

## Examining the incidence of acute stress in pediatric trauma patients

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**ABSTRACT**

**Objective** Pediatric patients can be significantly impacted emotionally by exposure to acute trauma which may negatively impact long-term functioning and lead to an increase in overall distress. This study reports on the incidence of acute stress disorder among pediatric trauma patients in a hospital setting in the southeastern region of the USA.

**Methods** Pediatric patient mental health assessments were conducted using the Childhood Stress Disorders Checklist- Short Form (CSDC-SF) as part of a new integrated behavioral health standard of care within the Trauma Services Division of a level 1 pediatric hospital. Mental health consultations occurred at bedside on inpatient hospital admission into trauma services, or at the outpatient hospital clinic after discharge for injuries treated in the emergency department.

**Results** Associations among type of trauma, child age, and sex were explored in a sample of 617 children (58.9% male) aged 2–18 years ( $M_{age} = 10.27$ ). The sample was primarily ethnic minorities (56.1% black/African-American, 5% Hispanic/Latinx). Fifteen per cent or more of trauma reports were for burns (26%), motor vehicle accident (22.7%), and recreational sports or leisure activity-related injury (17.5%). Sixty-four per cent of children scored  $\geq 1$  on the CSDC-SF, indicating symptoms consistent with acute stress disorder. Higher scores were associated with female sex, age, and injury type.

**Level of evidence** Level IV study provides evidence of the link between traumatic injury and mental health symptoms in a pediatric population. Findings highlight the critical need for mental health screening and provision of integrated mental health counseling services at time of acute pediatric trauma.

**EXAMINING THE INCIDENCE OF ACUTE STRESS IN PEDIATRIC TRAUMA PATIENTS**

Since the turn of the current century, healthcare institutions, providers, researchers, and government agencies have maintained a long-standing objective to integrate physical, mental, and behavioral healthcare; however, evidence-based approaches to integrative health services are only beginning to emerge more than two decades later. Existing literature has primarily focused on establishing integrated healthcare models in primary care settings.<sup>1,2</sup> Over the past two decades, models for integrating mental and behavioral health services in primary care settings have improved patient health outcomes

**WHAT IS ALREADY KNOWN ON THIS TOPIC**

⇒ Despite the increased focus on pediatric mental health needs highlighted by the COVID-19 pandemic, integrated behavioral health services that provide screening and mental health counseling for pediatric trauma patients in hospital settings are sparse.

**WHAT THIS STUDY ADDS**

⇒ The current study is the largest to examine the incidence of pediatric acute stress disorder following a traumatic injury.  
⇒ The current study was conducted as a needs assessment to understand the incidence of pediatric acute stress disorder following traumatic injury and to provide data in support of increased mental health services in hospital settings.

**HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY**

⇒ The current study provides medical and public health officials with data to advocate for the creation of integrated mental health screening and service provision in hospital systems.

and reduced patient costs.<sup>3</sup> Yet, collaborative care research has less frequently examined effective integrated health services within a hospital-based setting.

Despite the potential benefits that would occur were hospitals to adopt a primary care model, most hospitals in the USA do not provide integrated mental healthcare along with the provision of treatment for physical illness. According to a study conducted by Fakhry *et al*,<sup>4</sup> roughly 90% of those with postinjury post-traumatic stress disorder (PTSD) go without treatment for mental health needs when hospitals do not screen for mental health distress during intake. There is a dearth of knowledge on effective care models within hospitals, specifically regarding the dual occurrence of physical and behavioral needs. O'Leary *et al*<sup>5</sup> note that providing high-quality patient care in hospitals requires integration of services and professionals; however, hospital settings frequently lack collaborative care models and integrated professional teams. Further research is needed to better understand integrated healthcare service delivery and utilization in both primary care and hospital settings.<sup>5</sup>

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Literature focused on addressing the mental health needs of pediatric hospital patients is particularly lacking. In addition, evidence-based models of care that attend to the behavioral health needs of pediatric trauma patients in hospital settings is sparse, despite the literature suggesting that exposure to acute trauma within pediatric populations is common.<sup>6–11</sup> Results from Mazo *et al*<sup>10</sup> revealed that when pediatric trauma patients were assessed for acute stress disorder (ASD) and PTSD in 52 patients following a traumatic event, around 41% of patients met criteria for ASD, and 31% met criteria for PTSD. Similarly, Ridings *et al*<sup>11</sup> found that 35.5% of a sample of 90 pediatric trauma patients experience clinically significant symptoms of PTSD when assessed at 30 days postinjury. Despite the smaller sample sizes of these studies, these findings highlight the need for more extensive assessment of pediatric trauma.

Historically, research focused on trauma assessments for pediatric patients has primarily concentrated on PTSD symptomology. According to the Diagnostic and Statistical Manual for Mental Disorders, Fifth Edition, an individual must experience symptoms of avoidance, intrusive thoughts, negative mood, and changes in arousal for a minimum of 1 month to meet the diagnostic criteria for a diagnosis of PTSD.<sup>12</sup> Contemporary research has emphasized a need for more immediate trauma assessment following a potentially traumatic event by demonstrating how acute stress reactions and acute-onset stress symptoms may indicate a higher likelihood for developing later onset of PTSD symptoms. ASD symptoms such as avoidance, negative mood, arousal, and intrusive symptoms such as dissociation typically occur immediately following the trauma but last at least 3 days to 1 month, after which, a diagnosis of PTSD may occur if diagnostic criteria are met.<sup>12</sup> Given this, it is critical that greater attention be paid to screening for symptoms of ASD to provide early intervention to prevent the development of PTSD. Additionally, the literature on pediatric trauma patients has called attention to the risk of subsequent trauma exposure when children and adolescents have experienced at least one previously traumatic incident.

Pediatric populations can be significantly impacted emotionally by exposure to acute trauma and these traumatic experiences may negatively impact long-term functioning and lead to an increase in overall mental health distress.<sup>10–11</sup> While some youth exhibit resilience in connection with traumatic experiences, many others remain vulnerable to the onset of acute stress reaction or ASD. A vast amount of literature has shown that children and adolescents who display symptoms of ASD are at greater risk for developing long-term effects associated with PTSD.<sup>13–14</sup> Youth who receive early assessment for ASD and proper intervention are much less likely to meet criteria for PTSD at 6 and 18 months after exposure to a traumatic event.<sup>15–16</sup> However, only a handful of studies have assessed effective screening procedures for ASD in hospitals for pediatric trauma patients.

## CURRENT STUDY

### Procedure

In response to the precipitous rise in regional pediatric trauma coupled with heightened mental distress wrought by the COVID-19 pandemic, the investigators were awarded a grant to establish a new Trauma Mental Health Counseling Division at the region's largest level 1 pediatric trauma hospital in the southeastern region of the USA. This program was created to (1) assess the incidence of pediatric trauma patients experiencing symptoms of acute stress and (2) provide integrated mental health counseling services in tandem with medical care in the hospital setting.

The current study was conducted as a needs assessment to examine the incidence of pediatric trauma patients who report symptoms of ASD postinjury. By examining the incidence of ASD, the current study seeks to establish a baseline understanding of mental health needs in pediatric trauma patients following injury.

## Method

### Design

The data presented were collected over an 8-month period in 2021 from a newly established hospital-based standard of care for the provision of integrated mental health services.

Participants (n=617) consisted of children aged 2–18 years who were treated in the Trauma Services Division of the hospital or at the outpatient trauma clinic and received trauma mental health consultation at the time of treatment for physical injury. Integrating mental health services into the standard of care allowed mental health counselors the ability to screen a large number of pediatric trauma patients within 24–48 hours of their acute injury. This allowed for more salient screening procedures and immediate mental healthcare to be implemented. Integrating services also allowed for an increased number of patients screened due to accessibility to services and pertinent psychoeducation given on the bilateral relationship of physical injury and emotional distress. This integration also allowed mental health counselors to work in tandem with medical professionals for continuum of care.

Patients' injuries ranged in level of acuity and were treated for various injury types such as motor vehicle accidents, non-accidental trauma, falls, sports injuries, and burns. Patients received mental health services by trained trauma mental health staff that included licensed university faculty and staff as well as advanced-standing graduate students completing their master's degrees in clinical mental health counseling. All trauma mental health staff completed over 30 hours of intensive training and received certifications in Mindfulness-based Stress Reduction, Interpersonal and Social Rhythm Therapy, and ACTIVE Parenting, in addition to assessment administration and data collection procedures.

All data were collected at baseline during the initial consultation visit, which included a structured clinical interview comprising a demographic questionnaire and the Childhood Stress Disorders Checklist-Short Form (CSDC-SF). Consultations occurred at bedside typically 24–48 hours on inpatient hospital admission into trauma services during business hours from 08:00 to 17:00 hours, Monday–Friday. If patients were admitted during times when mental health counselors were not available, such as weekends, the initial consultation would occur when a mental health counselor returned to the site. If a patient was discharged from hospital services prior to initial consultation, a mental health consultation would occur at the outpatient clinic location where patients receive medical follow-up care after discharge from the hospital. Medical follow-up visits typically occur within 1 week of discharge from the hospital and patients are able to be assessed up to 1 month postinjury for ASD symptoms. All patients, regardless of score, were engaged in emotional support and psychoeducation, and were given information for free outpatient counseling services. CSDC-SF scores higher than a '1' indicated acute stress and potential for the further development of PTSD. Patients scoring  $\geq 1$  and their caregivers were educated on potential risk factors for PTSD, coping mechanisms for stress, anxiety, and given a recommendation to continue outpatient services to mitigate risk. The

CSDC-SF was administered to patients aged 6 years and older via structured clinical interview by trained trauma mental health staff; caregivers answered on behalf of children aged 2–5 years.

### Instrument

The CSDC-SF is a four-item self-report assessment adapted from the 36-item Child Stress Disorders Checklist (CSDC) to be a brief, reliable, and valid measure for assessing potential acute stress within pediatric populations from ages 2 to 18 years following a traumatic event.<sup>17</sup> Items assess acute stress symptoms of hypervigilance, avoidance, and physical responses to thoughts of the specific incident of trauma up to 1 month following the specific event. The measure assesses a patient’s experience of these specific mental health symptoms following a traumatic event. The CSDC and CSDC-SF have been used within hospital settings and posthospitalization to measure risk for development of ASD and PTSD.<sup>17 18</sup> Items rate child’s behaviors of avoidance, emotional distress, and hyperarousal using a 3-point scale (0=‘not true’, 1=‘somewhat true’, 2=‘very true’). The CSDC-SF displayed psychometric properties equal to the validated CSDC, which include comparable concurrent validity and reliability, discriminant, and predictive validity. Analyses found that the 4-item scale was highly correlated with the 30-item scale ( $r_s=0.85$ ,  $p<0.001$ ).<sup>19</sup> The CSDC-SF and CSDC were correlated with other measures of traumatic stress to assess predictive validity for ASD and potential PTSD symptoms after a 3-month period.

The CSDC-SF has psychometric properties to screen for the potential development of PTSD symptoms at the 3-month mark in pediatric patients with scores higher than ‘1’, however, for the purposes of this study, we conducted a needs assessment which sought to examine the incidence of ASD to better understand the immediate and baseline mental health symptoms and needs of pediatric trauma patients in our community. The CSDC-SF measure was collected only once, during the initial consultation visit with our mental health counselors in order to better understand acute stress response in the immediate aftermath of a traumatic event which resulted in acute hospital care.

### Results

Descriptive statistics are provided in [table 1](#). The average age of our 617 participants is 10.33 years (SD=4.77) and the majority (55.9%) were black/African-American. Patients had an average ASD score of 1.71 (SD=1.75); 64.8% scored 1 or higher, indicating that most experienced symptoms consistent with acute stress. Based on bivariate Pearson’s correlation analysis, higher age was associated with higher levels of acute stress ( $r=0.15$ ,  $p<0.001$ ). Female participants, motor vehicle collision (MVC) patients, and weapons-related patients in our sample experienced higher levels of ASD and PTSD symptoms when compared with male participants ( $p<0.001$ ), non-MVC patients ( $p<0.001$ ), and non-weapons-related patients ( $p<0.0012$ ), respectively, by Mann-Whitney U test analyses.

### Discussion

Our study represents the largest study to date examining the prevalence of ASD symptoms among pediatric trauma patients in a hospital setting. Participants had an average CSDC-SF score of 1.71 (SD=1.75) indicating ASD symptoms; 64.8% exhibited symptoms of ASD and scored 1 or greater on the CSDC-SF screen. This finding is of critical significance in highlighting the need for mental health screening as well as the need for integration of mental healthcare to treat presenting symptoms of acute

**Table 1** Descriptive statistics of study population

	Frequency	Per cent (%)	CSDC-SF ( $\mu$ )
Population	617	100.0	1.71 ( $\sigma=1.75$ )
Race (n=590)			
Black/African-American	330	55.9	1.74 ( $\sigma=1.72$ )
White/Caucasian	210	35.6	1.61 ( $\sigma=1.76$ )
Hispanic/Latinx	30	5.08	2.03 ( $\sigma=1.85$ )
Biracial/Multiracial	9	1.53	2.58 ( $\sigma=2.47$ )
Asian/Pacific Islander	5	0.85	0.20 ( $\sigma=0.45$ )
American Indian/Alaskan Native	1	0.17	N/A
Hawaiian/Other Pacific Islander	1	0.17	N/A
Others	4	0.68	0.25 ( $\sigma=0.50$ )
Sex (n=617)			
Male	364	59.0	1.43 ( $\sigma=1.59$ )
Female	253	41.0	2.11 ( $\sigma=1.89$ )
Age (years) (n=609)			
Early childhood (2–5)	127	20.9	1.20 ( $\sigma=1.58$ )
Elementary school (6–10)	165	27.1	1.78 ( $\sigma=1.69$ )
Middle school (11–13)	120	19.7	1.90 ( $\sigma=1.80$ )
High school (14–18)	197	32.3	1.88 ( $\sigma=1.81$ )
Injury type (n=601)			
Burn	154	25.6	1.40 ( $\sigma=1.62$ )
Motor vehicle collision	137	22.8	2.18 ( $\sigma=1.87$ )
Sports/Leisure activity	106	17.6	1.54 ( $\sigma=1.64$ )
Weapons-related	67	11.1	2.37 ( $\sigma=1.91$ )
Fall	62	10.3	1.19 ( $\sigma=1.33$ )
Bodily injury	22	3.66	1.50 ( $\sigma=1.29$ )
Animal-related	18	3.00	1.36 ( $\sigma=1.71$ )
Pedestrian struck by vehicle	10	1.66	1.60 ( $\sigma=1.58$ )
Others	25	4.16	2.44 ( $\sigma=2.33$ )

CSDC-SF, Childhood Stress Disorders Checklist-Short Form; N/A, not available.

stress in hospital settings. Compared with the few published studies examining ASD and PTSD among pediatric trauma patients,<sup>8 20 21</sup> our study represents some of the highest rates of ASD symptoms in a pediatric population. These high scores may be attributed to the effect of physical trauma coupled with the COVID-19 pandemic and its impact on pediatric mental health symptoms.

Compared with previous research, our results indicate significantly higher percentages of patients exhibiting symptoms of ASD. These findings may be attributed to a heightened stress response due to the COVID-19 pandemic. Prior research conducted in this area was done prior to the pandemic. It is possible that these higher scores be linked to a compounding effect of the pandemic on pediatric mental health in combination with the traumatic injury. The rise in mental health concerns occurring during the pandemic may have a significant impact on pediatric patients’ stress reaction to further medical traumas. Having increased levels of stress for prolonged periods of time combined with traumatic incidents, which have increased during the pandemic, could lead to higher reported levels of acute stress surrounding specific incidents.

Research has shown that prolonged exposure to severe stress, like that presented by a global pandemic, has been recognized to have short-term and long-term negative impacts on children’s health and well-being. If left untreated, health problems such

as cancer, alcoholism, depression, and heart disease can occur in later life.<sup>22</sup> Of particular note, Sprang and Silman<sup>23</sup> found that children and adolescents who were isolated or quarantined reported PTSD symptoms at a rate four times higher than youth who did not experience isolation or quarantine. A growing body of evidence illuminates the physiological and psychological effects of isolation, school closures, and quarantine on children and adolescents, such as reduced physical activity, poor nutrition, irregular sleep routines, anxiety, depression, panic disorder, acute stress reaction, and PTSD symptoms.<sup>22</sup> Additionally, as a result of the COVID-19 pandemic, certain youth have been exposed to added harmful experiences (eg, domestic violence and physical or sexual abuse) placing these children and adolescents at even greater risk for physical and mental health consequences.<sup>24 25</sup>

In our sample, the older the patients were, the higher the scores for acute stress and higher potential for PTSD to occur in the future. This is reflective of previous research suggesting that adolescence is a period of elevated risk for exposure to all types of traumatic events, including accidents, injuries, loss of a loved one, and other traumatic events that happen to close friends or family.<sup>26 27</sup> In addition, it is possible that these results indicate that older children are more likely to recognize and report problematic symptoms.

It is significant to highlight that caregiver served as the CSDC-SF respondents for children aged 2–5 years. Children in early childhood had the lowest reported CSDC-SF scores of all age ranges, with a mean of 1.20 (SD=1.58) compared with 1.78 (SD=1.69) for children in elementary school, 1.90 (SD=1.80) for middle school and 1.88 (SD=1.81) for the high school age ranges. These findings perhaps suggest caregivers' inability to recognize symptoms of acute distress in their young children or perhaps they may be less likely to report symptoms of distress in their younger children. These findings for caregiver reports seem to be consistent with previous literature indicating that parents are likely to report fewer symptoms and may be unaware of when their children are experiencing symptoms of emotional distress.<sup>28</sup> Under-reporting among caregivers becomes a cause for concern when it impacts help-seeking efforts for children experiencing emotional health problems.<sup>29</sup>

Results from the current study suggest that female patients experience higher levels of acute stress than male patients. These results support multiple studies revealing that higher rates of ASD and PTSD following a pediatric injury are observed in female patients.<sup>18 30 31</sup> For example, Saxe *et al*<sup>17</sup> found that predictors of ASD have included female gender as well as the child's age. In the acute phase, female gender typically score higher than male gender on subjective experience such as threat perception, peritraumatic dissociation and known predictors of future PTSD.<sup>32</sup> In a study examining high rates of ASD's impact on quality-of-life outcomes in injured adolescents, they found that female patients were more likely to have chronic symptoms, whereas male patients were more likely to either not develop any significant symptoms or recover from acute distress.<sup>31</sup> These results indicate that coping strategies and stress perception could potentially differ among male and female patients.

Patients with violent injuries such as weapons-related injury and MVC reported experiencing greater symptoms of ASD. These findings illustrate the link between increased severity of injury and the greater likelihood of mental distress.<sup>33</sup> It is particularly relevant to note that compared with national averages, our population is similar demographically with other large southern urban cities, however our rates of community and gun violence were highest in the nation for cities with populations

over 200 000 according to 2020 data from FBI's Uniform Crime Report.<sup>34</sup> Given these high rates of violent crime in our community, it is possible that the high incidence of ASD recorded in this study could be attributed to the compounding effect of community-wide violence in combination with traumatic injury.

Considerable research provides evidence that certain youth are at even higher risk for physiological and/or psychological consequences due to pre-existing health disparities such as exposure to community and gun violence and the absence of previously accessible, necessary resources obtained from protective school and community environments due to the COVID-19 pandemic (eg, nutritional meals, physical activity, essential learning, child-care, social connection, peer and teacher support, and routine and stability).<sup>35 36</sup> Recent research indicates that youth in vulnerable socioeconomic circumstances, exposed to community-wide gun violence, domestic violence in the home, and with previous COVID-19 infection are particularly susceptible to developing psychological disorders.<sup>24</sup>

Our findings further support literature indicating that ASD is a prevalent reaction that children experience following an injury.<sup>10 11</sup> Although traumatic injuries are common among the pediatric population, proper screening, early identification, and treatment can lead to improved mental health outcomes among children and adolescents postinjury.<sup>11</sup>

### Counseling implications and future research

Our study provides substantive evidence of the relationship between traumatic injury and mental health symptoms in a pediatric trauma population. The data provide information that patients experience elevated levels of stress different from their baseline following the experience of a specific traumatic event. These findings highlight the critical need for providing integrated mental health and behavioral health counseling services at time of acute trauma. These data inform medical personnel of the impact that patients are experiencing beyond the symptoms of physical suffering. Providing trauma-focused mental health counseling interventions in the aftermath of traumatic injury can mean the difference between developing adaptive coping strategies and mental wellness for patients experiencing days to years of ongoing suffering.

Our findings provide data needed by trauma physicians and medical personnel and hospital administrators to advocate for integrated mental and behavioral health departments within hospital settings. These new mental health departments must be able to provide trauma-informed counseling interventions, particularly those which focus treating on the mind-body connection and addressing the neurobiology of physiological arousal.<sup>37</sup> Examples of evidence-based therapies with a mind-body focus include mindfulness-based stress reduction, interpersonal social rhythm therapy and acceptance and commitment therapy.<sup>38–40</sup>

Medical and behavioral health professionals have investigated a variety of approaches to treat ASD and PTSD in trauma patients. For instance, Tsang *et al*<sup>41</sup> found that terminally ill patients with cancer who engaged in a body scan meditation (BSM) technique as part of a mindfulness-based stress reduction intervention showed significant differences in mental health scores when compared with the control group. Adult patients with cancer who participated in BSM for 1 month reported a generally improved mood and increased feelings of hope, happiness, and calmness, which positively contributed to their overall mental well-being. In addition, interpersonal social rhythm therapy has also been credited to improve mood disorders and

assist with patients whose circadian rhythm has been disjointed due to being within an inpatient facility.<sup>42</sup>

Future research is needed to assess the efficacy of various evidence-based counseling interventions and, more specifically, which approaches are most efficacious given age, mental health symptoms, and presenting injury of the patient. Future research will re-assess ASD symptoms at the 3-month mark to examine if patients who received mental health services qualified for a PTSD diagnosis or if symptoms were reduced. Screening for other emergencies that result in acute hospitalization should be conducted to examine the incidence of ASD among other hospitalized pediatric populations for comparison. Future collaborations within diverse hospital departments would allow for a more comprehensive approach to pediatric healthcare and better understanding of mental health needs. In addition, future research should examine caregivers' ability to recognize symptoms of ASD within their child.

**Collaborators** The BRAIN Center at the University of Memphis: Eraina Schauss, Kiersten Hawes, Sydnie Roberts, Mitch Clayton, Chi Li, Alexandria Littlejohn, Debra Bartelli, Regan Williams.

**Contributors** ES, Principal Investigator (PI) and guarantor, was responsible for all aspects of the project and in securing and writing the grant that funded this work. She developed and created all requisite affiliation agreements between institutions, conducted staff hiring and training, developed and created Trauma Mental Health Counseling Division at LeBonheur Children's Hospital, and related standard of care procedures. As the PI and BRAIN Center Director, she leads the team in developing the research design and related training and protocols. She was responsible for instrument selection, student training, data collection, manuscript writing, and IRB approval. KH trained and supervised trauma mental health counselors, aided in data collection, conceptualization, and study design, co-wrote discussion section, reviewed, and revised manuscript. SR aided in the conceptualization and collection of REDCap data, co-authored the literature section, co-authored methods section, created APA citation list, and reviewed and revised the manuscript and worked on the reviewer revisions. JMC input data into REDCap, cleaned data for analysis, analyzed data, created data table, wrote final results section, and reviewed and revised the manuscript. Co-conducted data analysis and co-wrote up results section and reviewed and revised the manuscript. AL participated in study conception and design, literature review, draft manuscript preparation, and review and revisions of the final version of the manuscript. DB input participated in the design of the study, wrote abstract, assisted with writing results section, critically reviewed, and revised the manuscript. RW participated in the conceptualization and design of the study, coordinated, and supervised data collection, and critically reviewed the manuscript for important intellectual content.

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**Data availability statement** Data are available on reasonable request.

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