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Predicting the Transition from Acute Stress Disorder to Posttraumatic Stress Disorder in Children with Severe Injuries

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Abstract

Introduction—To examine predictors of risk for and the transition between acute stress disorder (ASD) and posttraumatic stress disorder (PTSD) in a longitudinal sample of youth with severe injuries admitted to the hospital to assist with treatment and discharge planning.

Methods—Youth were assessed for ASD during the initial hospital stay, and followed-up over an 18-month period for PTSD (n=151). Youth were classified into 4 groups including Resilient (ASD-, PTSD-), ASD Only (ASD+, PTSD-), PTSD Only (ASD-, PTSD+), and Chronic (ASD+, PTSD+). Demographic, psychiatric, social context, and injury-related factors were examined as predictors of diagnostic transition.

Results—The results of MANOVA and pairwise comparisons found that peritraumatic dissociation, gender, and SES were significant predictors after controlling for multiple testing.

Discussion—Results suggest both within-child and contextual factors contribute to longitudinal response to trauma in children. Clinicians should consider early screening and discharge planning, particularly for those most at risk.

Keywords

Trauma; Acute Stress Disorder; Posttraumatic Stress Disorder; Longitudinal

Injury severe enough to warrant hospitalization is common among youth. According to the Centers for Disease Control, in 2013 over 300,00 youth aged 18 or younger were injured severely enough to warrant hospitalization or transfer to a trauma center or medical facility (Centers for Disease Control and Prevention, 2013). Posttraumatic stress disorder (PTSD) in

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youth surviving pediatric injury is common and studies show prevalence as high as 19% to 40%, with higher rates observed in females (Holbrook, 2005; Zatzick, et al., 2006). A growing body of research has demonstrated that traumatic stress is associated with negative long-term outcomes affecting mental health (e.g., anxiety, depression, PTSD) and physical health (e.g., hypertension, hyperlipidemia, obesity, and coronary heart disease) (see McFarlane, 2010). In addition to connecting patients with services that address basic needs (e.g., housing, food) or follow-up medical care, hospitals serve as a critical opportunity to identify and connect patients with follow-up mental health services that may reduce long-term negative health outcomes and risks for future hospital admissions (Gordon, 1999). Thus, in-hospital identification of traumatized youth at risk for long-term traumatic stress outcomes is an important part of discharge planning to help prevent some of the negative health consequences associated with traumatic injury.

Acute stress disorder (ASD) is an initial warning sign of risk for traumatic-stress related outcomes observable during the hospital stay. ASD involves many of the symptoms associated with PTSD (i.e., re-experiencing, avoidance, physiological arousal, distress/impairment) as well as dissociative symptoms (i.e., numbing, reduces awareness, derealization, depersonalization, amnesia) (American Psychiatric Association, 1994)[1]. Predictors of ASD have included female gender and violent injury (Holbrook, 2005), as well as family stress, caregiver stress, pain severity, and child's age (Saxe, et al., 2005). However, studies that have mixed support for the ability of ASD to predict PTSD or other traumatic-stress related outcomes (Bryant, Salmon, Sinclair, & Davidson, 2007; Kassam-Adams & Winston, 2004a; Meiser-Stedman, Yule, Smith, Glucksman, & Dalgleish, 2005). Thus, more research is needed to better predict longer-term outcomes such as PTSD, particularly from data available during hospitalization.

Prior research with injured patients has suggested that PTSD is associated with a number of pre-trauma factors, many of which overlap with ASD, including female gender, age, minority status, pre-injury psychological functioning, and a history of prior trauma exposure (for review, see Brosbe, Hoefling, & Faust, 2011). Studies have also found that PTSD is associated with injury-related factors including greater perceived trauma severity and increased acute heart rate (Brosbe, et al., 2011; De Young, Kenardy, & Spence, 2007; Holbrook, 2005; Kassam-Adams, Garcia-Espana, Fein, & Winston, 2005; Meiser-Stedman, 2007; Nugent, Christopher, & Delahanty, 2006). Researchers have also considered early predictors that may be modifiable; parent functioning, for example, has been found to predict child PTSD and to even moderate the influence of peritraumatic stress symptoms (Brosbe, et al., 2011; Hall, et al., 2006; Nugent, Ostrowski, Christopher, & Delahanty, 2007). Unfortunately, methods for combining risk factors associated with ASD and PTSD individually to predict long-term adjustment have remained largely unexplored.

The present investigation furthers this literature by classifying a sample of pediatric injury patients based on transition from ASD diagnostic status while hospitalized to PTSD diagnostic status over the course of an 18-month follow-up. We then examine what factors

[1]In the DSM-IV, dissociative symptoms were required for diagnosis. In the DSM-5, the dissociative symptoms are included but not required for ASD (Association, 2013).

predict transition from ASD to PTSD. Specifically, we aim to address two important questions in pediatric injury research. First, we sought to characterize the prevalence of pediatric injury patients who were categorized into one of four potential groups (Bonanno & Mancini, 2012; Norris, Tracy, & Galea, 2009) including those who: (a) do not meet ASD or PTSD criteria (Resilient), (b) meet ASD criteria but do not meet PTSD criteria (ASD Only), (c) do not meet ASD criteria but do meet PTSD criteria (PTSD Only), and (d) meet both ASD and PTSD criteria (Chronic). Second, we conducted exploratory analyses to examine the wide range of predictors that have been previous associated with ASD or PTSD individually, but have yet to be used to predict transition between these diagnostic categories.

We hypothesized that demographic (younger age, female sex), psychiatric (fewer peritraumatic dissociation symptoms, lower internalizing, and lower externalizing symptoms), social context (European-American ethnicity, lower family strain, lower maternal stress reaction, and higher socio-economic status), and injury-related (lower pain, lower injury severity, and nonviolent injury type) variables would differentiate the Resilient transition status group from ASD Only, PTSD Only, and Chronic groups. We also hypothesized that the largest difference would be observed between the Resilient and Chronic groups, with intermediate differences observed for the ASD Only and PTSD Only groups. Identifying the factors that influence the transition from ASD to PTSD may help care providers identify injured youth at risk for long-term distress, ideally before hospital discharge while the youth and family are still service-connected.

METHODS

Participants

Participants were 151 youth ages 7 to 18 and their parents drawn from a sample of 204 youth who were sequentially admitted to Shriner's Burn Hospital in Boston and Boston Medical Center for burns and injuries between April 2002 and January 2004 as part of a prospective study (Hall, 2005; Hall, et al., 2006; Saxe, et al., 2005). All children ages 7 to 18 were eligible for inclusion unless they or their parents did not speak sufficient English to complete study measures, had a Glasgow Coma Scale equal to or less than 7 at the time of admission to the hospital, or lived more than 2 hours from the hospital. As is common with longitudinal studies, attrition and missed assessments occurred throughout the 18-month follow-up period. Rates of completion and missingness for the traumatic stress assessments can be seen in Table 1.

Procedure

The study protocol and research materials were reviewed and approved by the Institutional Review Boards of both hospitals. Children and parents were invited to participate in the study by trained research personnel after the attending physician deemed them medically stable. After obtaining assent and consent, parents completed a battery of questionnaires assessing their own and their child's psychosocial functioning, acute stress symptoms, and family functioning. A researcher interviewed the child and parent during the initial hospital stay (M=5.47, SD=10.69, days following injury) using semi-structured interviews described

below. Every effort was made to interview parent and child separately to ensure privacy. Parents and children completed questionnaires and interviews 3, 6, 12, and 18 months later to assess for posttraumatic symptoms and psychosocial functioning. Participants were paid $50 for participation in the acute assessment, and $50 (and transportation costs) for follow-up assessments.

Measures

Demographics—Demographic information was collected during the parent interview.Parents reported the child's age, gender, and race. Race was classified as European American or Minority for the current analyses.

Violent/Nonviolent Injury—Trauma type was classified as either nonviolent injury (e.g., motor vehicle accident, pedestrian motor vehicle accident, fell off bike, fell of cliff, fell, crushing injury, suffocation, sports injury, accidental penetrating injury), or violent injury (e.g., stab wound, gunshot wound, assault) for the pediatric injury sample. Information about the nature of the burns in the burn sample was not available, and thus was not included in this classification.

Colored Analogue Pain Scale—The Colored Analogue Pain Scale is an easily administered visual analogue instrument in which the child slides a marker along a 10-cm line with increasing intensity of red color corresponding to increased intensity of current pain. Scores on this instrument correlate highly with visual analogue instruments, which are very widely used with populations of children who have pain syndromes (McGrath, Seifert, Speechley, & J.C., 1996).

Morphine Dose—Mean equivalency doses of morphine and other psychotropic medications, administered in the entire hospital period, were ascertained via chart review by trained research staff. Sums of all entries of the dose administered throughout the hospital stay for all opiate and psychoactive medications were divided by the child's weight and the number of days hospitalized for a final mg/kg/day value for each medication administered. Children received opiate medications in various forms (e.g., morphine, meperidine) and through various routes of administration (oral, parenteral), thus an equivalency dose of oral morphine was calculated by using a protocol from a standard pharmacology textbook (Reisine and Pasternak, 1996). Morphine dose was categorized into no morphine, low dose (. 01 – 1.0 mg/kg/day), and high dose (1.01 – 9.65 mg/kg/day).

***Diagnostic Interview for Children and Adolescents* (DICA; Reich, 2000)—**The DICA is a structured diagnostic interview that was used to assess ASD and PTSD associated with the injury, as well as past PTSD. The DICA-PTSD module (Reich, 2000) was used to assess posttraumatic stress symptoms at the follow-up assessments. Symptoms are rated by the clinician as present or absent and diagnosis is made based on the presence of the requisite number of symptom in each symptom class. The DICA-PTSD module has been widely used to diagnose PTSD in children in clinical and nonclinical populations who have been exposed to a variety of traumatic experiences and has demonstrated sound

psychometric properties (Hawkins & Radcliffe, 2006; Yasik, et al., 2001). PTSD was coded as present or absent.

ASD was assessed at the acute phase using a modified version of the PTSD module of the DICA. The DICA-ASD (Miller, Enlow, Reich, & Saxe, 2009) is a structured clinical interview that was modified to include five additional symptom clusters to be consistent with diagnostic criteria of ASD in the Diagnostic and Statistical Manual, Fourth Edition (DSM-IV; American Psychiatric Association, 2000). These additional symptom clusters included emotional numbing, reduction of awareness of surroundings, derealization, depersonalization, and dissociative amnesia. The DICA-ASD has been found to have excellent reliability (α=.97, κ=1.00) and validity (Miller, et al., 2009). ASD was coded as present or absent.

Peritraumatic Dissociation—To examine if the severity of peritraumatic dissociation symptoms predict the transition from ASD to PTSD, the nine peritraumatic dissociation items from the DICA-ASD (Miller, et al., 2009) were summed to create a continuous peritraumatic dissociation total score. Items were scored 1=no, 3= sometimes, 5=yes; total scores ranged from 9 to 45.

The Child Behavior Checklist **(CBCL; Achenbach, 1991)—**was used to assess symptoms of internalizing and externalizing distress at the acute assessment. The CBCL is a 118-item parent-report measure of behavioral and emotional problems. It provides norm-referenced scores on a variety of scales including empirically derived scales (e.g., anxious/depressed, thought problems, aggressive behavior) and DSM-oriented scales (e.g., anxiety problems, attention deficit/hyperactivity problems, oppositional defiant problems). For the purpose of this study, only the total internalizing and total externalizing raw scores were used. SES was calculated as a weighted average of parents' occupation (Hollingshead, 1975) as reported on the CBCL.

The Coddington Life Events Scale **(LES; Coddington, 1972; Holmes & Rahe, 1967)—**The LES identifies life events experienced by the participant and significant others in the past year. Events are assigned "life change units" to weight the impact of each event (e.g., *death of a parent* versus *beginning school*). The Coddington scales have been developed and utilized across multiple socioeconomic and ethnic groups. Examples of items are: (1) the death of a parent, (2) birth of a brother or sister, (3) failing a grade in school, (4) appearance in juvenile court, (5) illness in the family, and (6) loss of a parent's job.

PTSD Checklist **(PCL-C; Weathers, Litz, Herman, Huska, & Keane, 1993)—**Parental posttraumatic stress symptoms in reaction to their child's injury was assessed at the 3-month assessment using the civilian version of the PCL-C, a 17-item self-report questionnaire that assesses PTSD symptoms consistent with the DSM-IV diagnostic criteria. The PCL-C has strong psychometric properties and has been cross-validated with the Clinician Administered PTSD Scale (Blake, et al., 1995; Blanchard, Jones-Alexander, Buckley, & Forneris, 1996).

***Family Strains Index* (FSI; McCubbin, Patterson, & Wilson, 1987)—**Parents completed the FSI, a 10-item self-report measure of changes and stressful life events that are believed to increase vulnerability to the effects of subsequent stressors. Items are scored dichotomously (i.e., yes or no). The total score of the FSI from the acute assessment was used in the current study. Previous studies have reported favorable reliability and convergent validity (McCubbin, Thompson, & McCubbin, 1996). The FSI has an internal consistency of 0.72 and a test-retest reliability of 0.73. The FSI was not administered to the burn sample, thus is only available for the violent and nonviolent injury cases.

Data Analysis

Youth were classified into four groups based on transitions from ASD diagnostic status at the acute assessment and PTSD diagnostic status at any time during the 18-month follow-up period. These groups were defined as: Resilient (no ASD or PTSD), ASD Only, PTSD Only (no ASD, but PTSD), and Chronic (ASD and PTSD). All data were analyzed using SPSS 21. Data were missing primarily due to differences in data collection between the two samples (e.g., not all data collected in all waves for both burn and injury samples) and attrition. Missing Value Analysis indicated that missingness was associated with other observed variables in the dataset, suggesting that the data were missing at random and could be reasonably estimated from available data. Multiple imputation was used to impute predictor variables for 10 datasets, and imputed values were restricted to the range of observed scores of available data. Pooled results are reported for all analyses. Imputation was not used for ASD or PTSD diagnoses, and thus not transition status.

For the primary aims, four separate MANOVAs, with transition status as the DV, were used to examine predictor sets (demographic, psychosocial, social context, and injury related) as it is recommended that no more than 10 predictors are used in each model with smaller samples (Stevens, 1980). Roy's Largest Root was used for multivariate significance testing. Significant variables from each predictor set MANOVA were then entered into the final model MANOVA. Type III Sums of Squares were computed to determine the effects of each variable accounting for the effects of other variables entered into the model, regardless of order entered. Sidak-corrected *post hoc* comparisons were used to follow-up significant predictors in the final model to correct for Type I error. Pooled statistics are not available for MANOVA in SPSS 21, thus the pooled statistics were calculated separately in Excel 2013. Pooled multivariate and tests of between subject effects were calculated by creating an average of the *F*-statistic and conducting a test of significance using the pooled *F*. Pooled *post hoc* comparisons were calculated by creating the average of the mean difference and standard error of the mean difference for the imputed datasets (excluding the original dataset) to create a pooled *t*-ratio and the uncorrected p-value was estimated. The *p*-values were then adjusted for multiple testing using the Sidak correction.

RESULTS

Descriptive Statistics

Descriptive statistics of all predictor variables and degree of missingness can be found in Table 1 for all participants enrolled in the study (n=204). Participants included in subsequent

analyses were youth and their parents who completed both acute and at least one follow-up assessment over the 18-month follow-up period (n=151). *T*-tests comparing completers to noncompleters revealed that non-completers had shorter hospital stays ($M_{difference}$ = −5.5 days, *p*=.002), greater internalizing symptoms ($M_{difference}$ = 4.1, $p < .001$), and less family strain ($M_{difference}$ = −1.7, $p = .039$). Completers and non-completers did not significantly differ on any other study variable.

Approximately half (51.7%, n = 78) of the sample was classified as Resilient. The remaining youth were diagnosed with ASD and/or PTSD at some point in the study period. Of those diagnosed with ASD (n=57; 37.7%), only 29.8% (n=17) were diagnosed with PTSD during follow-up (i.e., Chronic, 11.3% of total sample), where as most (70.2%) of those diagnosed with ASD did not report PTSD during follow-up (i.e., ASD Only, n = 40, 26.5% of total sample). Of those diagnosed with PTSD during the follow-up (n=33, 21.9%), 48.5% (n=16) were not diagnosed with ASD at the acute assessment (i.e., PTSD Only, 10.6% of the total sample).

Individual Models

Results of the primary MANOVA models are found in Table 2.

Demographic Predictors—Age and gender were examined as demographic predictors. No data was missing on these variables, thus results from the non-imputed data are presented. The overall multivariate test was significant (Roy's largest root = .067, $F(3, 147) = 3.282$, $p = .023$, partial $\eta^2 = .06$). Tests of between-subjects effects revealed that only gender was significant ($F(3, 147) = 3.266$, $p = .023$, partial $\eta^2 = .06$).

Psychiatric Predictors—Peritraumatic dissociation, internalizing symptoms, externalizing symptoms, and past PTSD symptoms were examined as psychiatric predictors. The overall multivariate test was significant (pooled Roy's largest root = .302, $F(4, 146) = 11.016$, $p < .001$, partial $\eta^2 = .25$). Tests of between-subjects effects revealed that peritraumatic distress (pooled $F(3, 147) = 11.890$, $p < .001$, partial $\eta^2 = .20$) and externalizing symptoms (pooled $F(3, 147) = 2.850$, $p = .039$, partial $\eta^2 = .05$) were significant, with peritraumatic dissociation accounting for the largest portion of variance. Internalizing symptoms and past PTSD symptoms, accounting for other variables in the model, were not significant.

Social Context Predictors—Social context variables associated with social and family environment (SES, minority status, stressful life events, family strain, and parental post-traumatic symptoms) were tested in a single model. The overall multivariate test was significant (pooled Roy's largest root = .098, $F(5, 145) = 2.830$, $p = .018$, partial $\eta^2 = .09$). Tests of between-subjects effects revealed that SES (pooled $F(3, 147) = 2.888$, $p = .038$, partial $\eta^2 = .06$) and parental posttraumatic symptoms (pooled $F(3, 147) = 3.011$, $p = .032$, partial $\eta^2 = .06$) were significant. Minority status, stressful life events, and family strain were not significant, controlling for other variables in the model.

Injury-Related Predictors—Pain, days in the hospital, morphine dose, and violent vs. non-violent injury were examined as injury-related predictors. The overall multivariate test

was not significant (pooled Roy's largest root = .043, $F(4, 110) = 1.167$, $p = .330$, partial $\eta^2 = .04$).

Final Model

The final model included those significant predictors from the previous models, gender, peritraumatic dissociation, externalizing symptoms, SES, and parental posttraumatic stress symptoms. The overall multivariate test was significant (pooled Roy's largest root = .417, $F(5, 145) = 12.083$, $p < .001$, partial $\eta^2 = .29$), and explained 29% of the variance in ASD/PTSD transition status. Tests of between-subjects effects revealed that all predictors were significant: gender (pooled $F(3, 147) = 3.266$, $p = .023$, partial $\eta^2 = .06$), peritraumatic dissociation (pooled $F(3, 147) = 11.890$, $p < .001$, partial $\eta^2 = .20$), externalizing symptoms (pooled $F(3, 147) = 2.850$, $p = .039$, partial $\eta^2 = .05$), SES (pooled $F(3, 147) = 2.888$, $p = .038$, partial $\eta^2 = .06$), and parental posttraumatic symptoms (pooled $F(3, 147) = 3.011$, $p = .032$, partial $\eta^2 = .06$) were significant.

Post hoc comparisons with Sidak corrected *p*-values were conducted to determine which transition status groups differed on the significant predictors. Gender differentiated Chronic from Resilient (pooled $t = 2.984$, $p = .020$) and Chronic from ASD Only (pooled $t = 2.696$, $p = .046$), such that females were significantly more likely to be in the Chronic versus Resilient or ASD Only groups. Peritraumatic dissociation significantly differentiated between Resilient and ASD Only (pooled $t = 4.233$, $p < .001$) with higher dissociative symptoms in the ASD Only group; between Resilient and Chronic (pooled $t = 4.985$, $p < .001$), with higher dissociative symptoms in the Chronic group, and between PTSD Only and Chronic (pooled $t = 3.478$, $p = .004$), also with higher dissociative symptoms in the Chronic group. These pairings represent the difference between groups diagnosed with ASD vs without ASD, of which peritraumatic dissociation is a primary feature. The exception was that ASD Only vs. PTSD Only groups were not significantly different ($p = .11$). SES significantly differentiated between ASD Only and Chronic groups (pooled $t = 2.671$, $p = .049$) suggesting that youth with low SES and ASD were less likely to recover. All other post hoc comparisons were not significant after correcting for multiple comparisons.

DISCUSSION

The present study sought to address two important questions in pediatric injury research about the transition from ASD to PTSD with a prospective study of severely injured youth. First, the study aimed to characterize the prevalence of pediatric injury patients who were categorized into one of four potential groups: (a) Resilient patients not meeting ASD or PTSD criteria, (b) Chronic patients meeting both ASD and PTSD criteria, (c) ASD Only patients who did not develop PTSD, and (d) PTSD Only patients not meeting ASD in the hospital. Second, the study aimed to test predictors of these classifications to help identify factors that may help in discharge planning from the hospital setting. The current study has several notable strengths including the prospective design, assessment of ASD during the acute hospital visit, and the use of diagnostic interviewing (versus self-report questionnaires) to classify participants to address these aims.

We first set out to describe the course of traumatic stress reactions by examining the prevalence of ASD and PTSD. Approximately a third of youth in this sample met diagnostic criteria for ASD. Other samples of trauma-exposed children have reports wide ranges in prevalence rates of ASD, such as 8% (Kassam-Adams & Winston, 2004b) to 28% (Winston, et al., 2002). The prevalence of PTSD in the current sample (21.9%) was within range of other research (e.g., 19 - 40%) that has looked at PTSD in youth experiencing variety of trauma types (Holbrook, 2005; Zatzick, et al., 2006). Approximately 52% of the youth in our sample were classified as Resilient, 27% as ASD Only, 11% PTSD Only, and 11% in the Chronic transition groups. The pattern of rates of the transition status groups found in our study were similar to rates of PTSD trajectories (not including ASD) found in other studies. For example, in a study of young unintentionally burned children (1-6 years old) and assessed PTSD at 1- and 6-months post-trauma using interviews with parents (De Young, Kenardy, Cobham, & Kimble, 2012). The majority of these children (72%) were classified as having a resilient trajectory (i.e., did not meet criteria for PTSD at any time point). The next largest group (18%) was described to be the recovery trajectory group (most similar to our ASD Only group) followed by the chronic PTSD group (8% of youth). Lastly, a smaller number (n = 3; 2%) showed a delayed onset of PTSD (most similar to our PTSD Only group).

Our second aim was to examine predictors of these transition groups. We focused primarily on variables that could be collected relatively easy during the hospital stay via parent or self-report questionnaires, with the exception of parental stress reaction collected at the 3-month follow-up. Peritraumatic dissociation, a primary feature of DSM-IV ASD criteria, was the strongest predictor of transition status, explaining 20% of the variance. Pairwise comparisons revealed that greater peritraumatic dissociation was associated with the transition groups that were defined by the presence of ASD (ASD Only and Chronic) when compared to the groups that did not have ASD (Resilient and PTSD Only). It did not, however, differentiate between those youth who initially developed ASD but not PTSD (i.e., ASD Only) from those youth who did not initially develop ASD but later developed PTSD (i.e., PTSD Only) after correcting for multiple testing. These results suggest that the absence of peritraumatic dissociation may predict those youth who will be resilient (both in the immediate aftermath and in the months that follow child injury), yet the presence of peritraumatic dissociation may not predict the development PTSD following child injury. This is consistent with research that found that peritraumatic dissociation does not predict long-term PTSD diagnosis (Bryant, Friedman, Spiegel, Ursano, & Strain, 2011).

Gender predicted who would be more likely to experience chronic traumatic stress from those who would either a) not develop any significant distress or b) would recover from initial traumatic distress. Females were more likely to develop a chronic course, whereas males were more likely to either not develop any significant symptoms or recover from acute distress.

SES was also a significant predictor of transition status. The only significant pairwise comparison after correction for multiple testing differentiated between ASD Only and Chronic transitions groups. This suggests that for youth with ASD, having low SES increases the risk for developing PTSD. Youth with low SES who did not develop ASD were

not at significantly greater risk of developing PTSD. This finding is consistent with prior research that suggests that lower SES predicts posttrauma adjustment (Galea, et al., 2007), as well as poor mental health more generally (Fryers, Melzer, & Jenkins, 2003). No consistent patterns were detected with the PTSD Only and ASD Only groups, which tended to fall along a continuum between the significantly different resilient and chronic groups.

Limitations

Findings from the current study should be considered in light of the following limitations. The data was collected over 10 years ago, prior to the release DSM-5. Peritraumatic dissociation, a primary and required feature of ASD in the DSM-IV, has received decreased emphasis in the diagnostic criteria of ASD in the DSM-5 (American Psychiatric Association, 2013). The requirement that dissociative symptoms be present in the DSM-IV classification was considered by many to be too restrictive, leading to the under-identification of individuals with severe acute stress reactions (Bryant, et al., 2011). Thus, our use of the DSM-IV based criteria likely resulted in a more restricted sample than would be obtained using DSM-5 criteria. As research emerges with the new DSM-5 ASD criteria the question of the utility of the role of peritraumatic dissociation in traumatic stress outcomes will require further examination.

The present study was limited by a relatively small sample size, especially in the lagged and persistent groups. As with many longitudinal studies, there was considerable attrition, resulting in reduced statistical power and the possibility of Type II errors. Multiple imputation was used to minimize these effects and reduce bias associated with deleting or ignoring missing data (Little, Jorgensen, Lang, & Moore, 2013), but is not without limitations. Our sample was limited to children who were injury or burn victims, thus results may not generalize to children and adults with other types of traumas (e.g., natural disasters, witnesses of trauma, sexual abuse). Future studies should examine ASD and PTSD symptoms in those who have experienced other types of traumatic events. This study was a naturalistic follow-up study, thus services upon discharge were not standardized, nor was information about service-use collected. It is possible that some youth at risk for PTSD received services in some form confounding our ability to predict long-term PTSD risk. This is an important area for future research.

The classification approach we used in the current study is only one of several methods of examining course. For example, we did not examine subthreshold classifications as used by Perkonigg and colleagues' (2005) study of PTSD trajectory. Although symptoms certainly fall on a continuum of severity, classification approaches have the benefit of providing simple heuristics that can be used to quickly make important clinical decisions and allow for allocation of limited resources (Marewski & Gigerenzer, 2012). Furthermore, insurers often require clinical diagnosis for reimbursement of treatment, thus prediction of diagnostic groups yields additional clinical utility. However, alternative models that account for greater symptom variation may produce different results (Bonanno & Mancini, 2012). We previously used growth mixture models to identify categorical trajectories of PTSD following trauma in a sample of children in families reported for violence (Nugent, et al.,

2009). Findings from that study revealed a resilient trajectory and a persistent symptom trajectory, with older age and more past trauma found in the persistent symptom class.

Clinical Implications

These findings hold important implications for clinical interventions. To begin, these data suggest that an extensive number of youth who have experienced physical trauma report significant acute psychiatric symptoms during their hospital stays. Although many of these youth reported symptom levels below diagnostic threshold within the 3 -18 months following the injury, a significant number of youth reported psychiatric distress above the diagnostic threshold for PTSD. Thus, it is important to identify youth at risk who may benefit from early clinical interventions at first sign of acute symptoms in order to prevent injured children from developing enduring psychiatric symptoms. In particular, female youth, youth experiencing peritraumatic dissociation, and youth with low SES are at highest risk for experiencing both ASD and PTSD and thus may benefit from targeted discharge and intervention planning. Information about these predictive risk factors can be easily obtained during the hospital stay to assist with treatment and discharge planning.

In particular, the finding that youth with ASD and low SES are vulnerable to long-term impairment suggests that additional discharge services may be warranted. Research has found that physicians are less likely to recommend additional services or follow-up care to low-income or uninsured patients (Mort, Edwards, Emmons, Convery, & Blumenthal, 1996), and that poor continuity of care is associated with poorer health outcomes, especially for low-income youth (Christakis, Mell, Koepsell, Zimmerman, & Connell, 2001).

Although discharge planning is important for all patients (O'Malley, Brown, & Krug, 2008; Pediatrics, 2001), our findings suggest that female youth, and youth with ASD and low SES, who may be more vulnerable to chronic traumatic stress symptoms but less likely to receive services, may need additional support and case management to overcome barriers to mental health services (Pampel, Krueger, & Denney, 2010). For example, research has suggested that attendance to follow-up visits can be improved when the appointments are made before leaving the hospital (Zorc, et al., 2003). This could also potentially help lessen the chance of acute psychological reactions from becoming chronic psychological and health problems.

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Table 1

Descriptive statistics for Full Sample, n=204

	Mean	(SD)	N	% missing
Age (years)	13.54	3.49	151	25.98%
Race			202	.98%
EA (n, %)	88	43.1		
AA (n, %)	80	39.6		
Other (n, %)	34	16.8		
Gender			202	.98%
Male (n, %)	150	74.3%		
Female (n, %)	52	25.7%		
Income (in thousands)	51.30	28.82	77	62.25%
Injury Type			204	0%
Burn (n, %)	41	20.1		
Nonviolent Injury (n, %)	117	57.4		
Violent Injury (n, %)	46	22.5		
Length of Stay (days)	11	14.58	151	25.98%
Pain	3.79	2.62	129	36.76%
Morphine Dose			181	11.27%
No morphine (n, %)	33	18.2%		
Low Dose (n, %)	62	34.3%		
High Dose (n, %)	86	47.5%		
Internalizing Symptoms	6.59	6.34	112	45.10%
Externalizing Symptoms	8.79	8.50	112	45.10%
Life Events Scale	163.70	121.44	115	43.63%
Family Strain	8.00	8.18	112	45.10%
Parental PTSD symptoms (3 months)	163.70	121.44	102	50.00%
Peritraumatic dissociation	22.97	8.94	149	26.96%
Days Since Injury (acute assessment)	6.07	11.17	150	26.47%
ASD (yes; n, %)	71	36%	197	3.43%
PTSD (any yes; n, %)	33	21.3%	155	24.02%
3-month (yes; n, %)	25	17.9%	140	31.37%
6-month (yes; n, %)	4	9.8%	41	79.90%
12-month (yes; n, %)	10	16.1%	62	69.61%
18-month (yes; n, %)	5	10.6%	47	76.96%
Transition			151	25.98%
Resilient (n, %)	78	51.7%		
ASD Only (n, %)	40	26.5%		
PTSD Only (n, %)	16	10.6%		
Chronic (n, %)	17	11.3%		

Note. EA=European American, AA = African American. Frequencies reported are valid percent. % missing is calculated based on original ascertainment of n=204.

Table 2

Multivariate Tests of Transitional Group Status.

	Resilient	ASD Only	PTSD Only	Chronic	Sig., partial η^2
			Demographic		
Gender, % female	19%	20%	31%	53%	$p = .023$, $\eta^2 = .06$
Age, in years	14.01	12.50	14.13	13.24	*n.s.*
			Psychiatric		
Peritraumatic Dissociation	19.88	26.52	20.88	30.65	$p < .001$, $\eta^2 = .20$
Internalizing	7.01	8.19	8.02	9.74	*n.s.*
Externalizing	9.23	11.38	7.30	14.22	$p = .039$, $\eta^2 = .05$
Past PTSD symptom count	2.88	3.33	2.87	4.01	*n.s.*
			Social Context		
SES	50.57	55.01	56.08	36.32	$p = .038$, $\eta^2 = .06$
% Minority	51%	55%	44%	71%	*n.s.*
Stressful Life Events	175.06	167.99	162.26	223.66	*n.s.*
Family Strains Index	8.50	10.10	8.60	9.52	*n.s.*
Parental PTSD symptoms	25.83	30.49	30.91	32.02	$p = .032$, $\eta^2 = .06$
			Injury		
Days in hospital	9.40	13.10	14.00	10.76	*n.s.*
Morphine dose, % high dose	46%	50%	62%	57%	*n.s.*
Pain	3.62	3.93	3.73	4.15	*n.s.*
Violent injury	21%	28%	29%	29%	*n.s.*

Note. Stressful Life Events = Coddington Life Events Scale life change units. SES calculated as weighted average of parents' occupation (Hollingshead, 1975).

Pooled means, frequencies, and test of significance across 10 imputed data sets are reported..

n.s. = not significant

Table 3

Post Hoc Pairwise Comparisons of Transitional Group Status.

DV			Mean Diff.	Std. Error	t-ratio	sig. [a]	Sidak sig. [b]
Gender	Resilient	ASD Only	−0.008	0.082	0.094	0.925	1.000
		PTSD Only	−0.120	0.116	1.038	0.301	0.884
		Chronic	−0.337	0.113	2.984	0.003*	0.020*
	ASD Only	PTSD Only	−0.113	0.125	0.901	0.369	0.937
		Chronic	−0.329	0.122	2.696	0.008*	0.046*
	PTSD Only	Chronic	−0.217	0.147	1.475	0.142	0.602
Perittraumatic Dissociation	Resilient	ASD Only	−6.640	1.569	4.233	0.000*	0.000*
		PTSD Only	−0.990	2.214	0.447	0.655	0.998
		Chronic	−10.762	2.159	4.985	0.000*	0.000*
	ASD Only	PTSD Only	5.650	2.386	2.368	0.019*	0.110
		Chronic	−4.122	2.335	1.765	0.080	0.392
	PTSD Only	Chronic	−9.772	2.809	3.478	0.001*	0.004*
Externalizing	Resilient	ASD Only	−2.152	1.666	1.292	0.198	0.735
		PTSD Only	1.929	2.351	0.821	0.413	0.959
		Chronic	−4.988	2.293	2.176	0.031*	0.173
	ASD Only	PTSD Only	4.081	2.534	1.611	0.109	0.501
		Chronic	−2.836	2.480	1.144	0.255	0.828
	PTSD Only	Chronic	−6.917	2.983	2.319	0.022*	0.124
Parental PTSD Symptom count	Resilient	ASD Only	−4.659	2.154	2.162	0.032*	0.178
		PTSD Only	−5.079	3.040	1.671	0.097	0.458
		Chronic	−6.184	2.965	2.086	0.039*	0.211
	ASD Only	PTSD Only	−0.420	3.277	0.128	0.898	1.000
		Chronic	−1.525	3.207	0.476	0.635	0.998
	PTSD Only	Chronic	−1.105	3.858	0.286	0.775	1.000
SES	Resilient	ASD Only	−4.438	4.698	0.945	0.346	0.922
		PTSD Only	−5.511	6.630	0.831	0.407	0.957
		Chronic	14.247	6.466	2.203	0.029*	0.163
	ASD Only	PTSD Only	−1.073	7.146	0.150	0.881	1.000
		Chronic	18.685	6.994	2.671	0.008*	0.049*
	PTSD Only	Chronic	19.759	8.415	2.348	0.020*	0.115

[a] p-values uncorrected for multiple testing

[b] p-values corrected for multiple testing using Sidak correction.