finding was replicated in both very young children and their caregivers following Hurricane Katrina in a subset of the sample in the present study (Scheeringa and Zeanah 2008). These represent the only known studies in which attention was paid to dates of onset of comorbid disorders both before and after traumatic events.

Type of traumatic event

Studies of comorbidity and symptom profiles have been inextricably linked to the definition and measurement of the traumatic events. The definition and measurement of trauma however has been handled differently in nearly every study. One key distinction has been whether trauma is defined as DSM type *life-threatening* or broadened to include non-life-threatening experiences.

When restricted to life-threatening events, studies in adults have indicated that the type of traumatic event leads to different prevalences of PTSD. A national survey limited to women showed that the rates of PTSD for sexual and physical assaults ranged from 31% to 39%, whereas PTSD from disasters or accidents was only 9% (Resnick et al. 1993). In another large national survey, the rate of PTSD in men who suffered sexual or physical assaults ranged from 2% to 65%, whereas the rates were only 4% to 6% for accidents, natural disasters or witnessed violence (Kessler et al. 1995). In another survey of females (2,507 undergraduate students), those with single interpersonal traumas had more traumatic stress symptoms than those with noninterpersonal traumas; and females with multiple interpersonal had more traumatic stress symptoms than those with either single interpersonal or noninterpersonal traumas (Green et al. 2000).

In children and adolescents, only one known study has compared outcomes in youth by type of trauma that was restricted to truly life-threatening DSM-level trauma. Copeland et al. (2007) followed 1,420 children who were nine to 13 years of age at baseline through age 16 years. Severity of posttraumatic stress symptoms was predicted by multiple traumas (Copeland et al. 2007). The prevalence of full PTSD however was unusually low, 0.5%, which limited the ability to study outcome by type of trauma.

Another key distinction has been whether events are single occurrence or repeated and prolonged. Herman (1992), focusing on adults, proposed that prolonged and repeated events led to a complex posttraumatic syndrome (Herman 1992). Examples included situations of control and captivity, such as prisons, concentration camps, slave labor camps, organized sexual exploitation, and some family circumstances. Herman referred to all of these circumstances as traumas but they included non-life threatening events that broadened the definition of trauma beyond the DSM. The evidence for a complex posttraumatic syndrome was not sufficient for inclusion in the DSM-IV, due in large part because a DSM-IV field trial showed that 96% of all individuals who qualified for complex PTSD also met criteria for PTSD (Roth et al. 1997).

Terr (1991), focusing on children and adolescents, proposed the existence of type I and type II childhood trauma events that supposedly lead to distinctly different syndrome profiles. Type I involved “one sudden blow,” whereas type II involved “longstanding or repeated ordeals” (page 11) (Terr 1991). While Terr was never explicit about operationalizing “ordeals,” all of her type II case examples described truly life-threatening traumatic events. There are however no known studies that have empirically tested this typology in children and adolescents. Jonkman and colleagues (2013) claimed to compare type I (69 children with single event trauma, 7-18 years old) to type II (138 children who experienced maltreatment, 2-18 years old). Because inclusion in the maltreatment group was based on placement in foster care, the majority (68%) experienced *non-life threatening* events such as lack of supervision, emotional abuse, or neglect; a minority (32%) experienced traumatic experiences of sexual or physical abuse (other traumatic events were not measured). It was not surprising then that the maltreatment group had significantly more “trauma-unrelated” problems while the single event group had significantly higher PTSD symptoms (Jonkman et al. 2013). In addition, 60% of the single event group involved sexual or physical assaults which were not obviously distinguishable from the maltreatment experiences of the

supposed type II group. This study is illustrative of the majority of studies in youth, which broadened the measurement of events to non-life threatening events (Finkelhor et al. 2007; Cloitre et al. 2009; van der Kolk 2005; Ford et al. 2009).

Furthermore, a child and adolescent analogy of Herman's complex posttraumatic syndrome, developmental trauma disorder, has been promoted in a series of speculative publications (van der Kolk 2005; D'Andrea et al. 2012). One of the alleged needs for this new disorder is that children who have been chronically exposed to interpersonal trauma in early childhood either cannot qualify for PTSD or need a better diagnosis than PTSD (van der Kolk 2005), and when they are mis-diagnosed or diagnosed with PTSD plus the inevitable comorbid disorder(s), this purportedly misleads clinicians to treat comorbid conditions rather than the trauma syndrome and “may run the risk of applying treatment approaches that are not helpful” (p. 406) (van der Kolk 2005). At this point, developmental trauma disorder lacks preliminary validity data and has not yet achieved face validity, and proponents have not provided empirical data that children have received the wrong treatments. In addition, it has not been documented that the signs and symptoms in chronically and repeatedly traumatized youngsters are not adequately represented by PTSD (Roth et al. 1997).

Type of syndrome

McMillen et al.'s Model A hypothesized that PTSD, as opposed to the traumatic event, leads to other disorders. Viewed from the different perspective of Herman (1992), Jonkman et al. (2013) and others, scholars have proposed that the nature of the event, as opposed to the presence of PTSD, was critical for determining the symptom response. The strategy of Jonkman has been followed by others in the child and adolescent field to broaden the stressor criterion to include aspects of caregiving environments, called complex trauma, and to broaden the assessment of symptoms, called symptom complexity, in order to draw attention to specific populations of victimized individuals (van der Kolk 2005; Finkelhor et al. 2007; Cloitre et al. 2009; Ford et al. 2009).

Finkelhor and colleagues (2009) promoted the concept of “poly-victimization” to draw attention to a group that has suffered interpersonal traumas such as abuse or witnessed domestic violence plus non-life threatening forms of victimization such as bullying and property crime (Finkelhor et al. 2007). Ford and colleagues (2009), in a chart-review study of residential treatment center patients, championed the concept of “complex trauma” that involved traditional physical and sexual abuse trauma events plus other psychosocial adversities such as out-of-home placement and severe parental impairment. Results were inconsistent depending on whether outcomes were measured categorically (disorders) or continuously (problems). Complex trauma patients had significantly fewer externalizing disorders but more severe externalizing problems compared to low trauma patients. In contrast, complex trauma patients had more internalizing disorders but did not differ on internalizing problems compared to low trauma patients. Cloitre et al. (2009) defined “trauma” events beyond life-threatening events by including neglect, emotional abuse, and not living with biological mothers. In their study of 152 three through 17 year-old youth, more cumulative “trauma” predicted greater “symptom complexity” as measured by PTSD, depression, externalizing, and dissociation symptoms. Hodges et al. (2013) measured

"trauma" as life-threatening events (sexual abuse, physical abuse, and exposure to domestic violence, but omitting disaster, accidents, and medical trauma, etc.) plus non-life threatening events of neglect and psychological abuse. In their study of 335 eight through 12 year-old clinic-referred children, more types of "traumas" significantly correlated with greater symptom complexity, as measured by six subscales of Briere's trauma symptom checklists. Cumulative traumas by child report accounted for only 3% of the variance in symptoms, and caregiver report accounted for only 9% of the variance. Nilsson et al. (2012) measured cumulative trauma from 18 noninterpersonal events and 13 interpersonal events, however many of the events did not have to be life-threatening traumatic (e.g., "Have you been in hospital?'). In their study of 462 adolescents recruited from schools in Sweden, they found for boys only that there were significant additive effects of adverse family circumstances with both interpersonal and noninterpersonal traumas to predict the total trauma-related symptoms. In addition, "traumatic" experiences were moderately to strongly positively correlated with other adverse family circumstances, indicating that cumulative trauma experiences do not happen at random; they tend to co-occur with other disadvantaged family variables. Lastly, Hickman et al. (2013) included neglect in their measure of trauma events. In their study of 768 three through 13 year-old children from nine sites, they also measured total lifetime frequency of exposure (number of occurrences), not just number of types of events (Hickman et al. 2012). Both number of occurrences and a categorical variable of poly-victimization (two or more events) predicted child behavior problems and PTSD symptoms. However, when both predictors were entered into a model, only poly-victimization was a significant predictor. Overall, depending on the measure of trauma, researchers have concluded that expanded conceptualizations of cumulative trauma lead to a wider range of problems, or symptom complexity, compared to single blow trauma (Hodges et al. 2013; Cloitre et al. 2009). While this strategy has strengths, the strategy prevents estimates of the true impact of only life-threatening traumas. Also, none of these studies gathered dates of onsets of non-PTSD symptoms, preventing them from knowing whether the symptom complexity was present prior to or following traumatic events.

The current study was meant to address several of these gaps in very young children. First, following McMillen et al. (2002), we hypothesized that few or no non-PTSD disorders would arise following traumatic events when children with substantial PTSD symptoms in addition to those with full PTSD were considered. As McMillen et al. showed, limiting this type of study to only those with the full PTSD diagnosis is an overly constricted design and a broader definition to include those with substantial PTSD symptoms is more representative of the trauma-exposed and symptomatic population. As an advance over most prior studies, we collected dates of onsets for comorbid disorders to determine whether any differences between groups were present prior to the traumatic events or were caused by the traumatic events. This would extend McMillen's finding to other types of traumas besides disasters. Second, we recruited specifically for three types of trauma exposures in order to test claims that prolonged and repeated traumas result in different symptom outcomes. We hypothesized that, consistent with the trends in older children (Ford et al. 2009; Cloitre et al. 2009; Hodges et al. 2013; Nilsson et al. 2012), more internalizing and externalizing problems would be associated with a repeated events group. This would provide much needed empirical data to inform speculations about the impact of repeated trauma in young

children. We also gathered data on the frequency of PTSD symptoms as an additional test to examine whether frequency of PTSD symptoms was a more sensitive outcome than the mere presence of PTSD symptoms. Third, we aimed to replicate the findings of Nilsson 2012 and Hickman 2013 who showed that exposure to multiple events, not the type of event, was a more important predictor of symptoms and extend this to a population of very young children.

The examination of these issues in very young children was deemed advantageous for several reasons. Previous research in young children had established the same high degree of comorbid disorders with PTSD as has been found in adults (Scheeringa et al. 2003; Scheeringa and Zeanah 2008), whereas studies of comorbidity in PTSD in older youth have been less common (Fan et al. 2011). The narrow age range provided a cohort with relatively fewer possible developmental confounder variables than would be possible in a cohort with a wider age range. Lastly, a cohort of older children and adolescents would have been alive for a longer duration and experienced many more adverse life experiences that could serve as potential confounding variables.

Method

Design

This was a cross-sectional assessment study.

Participants—Children were recruited for three types of trauma experiences by design to explore differences between trauma exposure - single event, repeated events, or Hurricane Katrina. The Single Event group comprised 62 children. This included 54 participants identified from a Level I Trauma Center registry; the events included 43 motor vehicle accidents and 11 accidental injuries of other origins. Eight children were recruited from newspaper advertisements, all of whom witnessed single incidents of relatives murdered, assaulted, or severely injured.

The Hurricane Katrina group consisted of 138 children. Exposure included being in the path of the storm or returning (after having evacuated before the storm) to view their devastated homes. We have previously demonstrated that the sudden and unexpected panic produced when returning to view their devastated homes often led to PTSD in young children (Scheeringa and Zeanah 2008) . Recruitment was primarily through newspaper advertisements. One child was excluded because he witnessed domestic violence and could not be exclusively in either the repeated or Katrina group. The final sample was 137.

The Repeated Events group was 85 participants who were identified through the three main battered women's programs in the New Orleans area. The staff at these programs gave mothers a phone number to contact regarding the study. All of the children had witnessed domestic violence, and 92% of caregivers endorsed this as their children's worst experience. Children had to experience at least two trauma occurrences to be in the Repeated Events group.

When Single and Repeated Events participants were recruited post-Katrina, they could not have a life-threatening Katrina disaster experience.

For all three of the groups, there were two inclusion criteria: (1) experienced at least one life-threatening trauma when the child was old enough to remember it with a narrative recall (at least 3 years old). We did not gather data on traumas prior to three years of age because of the normal developmental (Fivush and Hamond 1990) and clinical evidence (Terr 1988) that narratives of autobiographical events do not emerge until approximately 36 months of age, and there being no known published cases of PTSD below three years of age. Medical events counted only if they involved major surgery or were invasive beyond blood draws (e.g., lumbar puncture); (2) between the ages of 36 months and 83 months at the time of enrollment. Exclusion criteria: head trauma with Glascow Coma Scale score 7 or less in the emergency room, mental retardation, autistic disorder, blindness, deafness, and foreign language-speaking families.

Measures—The Preschool Age Psychiatric Assessment (PAPA) (Egger et al. 2006) is a structured psychiatric interview with the caregiver. Test-retest reliability kappas in a community sample of 307 2-5 year old children were .73 for PTSD, .72 for major depression disorder (MDD), .74 for attention-deficit/hyperactivity disorder (ADHD), .57 for oppositional defiant disorder (ODD), .60 for separation anxiety disorder (SAD), .54 for social phobia, .36 for specific phobia, and .39 for generalized anxiety disorder (GAD).

Data were collected on traumatic exposure using 12 events from the Life Events section. A modified measure of traumatic life events was used that asked for the date of the first event, the date of the last event, and a frequency count of the number of each type of traumatic event. Type of event (or group membership) was coded as Single Event, Hurricane Katrina, or Repeated Events. Cumulative types of events was the sum of the number of the 12 possible events. Total occurrences of traumas was the sum of the number of lifetime occurrences for all types of events.

The PTSD module included developmental modifications that are consistent with the new DSM-5 disorder titled posttraumatic stress disorder for children 6 years and younger and which have been empirically supported for diagnostic validity in numerous studies (Scheeringa et al. 2010). Intrusive recollections could be accompanied by neutral affect as well as negative emotions. Diminished interests could be manifest in play activities. Detachment or estrangement from others was measured as socially withdrawn behavior. Restricted range of affect was coded only for restricted positive affects. The new DSM-5 symptom “Substantially increased frequency of negative emotional states – for example, fear, guilt, sadness, shame, or confusion” was measured as either the symptom of sadness or guilt from the major depression disorder module. Irritability and outbursts of anger could include new extreme temper tantrums. The diagnosis followed the DSM-5 algorithm that requires one intrusion, one avoidance or numbing, and two increased arousal symptoms, plus functional impairment.

In addition to capturing the presence or absence of each PTSD symptom, the PAPA also captured the frequency of the five intrusion symptoms and three of the increased arousal

symptoms (sleep, concentration, and irritability). Frequency was recorded as the number of incidents of each symptom over the past four weeks. Frequencies were not recorded for the other PTSD symptoms because they were more persistent behaviors (e.g., socially withdrawn) that did not typically happen as discrete occurrences.

The MDD, ADHD, and ODD modules were used. Anxiety was measured as a combination of the SAD, specific phobia, and social phobia modules. GAD was also collected but the PAPA did not gather dates of onset so it could not be determined if this disorder started prior to or following traumatic events.

Procedure—The study was approved by the Tulane University Committee on Use of Human Subjects. Interviewers received extensive training and ongoing supervision. The initial interviewers and the principal investigator were trained on the PAPA by a trainer from Duke University where the PAPA was created. Subsequent interviewers were trained by the PI. The PI watched portions of every interview on videotape with the research assistants to maintain fidelity. Written informed consent was obtained from primary caregivers. Signed assent was not obtained from children because of their young age. Interviews were conducted at a lab. Participants were monetarily compensated for their participation.

Data Analysis—Comparisons between the three groups were conducted with ANOVA or MANOVA (three groups as predictor) for continuous variables, with Student-Newman-Keuls multiple range tests for pairwise follow-up tests. For categorical variables, chi-square tests were conducted, with chi-square or Fisher's exact test for pairwise follow-up tests. For the analysis of the best predictor, hierarchical stepwise regression was used. Predictor variables were centered to reduce effects of colinearity and then entered sequentially to determine how much additional variance was accounted for by each variable.

Results

Preliminary Analyses

The three groups did not differ on children's age, sex, or whether fathers were employed. The groups differed on maternal age, maternal years of education, paternal age, paternal years of education, race, whether mothers were employed, and whether fathers lived in the homes. The statistical tests, means, and percentages are in Table 1. Because the Repeated Events group was primarily composed of children who witnessed domestic violence, it was expected that fathers would not live in the homes and mothers would be employed less often. Because the Hurricane Katrina disaster impacted the entire city of New Orleans, as opposed to a disadvantaged socioeconomic group such as the other two groups, it was expected that mothers’ and father's number of years of education would be higher. Tests of hypotheses were not controlled for these demographics because differences on demographics were expected (as in Nilsson et al., 2012) and controlling for these variables would eliminate variance due to group membership.

Did Non-PTSD Disorders Arise in the Absence of PTSD Symptoms?

Following McMillen et al (2002), if participants had three or more symptoms of PTSD, they were considered as categorical cases of PTSD for this analysis even though all of them did not have the full diagnosis. Nineteen percent (n=53) had two or fewer PTSD symptoms, 34% (n=97) had three or more PTSD symptoms but not the full diagnosis, and 47% (n=134) had the full PTSD diagnosis. All total, 81% (n=231) were considered PTSD cases.

Twenty-seven children developed MDD following their earliest traumas, and zero of these developed MDD in the absence of PTSD symptoms, χ^2 (1, N=284) = 6.85, p < .01. Thirty-nine children developed an anxiety disorder (SAD, specific phobia, or social phobia) following their earliest traumas and only two of these (5%) developed an anxiety disorder in the absence of PTSD symptoms, χ^2 (1, N=284) = 8.01, p < .005; both of them were in the Repeated Events group. Twenty-seven children developed ADHD following their earliest traumas and only two of these (7%) developed ADHD in the absence of PTSD symptoms, but this difference was not significant χ^2 (1, N=284) = 2.49, p = .11; both of them were in the Repeated Events group. For the actual proportion of children with ADHD in the absence of PTSD (4%), this study had 0.80 power to detect a difference if the proportion of children with ADHD in the presence of PTSD had been 15% or higher (the actual proportion was 11%). Fifty-five children developed ODD following their earliest traumas and only three of these (5%) developed ODD in the absence of PTSD symptoms, χ^2 (1, N=284) = 7.84, p < .01; two of them were in the Repeated Events group and one was in the Katrina group.

Aggregating all four new non-PTSD disorders together (MDD, anxiety, ADHD, and ODD), the 148 non-PTSD disorders with onsets after the earliest traumas were in 94 children, of which 97% were also PTSD cases, χ^2 (1, N=284) = 7.55, p < .01. Within each group, those with new non-PTSD disorders who also were PTSD cases were 100% in the Single Event group, 98% in the Katrina group, and 89% in the Repeated Events group.

Non-PTSD Disorders that Started *Prior* to the Earliest Traumas

On continuous measures of the number of symptoms for disorders that had onsets *prior* to the earliest traumatic events, the three groups did not differ on depression, anxiety, ADHD, or ODD, *Wilks' lambda* = 0.95, $F(8, 552) = 1.64$, $p = .11$) (Table 2).

On categorical measures of diagnoses for disorders that had onsets *prior* to the earliest traumatic events, the three groups did not differ on depression, anxiety, or ADHD, but they did differ on ODD diagnoses, χ^2 (2, N=284) = 6.04, p < .05. Pairwise comparisons showed that the Repeated Events group had significantly more ODD diagnoses that had onsets prior to the earliest traumatic events compared to both the Single Event , χ^2 (1, N=187) = 4.18, p < .05 and Katrina groups, χ^2 (1, N=222) = 4.17, p < .05.

PTSD and Non-PTSD Disorders that Started *Following* the Earliest Traumas

On continuous measures of the number of symptoms for disorders that had onsets *following* the earliest traumatic events, the three groups did not differ on PTSD, depression, anxiety, ADHD, or ODD, *Wilks' lambda* = 0.95, $F(8, 552) = 1.64$, $p = .11$) (Table 3).

The frequency of PTSD symptoms was also an a priori question regardless of whether overall PTSD severity differed between groups. Results were analyzed using a MANOVA with three predictor variables (groups) and eight criterion variables (eight PTSD symptom frequencies). This analysis revealed a significant multivariate effect for group, Wilks' lambda = 0.86, F(16, 546) = 2.66, p < .0005. Post hoc Student-Newman-Keuls tests revealed that the Single Event group had more frequent psychological distress at reminders (M = 9.2, SD = 11.3) compared to the Katrina (M = 6.3, SD = 8.1) and Repeated Events (M = 4.5, SD = 9.1) groups (p < .05). Whereas the Repeated Events group had more frequent physiological distress at reminders (M = 5.4, SD = 15.7) compared to the Single (M = 0.8, SD = 3.7) and Katrina (M = 0.6, SD = 3.0) groups (p < .0005). The groups did not differ significantly on frequencies of intrusive recollections, flashbacks, nightmares, sleep, concentration, or irritability.

On categorical measures of diagnoses for disorders that had onsets *following* the earliest traumatic events, the three groups did not differ on PTSD, depression, anxiety, or ADHD, but they did differ on ODD diagnoses, χ^2 (2, N=284) = 9.37, p < .01. Pairwise comparisons showed that both the Katrina group, χ^2 (1, N=199) = 3.87, p < .05, and the Repeated Events group, χ^2 (1, N=147) = 9.21, p < .005, had significantly more ODD diagnoses that had onsets following the earliest traumatic events compared to the Single Event group.

Strongest Predictor: Type of Event, Cumulative Types of Events, or Total Occurrences of Traumas?

A correlation matrix of the model variables indicated that cumulative types of events had the strongest relation with the number of PTSD symptoms (r = .15, p < .05) relative to type of event (group) (r = .01, p = .89) or total occurrences of traumas (r = .03, p = .61), so cumulative types of events was entered first into the model. As shown in Table 4, cumulative types of events was a significant predictor of number of PTSD symptoms, F (1,282) = 6.22, p < . 05. Total occurrences of traumas was added next to the model but the additional variance accounted for (change in r^2 = 0.0006) was not significant. When group was added to the model, it also did not significantly predict additional variance (change in r^2 = 0.0019).

Lastly, a curvilinear relationship was tested by adding a quadratic term for cumulative types of events. As shown in Table 4, the quadratic term did not account for significant additional variance (change in r^2 = 0.0027).

In summary, only cumulative types of events was significant, but it accounted for only approximately 2% of the variance (r^2 = 0.0216).

The results were similar when the number of MDD, ADHD, and ODD symptoms with onsets after the earliest trauma were the dependent variables. None of the predictors were significant for the number of anxiety symptoms with onset after the earliest traumas.

Discussion

The design of this study had several unique features and/or methodological advances over prior studies. This was the largest study to date to examine comorbid disorders in young children following traumas. The measure of trauma events was restricted to purely life-threatening events consistent with the DSM-5. The onsets of comorbid disorders were gathered to determine whether comorbid disorders began prior to or following the earliest traumatic events. Total occurrences of each type of trauma event and frequency of PTSD symptoms were gathered, and symptoms were assessed with standardized diagnostic interviews. These led to several important findings.

First, we replicated McMillen et al.'s (2002) finding that non-PTSD disorders rarely arise in the absence of substantial PTSD symptoms and extended it to single event accidental injuries and a repeated events group that consisted primarily of witnessing domestic violence. This should be immediately helpful to clinicians in treatment planning; even when faced with multiple comorbid disorders it is empirically justified to focus initial treatment on PTSD. This should also be helpful when planning intervention programs following large-scale disasters or other community-wide traumas (Scheeringa et al. 2014). With limited funding and manpower to implement interventions, these data indicate that scarce resources ought to be focused on PTSD. In addition, we found little support for the notion that individuals with repeated and prolonged trauma exposures need a new disorder to help identify them (van der Kolk 2005) as 89% of individuals in the Repeated Events group with new non-PTSD disorders also were PTSD cases.

Second, we found little to no evidence to support the speculation that individuals with cumulative trauma develop more complex (Hodges et al. 2013; Cloitre et al. 2009) or more severe symptoms. Those in the Repeated Events were different from the Single Event and Katrina groups only on the prevalence of ODD diagnoses, and were not different on PTSD, depression, anxiety, or ADHD. Because the Repeated Events group also had a higher prevalence of ODD diagnoses prior to the earliest traumas, this suggests that ODD is more prevalent in this population for reasons other than trauma exposure (Nilsson et al. 2012). Our study however was restricted to truly life-threatening events, in contrast to Hodges et al. (2013) and Cloitre et al. (2009) who expanded the measure of trauma to non-life threatening experiences.

The finding that ODD was more prevalent in the Repeated Events group prior to the earliest traumas is the first known evidence in youth that a group with repeated/prolonged exposure had a different psychiatric profile *prior* to trauma exposure. The findings are consistent with Nilsson et al.'s (2012) study of 462 adolescents in Sweden which showed that traumatic and stressful experiences were positively correlated with adverse family circumstances, indicating that cumulative trauma experiences do not happen at random; they tend to co-occur with other disadvantaged family variables (Nilsson et al. 2012). These findings may be more relevant explanatory factors for why certain populations have different symptom profiles. For example, findings in prior studies that complex trauma samples had more symptom complexity (Ford et al. 2009; Cloitre et al. 2009; Hodges et al. 2013; Nilsson et al.

2012) may have been due to pre-trauma factors rather than due to exposure to complex trauma.

Third, these findings provide little support for the oft-cited typology of type I and II. No disorder was uniquely more common in the Repeated Events group following the earliest traumas, as ODD diagnoses were more prevalent in both the Repeated and Katrina groups. Cumulative types of events was a better predictor of severity of PTSD and several of the trauma-related comorbid disorders (MDD, ADHD, and ODD) than type of event or total occurrences of traumas, consistent with Hickman et al. (2013).

These findings indicate areas in need of future clarification. Type II events have been described to have the quality of “longstanding” (Terr 1991), similar to Herman's (1993) description of “prolonged” trauma in adults, as part of the “type.” In our study, both the Repeated Events group, which experienced longstanding domestic violence, and the Hurricane Katrina group, which experienced longstanding exposure to the devastation of the disaster, showed few differences from a Single Event group. Also, type II events have been described as “repeated” as part of the type (Terr 1991; Herman 1993). This implied that one type of event was experienced repeatedly. In our study, cumulative types of events, regardless if they were the same type, was the only significant predictor of symptom severity, whereas the Repeated Events group was not. Together, these suggest both a simpler and more complex picture. Simpler in the sense that repetition of trauma seems important, whereas the qualitative type of trauma was not. Complicated in the sense that those exposed to repetitive trauma appeared to be different prior to the experiences of trauma. Future studies may be more beneficial by focusing on pre-event individual differences that serve as vulnerability factors for the development of PTSD or comorbid disorders.

Lastly, a possible explanation of why these findings contrast with prior speculations about the impact of repeated trauma is perhaps related to how trauma is experienced *following* the events as opposed to how the events occurred. PTSD is one of the few disorders in which symptoms are triggered by internal or environmental reminders, including psychological or physiological distress at trauma reminders and avoidance of conversations, people, places, or activities that resemble the events. These results showed that the Single event actually had greater frequency of psychological distress triggered by reminders compared to the Katrina and Repeated Events groups. This may be because the Single Event group was primarily involved in motor vehicle accidents and these children had to ride in cars every day, multiple times a day in their routine of their daily lives. Every single car trip could potentially be a triggering reminder. The Katrina group was also exposed to constant reminders in their homes and neighborhoods of the destruction, but these may have been relatively less personally threatening. Children who witnessed domestic violence or suffered maltreatment in the Repeated Events group were likely not faced with such frequent reminders. The notion that certain PTSD symptoms may have reciprocal temporal impacts on each other is consistent with previous findings that high levels of ongoing arousal lead sequentially to emotional numbing and worsened symptoms (Weems et al. 2003; Flack et al. 2000; Litz et al. 1997).

In contrast, the Repeated Events group had more frequent physiological, as opposed to psychological, distress at reminders compared to the Single and Katrina groups. Physiological reactions to trauma stimuli have received considerable attention in previous research, but there are no prior studies that we are aware of that have examined concordance of psychological versus physiological reminders as a function of type of trauma exposure. The reason behind our finding that psychological distress at reminders was more common in the Single Event group but physiological distress at reminders was more common in the Repeated Events groups could be related to pre-trauma factors that differentiated the groups or to the different trauma experiences, but the finding needs replication and further study.

Limitations

In addition to the limitations mentioned earlier, the Repeated Events group was composed of children who experienced interpersonal violence in the form of witnessing domestic violence. A sample that included more victims of sexual and physical abuse may have produced different results, although such populations are likely to have the same issues of confounding pre-trauma individual and environmental differences. Caregivers dated the onsets of symptoms retrospectively, which may have led to errors in remembering dates, however the caregivers were blind to the reason that we were asking for dates. Furthermore, the span of time over which we asked was a maximum of five years in the past, which is relatively short compared to studies of older populations. The Repeated Events group sometimes were exposed to domestic violence since birth, but we did not allow the date for earliest trauma until three years of age because of the normal developmental (Fivush and Hamond 1990) and clinical (Terr 1988) evidence that children do not develop autobiographical narratives until around 36 months of age, and there are no documented cases of PTSD younger than three years. This method may have led to an underestimate of non-PTSD disorders that developed following traumas in all groups, but may have been relatively more pronounced in the Repeated Events group. Lastly, due to the shorter length of time alive and emerging executive function cognitive processes in young children, this may have limited the development of symptom complexity that has been hypothesized for older populations; however, our focus on younger children may have allowed a more controlled examination of the impact of events without influence from intervening variables over time.

In summary, high levels of comorbidity actually are not unique to PTSD. For example, estimates of the degree of comorbidity between two disorders such as anxiety in youth with depression range from 15% to 75% (Cummings et al. 2014). Between 40-60% of individuals with schizophrenia abuse alcohol or illicit drugs (Lubman et al. 2010). The rate of individuals with ADHD who have comorbid anxiety is estimated at 25% (Schatz and Rostain 2006). These estimates are low estimates of the total load of comorbidity because they are estimates of only two disorders, as opposed to the estimate of total number of comorbid disorders. The issue of comorbidity following trauma however has had unique salience because PTSD is one of the few major disorders with an etiologic event. The etiological event allows speculation about the times of onset of comorbid disorders with precision that is not possible with other disorders. This study employed that precision to address several important issues.

This body of findings does not support a theory that the type of traumatic event leads to different outcomes without also considering pre-trauma individual differences and the potential environmental triggers post trauma that may perpetuate PTSD symptoms. Type of event appears confounded with these other variables. In particular, these findings provide little support for the theory that interpersonal violence leads to more severe trauma-related symptoms. Lastly, while this debate is interesting, it must be noted that cumulative types of trauma accounted for only 2% of the variance in PTSD symptoms, consistent with Hodges et al. (2013) who found that cumulative trauma by child report accounted for only 3% of the variance in symptoms, and caregiver report accounted for only 9% of the variance.

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Table 1

Demographics for Single Event, Repeated Events, and Hurricane Katrina groups.

	Single (S) n = 62		Katrina (K) n = 137		Repeated (R) n = 85		Test
	M	SD	M	SD	M	SD	
Child age (years)	5.2	1.1	5.1	1.0	5.1	1.1	ns
Maternal age (years)	28.9	6.5	34.5	10.9	31.2	8.2	F (2, 281) = 8.4, p < .0005 SNK: K > R, S
Maternal years of education	12.4	2.3	13.7	2.5	12.0	2.3	F (2, 281) = 15.4, p < .0001 SNK: K > R, S
Paternal age (years)	30.4	5.4	34.1	8.8	33.6	7.2	F (2, 257) = 4.8, p < .01 SNK: K, R > S
Paternal years of education	11.9	2.3	13.0	2.7	11.7	1.9	F (2, 255) = 9.5, p < .0001 SNK: K > S, R

	%	n	%	n	%	n	
Sex (male)	68%	42	57%	78	65%	55	ns
Race							χ^2 (8,N=284)=17.0, p < .05
B/AA	81%	50	61%	83	61%	52	B/AA vs. all else: S > K, R
W/C	11%	7	28%	38	16%	14	W/C vs. all else: K > S
Mix	3%	2	5%	7	13%	11	
Other	2%	1	1%	2	2%	2	
Latino	3%	2	5%	7	7%	6	
Mother employed	60%	37	50%	69	28%	24	χ^2 (2,N=284)=16.5, p<.0005 S, K > R
Father employed	58%	29	65%	74	63%	44	ns
Father lives in home	23%	14	34%	46	7%	6	χ^2 (2,N=284)=20.7, p<.0001 S, K > R

	Median	Range	Median	Range	Median	Range
Number of types of events	1	1-1	1	1-4	1	1-4
Number of occurrences	1	1-1	1	1-5	9.0	2-1,097

	%	n	%	n	%	n
Accidental injury	70%	43	22%	30	31%	26
Witnessed domestic violence	15%	9	5%	7	100%	85
Medical	11%	7	4%	5	2%	2
Hurricane Katrina	3%	2	100%	137	8%	6
Physical abuse	0%	0	0%	0	6%	5
Sexual abuse	0%	0	2%	3	4%	3
Other	2%	1	9%%	11	13%	11

ns = not significant. SNK = Student-Newman-Keuls multiple range tests. B/AA = Black/African-American. W/C = White/Caucasian. Mix = mixed B/AA and W/C. Other traumatic event includes animal attack, house fire, and near drowning.

Table 2

Number of symptoms and percentage of diagnoses for each disorder that had onsets *prior* to the earliest traumatic events by groups.

Number of symptoms	Single Event (S)		Katrina (K)		Repeated Events (R)		Tests
	M	SD	M	SD	M	SD	
MDD	0.6	1.2	0.9	1.6	0.4	1.1	ns
Anxiety	1.4	1.4	1.5	1.6	1.2	1.3	ns
ADHD	2.9	4.7	2.8	4.3	3.2	4.6	ns
ODD	1.6	2.3	1.5	2.3	1.8	2.5	ns

Diagnosis	%	n	%	n	%	n	Chi-square tests
MDD	2%	1	6%	8	1%	1	ns
Anxiety	5%	3	13%	18	11%	9	ns
ADHD	11%	7	12%	17	19%	16	ns
ODD	11%	7	14%	19	25%	21	χ^2 (2,N=284)=6.0, p < .05 R > S, K

ns = not significant.

Table 3

Number of symptoms and percentage of diagnoses for each disorder that had onsets following the earliest traumatic events by groups.

Number of symptoms	Single Event (S)		Katrina (K)		Repeated Events (R)		Tests
	M	SD	M	SD	M	SD	
PTSD	5.6	3.4	5.7	3.2	5.7	3.2	*Wilks' lambda = 0.94, F (10,554) = 1.70, p = 0.08
MDD	1.4	1.8	1.7	2.0	1.9	1.9	
Anx	1.0	1.5	0.8	1.4	1.3	1.6	
ADHD	1.0	2.5	2.2	4.2	2.8	4.4	
ODD	1.3	2.0	1.7	2.5	2.4	2.7	
PTSD Frequency	58.4	54.3	53.8	43.7	49.1	41.1	ns

Diagnosis	%	n	%	N	%	n	Chi-square tests
PTSD	40%	25	46%	39	51%	70	ns
MDD	6%	4	10%	14	11%	9	ns
Anxiety	18%	11	11%	15	16%	14	ns
ADHD	5%	3	9%	12	14%	12	ns
ODD	8%	5	19%	26	28%	24	χ^2 (2,N=284) = 9.4, p < .01

* One-way MANOVA with three groups and five disorders as outcomes (PTSD, MDD, Anxiety, ADHD, and ODD). PTSD = posttraumatic stress disorder. MDD = major depressive disorder. Anxiety = combination of separation anxiety, specific phobia, and social phobia. ADHD = attention-deficit/hyperactivity disorder. ODD = oppositional defiant disorder. PTSD Frequency = number of occurrences of PTSD symptoms over 4 weeks period. ns = not significant.

Table 4

Results of hierarchical stepwise regression model building.

	β	t	R^2	Changing in R^2	F
Model 1					
Number of types of events	0.015	2.49		0.0213	6.22*
Model 2					
Number of types of events	0.146	2.47			
Number of occurrences	0.024	0.41	0.0222	0.0006	0.17
Model 3					
Number of types of events	0.162	2.60			
Group	−0.046	−0.74	0.0235	0.0019	0.54
Quadratic model					
Number of types of events	0.022	0.15			
Quadratic term	0.135	0.89	0.0243	0.0027	0.78

β = beta weight, or standardized multiple regression coefficients.