POST-TRAUMATIC STRESS DISORDER (PTSD) IN CHILDREN FOLLOWING ACUTE INJURIES REQUIRING EMERGENCY MEDICAL CARE

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ABSTRACT OF DISSERTATION

Virginia Depp Cline

The Graduate School
University of Kentucky

2007
POST-TRAUMATIC STRESS DISORDER (PTSD) IN CHILDREN FOLLOWING ACUTE INJURIES REQUIRING EMERGENCY MEDICAL CARE

ABSTRACT OF DISSERTATION

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Education at the University of Kentucky

By
Virginia Depp Cline
Lexington, Kentucky

Director: Dr. H.T. Prout, Professor of Educational & Counseling Psychology
Lexington, Kentucky
2007

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ABSTRACT OF DISSERTATION

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Unfortunately, one rite of passage of childhood is often serious injury that carries psychological impact along with the obvious physical repercussions. Prior studies have found conflicting results for protective/risk factors, thus this study attempted to explore PTSD in a sample of children ages seven to thirteen years of age with moderate to severe injuries. In this study (N = 32), 31.3% of children experiencing such a sudden injury requiring hospitalization at the University of Kentucky Children’s Hospital demonstrated significant indications of post-traumatic stress disorder (PTSD) following the injury.

Several pre, peri, and post-trauma variables from during the child’s hospitalization to the follow-up period four to five weeks later were correlated with this outcome including age, ethnicity, acute stress disorder (ASD) with or without dissociation criteria being met, prior medical experience, parent’s score on the BSI-18 while the child is still in this hospital, chronic illness status, gender, number of coping strategies reported by the child while in the hospital, the number of negative coping strategies reported, the amount of pain reported, and several follow-up variables (parent’s BSI-18 score, number of coping strategies reported, number of negative and positive
coping strategies reported, injury threat, and total number of impairments reported by the child and by the parent). Negative coping did not significantly change from the in-hospital period to the follow-up period. Surprisingly, the STEPP, a current screener described and supported by some past research, was not successful in identifying these at-risk children; however, a new screening prototype was developed including age, acute stress disorder (ASD), and pain that did successfully predict 80% of those with PTSD and 85% of those without later PTSD. A follow-up screener consisting solely of parental items (parental symptoms on the BSI-18 and parental rating of child impairments) was also created and found to sensitively predict 90% of those children with PTSD. Implications from these findings along with study strengths and weaknesses were highlighted.

KEYWORDS: PTSD, Injury, Pediatric, Trauma, Screener

Virginia Depp Cline

May 10, 2007
POST-TRAUMATIC STRESS DISORDER (PTSD) IN CHILDREN FOLLOWING ACUTE INJURIES REQUIRING EMERGENCY MEDICAL CARE

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# TABLE OF CONTENTS

Acknowledgements ........................................................................................................ iii

List of Tables .................................................................................................................. vii

Chapter One: Introduction ............................................................................................ 1
  PTSD .......................................................................................................................... 1
  Children and PTSD ............................................................................................... 3
  Medical Conditions and PTSD ........................................................................ 4
    Acute Injuries ..................................................................................................... 5
    Children and Acute Injuries ............................................................................ 6

Theoretical Basis of PTSD ....................................................................................... 7

Literature Review ....................................................................................................... 7
  Children, Acute Injury, and PTSD ................................................................. 8
  Acute Stress Disorder (ASD) ............................................................................ 9
  Children with Motor Vehicle Accidents (MVAs) ...................................... 10
  Children with Brain Injury (TBI) .................................................................. 12
  Children with Spinal Cord Injury (SCI) ......................................................... 14
  Children with Burns ......................................................................................... 14

Risk Factors for Developing PTSD ....................................................................... 15
  Pretrauma Factors .......................................................................................... 16
  Peritraumatic Factors ..................................................................................... 19
  Posttrauma Factors ......................................................................................... 23

Conclusions and Implications .................................................................................. 30

Purpose of Study ....................................................................................................... 32

Research Question 1 ............................................................................................... 32

Research Question 2 ............................................................................................... 32

Research Question 3 ............................................................................................... 33

Research Question 4 ............................................................................................... 33

Chapter Two: Research Design and Methodology ................................................. 34

Participants .............................................................................................................. 34

Instrumentation ....................................................................................................... 35

Predictor Measures ................................................................................................. 36
  Participant Information Sheet ......................................................................... 36
  Demographic Information Sheet .................................................................. 36
  Injury and Impact Information Sheet ......................................................... 36
  Coping Style ...................................................................................................... 37
  Sense of Threat .................................................................................................. 37
  Hospital Variables .............................................................................................. 38
  Brief Symptom Inventory – 18 (BSI-18) ...................................................... 39
  PTSD Checklist – Parent Report (PCL) ......................................................... 40
  Measure of Dissociation .................................................................................. 41
LIST OF TABLES

Table I, Descriptives for Participants With and Without Significant PTSD Symptoms (Means, SD, and Percentages) ........................................ 51
Table II, Significant Correlations for In-Hospital Predictor Variables .................. 56
Table III, Significant Correlations for Follow-Up Predictor Variables ................. 57
Table IV, STEPP Correlations ............................................................................. 60
Table V, Prediction of PTSD Status based on STEPP Screener ....................... 62
Table VI, Percent Correct, Sensitivity, Specificity, and ROC area for In-Hospital Predictor Variables .......................................................... 64
Table VII, Percent Correct, Sensitivity, Specificity, and ROC area for Follow-Up Predictor Variables ................................................................. 69
Chapter One: Introduction

An “ideal emergency care system should be able to manage both the psychological and medical aspects of critical illness and injury (Athey, O’Malley, Henderson, & Ball, 1997, p. 466). Heeding this call, there is an urgent need for the consideration of, identification of, and treatment of post-traumatic stress disorder (PTSD) in the acutely injured, and especially children/adolescents. Unfortunately, the lack of consistent findings for rates of PTSD among this population and for risk factors for the development of PTSD is a hindrance in providing this care to those most in need.

This chapter will address the symptoms of PTSD including specific findings focusing on children, PTSD as related to medical traumas, the theoretical basis explaining the differential development of PTSD, the current knowledge base concerning children and acute injuries and subsequent PTSD including areas in need of more research, research regarding possible risk factors for developing PTSD including pretrauma events/factors, peritraumatic factors, and posttrauma factors, the current problems in the status of the field of PTSD and children experiencing acute injuries and medical trauma, and finally research questions and hypotheses for the current study.

PTSD

Known through epics and suspenseful life stories in our world’s history, PTSD is a worldwide phenomenon, affecting individuals in all cultures of the world (Perrin, Smith, and Yule, 2000). PTSD follows in frequency only behind depression, phobias, and dependence disorders as common mental health disorders (Davis & Siegel, 2000), and it tends to have more pervasive and long-lasting effects on the individual’s life (Breslau, 2001a). Due to PTSD, a person can experience many negative repercussions
including the following: a decrease in confidence and an increase in inhibitions, sacrificed interpersonal relationships as it is difficult to be around someone who withdraws and is irritable, weakened cognitive abilities including memory and attention with their attendant personal and professional repercussions, other comorbid conditions including depression and anxiety, risky behaviors from attempts to deal with uncomfortable emotions/images (Wilson & Keane, 1997), and a detriment to physical health including an increase in somatic complaints and conditions including asthma and allergies. (Trad, 1989; Wilson & Keane, 1997).

The latest DSM criteria begin with the criteria A requirement of experiencing a traumatic event and reacting with strong negative emotions. Second, the individual must display at least one re-experiencing symptom such as thoughts, dreams, feelings of reliving the trauma, and psychological and physiological distress at reminders of the event. There must also be at least three avoidance/numbing symptoms such as decreased interest, lack of ability to remember the event, decreased affect, feeling detached from others, etc. Finally, at least two arousal symptoms, such as sleep problems, increased startle response, concentration difficulties, and hypervigilance are required. The above symptomology must be present for a duration of at least one month with accompanying impairment. Symptoms may follow differing courses with symptoms lasting for up to three months following the trauma (acute), for more than three months (chronic), or they may first appear after six months time since the trauma (delayed-onset) (American Psychiatric Association, 2000).

It is important to note that those who do not qualify for a full diagnosis of PTSD may still exhibit some of the hallmark symptoms, thus still having a negative impact on
their lives (Freedman, Brandes, Peri, & Shalev, 1999). Partial symptomology of PTSD, defined as meeting criteria A and B though with fewer than needed criteria C and D symptoms (Breslau, 2001b), has led to more problems in work, social, and family relationships than no symptoms, and these reported levels of difficulties were equivalent to those suffering from a full diagnosis (Breslau, 2001b). PTSD is also a possible risk factor for the development of other comorbid conditions including depression and anxiety, which can wreck their own havoc on a person’s life (Seedat, Kaminer, Lockhat, & Stein, 2000).

Children and PTSD

Some children, in fact, “may be particularly vulnerable in general, as they are in many cases truly helpless and easier to frighten than adults, who have more fully developed physiques, knowledge, social status, emotional resources and perspectives on the situation” (Dwivedi, 2000, p. 9).

Children’s cognitive and reasoning development can affect their reactions or lack thereof to traumas. They may be less able to understand the true danger in some situations, while they overemphasize the dangers in other, more benign cases (Dwivedi, 2000; Scheeringa & Zeanah, 2001). For example, Kazak et al. (1997) found that younger children may not be as traumatized by a cancer diagnosis due to their lack of understanding of its progression and lethality. Similarly, after the Three Mile Island incident, children, not appreciating the repercussions of such an event, were not found to suffer from the symptoms of PTSD as adults did (Salmon & Bryant, 2002). These children, though, when in doubt for how to appraise an incident and respond, will look to
adults for a model (Salmon & Bryant, 2002), thus possibly placing them at-risk if their model is one of psychopathology.

Younger children also have a less mature arousal system that may place them at-risk for developing PTSD following traumatic events. They become more easily aroused and startled than adults and have difficulty modulating their emotions and inhibiting thoughts, so they typically rely on others to soothe them. This could place such a child at risk for developing PTSD after a trauma, especially if the caretakers typically assuming this role were unable to support the child due to their absence or their own distress. This same lack of mature coping skills can be protective at the same time in that the trauma is not actively avoided, which may lead to fewer intrusion symptoms according to the cognitive theory of PTSD espoused by Ehlers and Clark (2000). However, any negative emotions produced by thinking about the trauma and attempting to process it are fully experienced with less protective coping skills (Salmon & Bryant, 2002). Weaker verbal skills may also mean that the child would have less of an opportunity to process the trauma, so the symptoms of re-experiencing and intrusions would be more common and resistant also due to the lack of processing (Breslau, 2001b; Salmon & Bryant, 2002; Scheeringa & Zeanah, 2001; Vasey & Dadds, 2001).

**Medical Conditions and PTSD**

With the advent of the latest DSM comes the acknowledgement that sometimes even common events/conditions can lead to PTSD. Serious medical illnesses such as cancer and acute injuries now join the notorious ranks of war, abuse, violence, etc. as precipitants to PTSD with the only requirement now that the event lead to “intense fear, helplessness or horror” (American Psychiatric Association, 2000, p. 463).
The reality is that the outcome from medical conditions/injuries can be just as severe and lead to even more health threats and burdens as the outcomes following these other more traditionally thought of traumas. For example, someone with PTSD after a medical event/illness may not attend follow-up appointments nor take their prescribed medications or treatments due to avoidance symptoms (Mundy & Baum, 2004). Transplant patients with PTSD have been found to be thirteen times more likely to die within the first three years post-transplant than those without PTSD (Tedstone & Tarrier, 2003). Patients may also over-consume healthcare services driving costs upward due to more somatization symptoms and alertness to physical symptoms compliments of their past medical trauma (Tedstone & Tarrier, 2003).

**Acute Injuries.**

Much of the research on PTSD involves victims of abuse, disasters, and war even though acute physical injury led to 11% of the population visiting the emergency department (ED) after a nonfatal injury in 2000 (O’Donnell, Creamer, Bryant, Schnyder, & Shalev, 2003). Certainly this highlights the need for a concentrated focus in the PTSD literature following acute injury. In fact, this need was emphasized in 1966 when the National Academy of Sciences voiced its concern with injuries being ignored as a public health (physical and mental) concern (Stoddard & Saxe, 2001).

Acute injuries resulting in emergency care may qualify as traumatic as there is often a high threat of actual injury/death and increased uncertainty and disorganization (Lewandowski & Baranoski, 1994). Further, there is a sudden shift in control, as the individual may receive treatment after treatment with the sole concern for saving a life. Personal choice and autonomy are pushed aside. There may also be a lack of familiarity
with the health care workers and procedures with emergent care. No prior rapport has been established, and the patient cannot know when the next pinch or new face will arrive (Lizasoain & Polaino, 1995), thus preventing preparatory coping (Axelrod, 1976).

*Children and Acute Injuries.*

Children’s mental health must be considered following all too common medical traumas. In fact, children have higher rates of injury than other population groups, with as many as one fourth of all children experiencing serious injuries (Caffo & Belaise, 2003) and 20-40% of the emergency room population consisting of children (McFarland & Stanton, 1991). Then, “For every child who dies from an injury, 40 more are hospitalized and over 1000 are treated in emergency departments in the US” (Frosch & Lewandowski, 1998, p. 216).

Specifically related to acute injuries requiring medical care, children may be at more risk for developing PTSD after such an injury. They “may not understand the role of helpers and may perceive them as a source of harm rather than help” (Bronfman, Campis, & Koocher, 1998, p. 578) nor may they understand the purpose behind painful treatments/procedures (Athey et al., 1997). On the surface, they see/feel strangers and sometimes even parents hurting them. “This lack of distinction between hurt and help complicates the child’s perception of the traumatic event and often leads to inclusion of the medical and surgical interventions as part of the trauma in the child’s eyes” (Frosch & Lewandowski, 1998, p. 218). Treatments and their pain may even be interpreted as punishment for some misdeed versus its actual life-saving intent. Adults typically understand that the original trauma is over and that they are actually being helped, thus possibly leading to less traumitization (Frosch & Lewandowski, 1998).
Children are also often separated from parents either on the way to the hospital or during procedures (Athey et al., 1997). Especially for younger children who rely on parents for comforting and appropriate reactions, this can be further traumatizing (Horowitz, Kassam-Adams, & Bergstein, 2001). Promising research has shown that parental presence during treatment does not decrease doctors’ skills or increase doctors’ anxiety levels, which could preclude parental presence (Frosch & Lewandowski, 1998).

_Theoretical Basis of PTSD_

This study is built on the diathesis-stress model of PTSD. According to this theory, PTSD results from interactions between diatheses, or premorbid ecological and biological factors, and stress. A person’s developmental history, coping skills, available role models, social support, genetics, neurological differences, and aspects of the unique aspects of the trauma itself are all examples of factors that could differentially explain one person’s versus another’s development of PTSD (McKeever & Huff, 2003).

Given a stressor, such as an acute medical trauma requiring emergency attention, these premorbid and event factors can support or weaken a person’s ability to respond healthily; however, these factors are unbalanced. A person could develop PTSD from a small stressor if he/she had many premorbid risks. Likewise, someone with few premorbid risk factors could develop PTSD due to experiencing a great stressor. Research is vital in determining which risk/resiliency factors are true, mediating, risk variables (McKeever & Huff, 2003).

_Literature Review_

This literature review examines the current literature regarding children and acute medical injuries. Prevalence rates found in diverse studies with varying injury severity
ratings and forms, pretrauma risk factors, peritraumatic factors, and posttrauma factors for the development of PTSD will be discussed.

*Children, Acute Injury, and PTSD*

Daviss, Mooney, Racusin, Ford, Fleischer, and McHugo (2000a) are among some of the pioneers investigating this public health concern with our younger generation. Patients surviving an injury were interviewed while still in the hospital and over one month later. Forty-five of the 48 youth reported meeting DSM-IV criterion A of extreme fear, while only 30 of the parents reported similarly, again demonstrating possible developmental differences in interpretation of events. Six children had full PTSD, and eight had partial symptoms. Significant predictors included prior psychopathology in the child and parental distress, and no accident/injury factors were predictors (e.g., severity of injury, death of others, TBI, etc.).

Aaron, Zaglul, and Emery (1999) interviewed 40 children after injury requiring hospitalization. Four weeks later, 22.5% had full PTSD while about 50% had partial symptoms. No relationships were found between PTSD and age, gender, ethnicity, SES, or specific hospital. There was a relationship between PTSD and the number of days of hospitalization, parents’ reports of the child’s initial traumatic response, higher scores of internalizing symptoms preceding the trauma, and suppression of thoughts related to the trauma. This evidence builds support for the consideration of pretraumatic, traumatic, and posttraumatic event variables in predicting PTSD.

With a follow-up period up to six months after the injury, Rennick, Johnston, Dougherty, Platt, and Ritchie (2002) found no differences in PTSD symptoms among children who had been in the pediatric intensive care unit (PICU) versus those who had
been in the general pediatric ward. Regardless of the treatment setting, the children were, however, more likely to have PTSD symptoms if they had more invasive procedures and if their parents were not present. With 10% of this sample still having negative effects six months later, PTSD appears to be an insidious opponent worthy of study and treatment. Interestingly, in this sample, decreased internal locus of control scores were discovered in 8.5% of the kids with many still exhibiting this trend even 12 months later. Thus, experiencing a trauma may alter the individual’s worldview including attributions and possible coping strategies.

Though parental reports have tended to underestimate childrens’ internalizing symptoms, de Vries, Kassam-Adams, Cnaan, Sherman-Slate, Gallagher, & Winston (1999) found that, according to 102 parents’ reports in their study, 25% of the children met PTSD criteria after an injury, while 49% had some impairment after the accident. Of these, only 46% received any sort of psychological assistance.

*Acute Stress Disorder (ASD)*

ASD was introduced in the DSM-IV and is diagnosed if a person has at least three dissociative symptoms along with at least one intrusion, avoidance, and hyperarousal symptom that last less than one month following a trauma (Classen, Koopman, Hales, & Spiegel, 1998). Some researchers have focused on these more immediate symptoms including Daviss et al. (2000a), who examined injured youth with at least an overnight admission. This was considered to be a traumatic event meeting criterion A by 92.6% of the kids, whereas only 64.8% of the parents agreed. ASD was present in 29.9% of the 54 youth with prior psychopathology, high parental distress, and permanent injury serving as risk factors.
Another study by Fein, Kassam-Adams, Gavin, Huang, Blanchard, and Datner (2002) strove to examine ASD and PTSD in children experiencing acute injury requiring the ED. In their sample, six percent met the criteria for PTSD, while 15% more had significant symptoms not fulfilling a full diagnosis. Over 80% reported ASD symptoms, and the measures for ASD and PTSD were modestly related (r=.39). Fein, Kassam-Adams, Vu, and Datner (2001) also found 30% of the children with violent injuries reporting symptoms of ASD in their study.

Meiser-Stedman, Yule, Smith, Glucksman, and Dalgleish (2005) followed a similar population in the United Kingdom. Of 93 children, ages ten to sixteen years of age, 19.4% met full criteria for ASD after an ED visit for assault or a motor vehicle accident (MVA) (while 24.7% met all of the criteria except for the dissociation requirement). This diagnosis of full or partial ASD then correctly classified 82.8% of the later PTSD cases with subthreshold ASD actually being more predictive than a full ASD diagnosis.

**Children with Motor Vehicle Accidents (MVAs)**

By the year 2020, the World Health Organization (WHO) predicts that MVA’s will be a leading cause of death and disability around the world (Mayou, 2002). In fact, approximately two million people are involved in MVAs a year in the US currently. In 1996, 938,000 kids younger than 21 years of age were injured in a vehicle, 39,000 were injured as pedestrians, and 33,000 were cyclists. Certainly this represents a public health concern (de Vries et al., 1999), especially considering the lack of holistic care currently surrounding these victims. (McDermott & Cvitanovich, 2000). Studies have begun to document the pervasive effects such an event can cause including the obvious physical
injuries and the less obvious, though equally insidious, psychological effects. Psychiatric disorders including depression, anxiety, phobias, and PTSD have been documented (Mayou, 2002). Though much less of this research has expanded to include children/young adolescents, similar outcomes have been found in the studies that are available (Mayou, 2002).

A few researchers have examined the effects of an MVA on children/adolescents. Di Gallo, Barton, and Parry-Jones (1997) followed 57 children who had been injured in a traffic accident. Interviewed 2-16 days and 12-15 weeks later, children evidenced posttraumatic stress symptoms (PTSS), or symptoms without a full diagnosis of PTSD, at both time points. Gillies, Barton, and Di Gallo (2003) then assessed 29 of these same children 18 months after the MVA. Moderate to severe symptoms of PTSD were a reality for 29%, and 44% had mild symptomology. In fact, the severity of symptoms was actually higher than when initially measured 12-15 weeks after the MVA (14% had moderate-severe symptoms at 12-15 weeks post-MVA (Lowenstein, 2001)), and 34% had developed delayed-onset PTSD. Then, Keppel-Benson, Ollendick, and Benson (2002) followed 50 children ages 7-16 years for nine months after a MVA. Though mostly mild injuries were present, 14% met the full criteria for PTSD with the severity of injury, the mode of injury (bike, pedestrian, etc.), and more parental vigilance serving as significant predictors. Finally, Stallard, Salter, and Velleman (2004) found 29.1% of the children attending the ED in a United Kindgom hospital met the criteria for PTSD four weeks following the MVA. These samples were small overall, though, so interpretations must be made with caution.
Stallard, Velleman, Langsf ord, and Baldwin (2001b) considered the role of PTSD and coping style, a possibly amenable characteristic/tendency with a larger population. Of 119 youth involved in an MVA, 41 met PTSD criteria six weeks later, and of these, avoidant coping was significantly more common. In fact, those with PTSD attempted more coping strategies overall. Eight months later, 25% of those sampled had PTSD. Girls and those with continuing physical/medical issues were most at-risk, as were those who had not talked about what happened. Investigations are clearly needed to examine this trend.

Children with Brain Injury (TBI)

Though much controversy exists regarding the possibility for trauma if a person cannot remember the event, injuries with a loss of consciousness, including a brain injury, may lead to the development of PTSD. According to the “dual representation model” (Harvey, Brewin, Jones, & Kopelman, 2003), “verbally accessible memory (VAM)” (Harvey et al., 2003, p. 664), which is verbal and can be intentionally recalled and thus integrated, is opposed by “situationally accessible memory (SAM)” (Harvey et al., 2003, p. 664), which is more implicit and built on sensory stimuli. Thus, even with the faulty functioning of one system of memory, the second system still allows for processing of the traumatic event and later symptoms of PTSD. These memories are more sensory and can be triggered by many reminders thus leading to the symptoms of PTSD (Harvey et al., 2003).

Other explanations follow as well for the reasoning to include children with TBI. First, memories just prior to the event or those from afterwards can serve as traumatic memories. Others also tell the patient what happened, so “stimulus reevaluation”
(Harvey et al., 2003, p. 669) is possible even with a loss of consciousness. The true
danger of what transpired is appreciated in the afterglow though this awareness was not
possible at the actual time of the trauma. Finally, “the amnesic gap itself may provide a
source for rumination that might itself become traumatic” (McMillan, Williams, &
Bryant, 2003, p. 158). A piece of the survivor’s life is unavailable, and this realization
can be traumatic along with the strategy of using one’s imagination for filling in holes in
their memory for what happened. This imagining can be just as horrifying as the actual
event (McMillan et al., 2003). For these reasons, it is vital to include this population in
studies of PTSD, though differentiations need to be considered for symptoms of the TBI
versus symptoms better explained by PTSD.

Children have been found to suffer from PTSD after TBI, with rates spanning
from 4% of children with varying degrees of head injury to 48.5% of children with severe
brain injuries (Gerring et al., 2002). In a study by Gerring et al. (2002), 95 youth ages 4-
19 years were studied over a year following a TBI. By this one-year mark, 13% had
PTSD, though there were significantly different reports between the kids and parents.
For the children, having any anxiety diagnoses, depression or anxiety symptoms, or other
premorbid psychiatric conditions predicted later PTSD. For parents, only female gender
was a significant predictor. In Mather, Tate, and Hannan’s (2003) study, 85.7% of the
children with concomitant TBI had PTSD. Though symptoms improved over time, 44%
still had symptoms 13 weeks later. Finally, Levi, Drotar, Yeates, and Taylor (1999)
examined children six and 12 months later after a TBI or orthopedic injury (OI). They
found that parents reported mild PTSS in their children at both time periods in the
presence of a severe TBI. Lower SES levels predicted more PTSS as did younger age of
the child. Finally, child and parent reports were not significantly related, ultimately underscoring the urgent need to assess the child’s own perception and report of symptoms.

*Children with Spinal Cord Injury (SCI)*

SCI’s claim physical and mental health consequences in many of our youngest population as well. Boyer, Knolls, Kafkalas, Tollen, and Swartz (2000) included 64 children ages 11-24 years in their study. Of these, 25.4% had PTSD with an additional 31.3% having partial symptoms. These rates are even higher than those found in adult populations, in other trauma forms in children, and for other psychiatric disorders including depression, signaling the urgent need for attention and care for this population.

*Children with Burns*

For burn injuries, “the burned child is thrust into an alien setting full of strangers in odd masks and costumes, frightening devices, smells of burned flesh and medication, and most importantly overwhelming pain” (Wisely, Masur, & Morgan, 1983, p. 51). This circumstance could certainly place these children at risk for PTSD. Pain in burn injuries “is unique in its severity, persistence, and intractability to analgesic and sedative medications” (Wisely et al., 1983, p. 46), and there are innumerous procedures and complications throughout the treatment process that can still lead to permanent disability and scarring. This reality makes burn injuries likely culprits for PTSD responses. In general, 19-45% of burn patients have been found to have PTSD up to one year later, and risk factors have included being female, having a premorbid mood disorder, blaming others for the burn, and having a longer hospitalization (Van Loey, Maas, Faber, & Taal, 2003). Saxe et al. (2005) studied 72 children ages seven to seventeen years with burn
injuries at Shriners Burns Hospital in Boston. In this sample, PTSD was present. Acute separation anxiety and acute dissociation explained 59% of the variance and served as two distinct pathways to developing PTSD.

The above literature review supports the presence of PTSD in children following acute medical traumas including MVAs, TBI, SCI, and burns. Though small samples are common, and research has spanned studies with varying time frames for assessment, varying reporters, and varying assessment tools, the findings speak to larger implications including the need to consider risk factors and the development of PTSD in this population.

**Risk Factors for Developing PTSD**

“An event that prompts PTSD in one individual may not do so in another” (Davis & Siegel, 2000, p. 140). Breslau (2001b) labeled this a “conditional risk” (Breslau, 2001b, p. 19). Fitting with the diathesis-stress model (McKeever & Huff, 2003), there appear to be varying risk factors for the development of PTSD in both adults and children; however, this area of research is garbled. Some variables have been consistently found to affect PTSD while others are less clear. (Perrin et al., 2000; Yehuda, 2004). This limits professionals’ ability to identify those most at-risk for developing PTSD and then to intervene early in order to decrease long-term, negative effects (Yehuda, 2004).

Risk factors may operate at several levels in conferring their risk for PTSD following a trauma. There are pretrauma factors, peritraumatic factors, and posttrauma factors to consider (Hsu, Chong, Yang, & Yen, 2002; Maes, Mylle, Delmeire, & Janca,
2001; Udwin, Boyle, Yule, Bolton, & O’Ryan, 2000). Several of these that may have a connection with later PTSD symptoms in children are reviewed below.

*Pretrauma Factors*

Pretrauma factors include many aspects of the individual including individual characteristics, prior traumas, and prior psychopathology (Maes et al., 2001; Ozer, Best, Lipsey, & Weiss, 2003).

According to epidemiological findings, women have a 2:1 ratio over men of having lifetime PTSD, even though men experience more traumas overall (Gavranidou & Rosner, 2003), and women’s symptoms seem to last longer (Breslau, 2001a). Murdoch, Hodges, Copwer, Fortier, and Van Ryn (2003) completed the Trauma Recovery Project (TRP) with 627 participants who experienced a traumatic event. Although there were no differences in injury severity, length of hospital stay, or perceived life threat, women had higher rates of PTSD than men. Many other researchers have found this relation (Mirza, Bhadrinath, Goodyer, & Gilmour, 1998; Stallard et al., 2001b; Stallard, Velleman, & Baldwin, 2001a; Zatzick, Russo, & Katon, 2003) including Stein, Walker, and Forde (2000), who followed 1002 participants in Canada. They too found that significantly more women than men had full or partial PTSD following various life traumas. However, Gill (2002), Aaron et al. (1999), Kapfhammer, Rothenhäusler, Krauseneck, Stoll, & Schelling (2004), and Zink and McCain (2003) examined adult and child patients and found no significant association between gender and PTSD.

Rates of PTSD also vary by ethnicity and culture in populations experiencing natural disaster and war trauma. Perilla, Norris, and Lavizzo (2002) followed individuals after Hurricane Andrew in order to examine this trend. Results showed that individuals
in minority cultures had higher rates of PTSD. Arousal symptoms were similar across all
groups though differences emerged when considering intrusion and avoidance. Overall,
minorities lived in more traumatized areas and had experienced more severe trauma from
the Hurricane. Finally, Pole et al. (2001) found higher rates of PTSD for police officers
in nondominant ethnic groups, especially Latinos, and following the Persian Gulf War,
individuals from minority groups had higher rates of PTSD symptoms and distress (Ruef,
Litz, & Schlenger, 2000).

However, ethnicity has not been a significant predictor in several studies
examining medical trauma including one by Gill (2002), which included 337 pediatric
patients (199 Latinos, 98 African-Americans, 28 Caucasians, and 12 other ethnicities),
Aaron et al.’s (1999) study composed of 40 children in the ICU or pediatric ward, of
which 85% were Caucasian and 15% were African-American, and the study by Zink and
McCain (2003), which included 143 children hospitalized after an MVA, of which 40
participants were African-American with the rest Caucasian.

Younger age appears to be related to PTSD in a couple of studies including one
examining hospitalized children (Mabe, Treiber, & Riley, 1991), as some have suggested
that younger children may be less able/likely to attempt independent coping (Salmon &
Pereira, 2002). Schreier, Ladakakos, Morabito, Chapman, & Knudson (2005) followed
acutely injured children and also found younger age associated with more severe
symptoms of PTSD. In particular, those ages seven to twelve years of age need further
study and attention. Other studies of adults and children have failed to support this
relationship though (Aaron et al., 1999; Gill, 2002; Kapfhammer et al., 2004; Mirza et al.,
1998; Van Loey et al., 2003; Zatzick et al., 2003; Zink & McCain, 2003). Conducting
studies with more similar aged youth instead of a heterogeneous grouping could assist in refining this inconsistency and possible risk factor (Davis & Siegel, 2000).

Mixed results pepper the literature surrounding the possible risk factor of prior traumas. Amir and Sol (1999) studied university students in Israel. Of these, 67% reported having experienced at least one life trauma, and 6% met criteria for PTSD. Those having lived through multiple traumas actually reported less distress than those reporting only one trauma; however, more intrusion symptoms were present in the group with multiple traumas. Mellman, David, Bustamante, Fins, and Esposito (2001) and Difede et al. (2002) also found no significant relationship between having prior traumas and later PTSD for adults with injury and/or burns; however, Schelling et al. (2004) reported a significant relationship for adult, cardiac patients. A better understanding of this variable is sought.

Most of the studies examining prior psychopathology have found no relation to PTSD after an illness/injury. These studies include adults and children with MVAs (Mirza et al., 1998), injury (Mellman et al., 2001), burns (Difede et al., 2002), and acute respiratory distress (ARD) (Kapfhammer et al., 2004). However, Daviss, Racusin, Fleischer, Mooney, Ford, and McHugo (2000b) studied 54 injured children and found a positive relationship, Widows, Jacobsen, and Fields (2000) found a similar positive result with adult bone marrow transplant (BMT) survivors, and Asarnow et al. (1999) found that a pre-existing anxiety disorder did serve as a significant risk factor for developing PTSD for 63 kids following an earthquake in California.

Thus, several pretrauma variables may serve as either risk/protective factors. Females have traditionally been found to be most at-risk, as have individuals from
diverse cultures. Divergent findings, though, are the reality for age, having experienced prior traumas, and having prior psychopathology.

Peritraumatic Factors

Variables that occur during the course of a traumatic event may also have an impact. These include objective and perceived life threat (Ozer et al., 2003), peritraumatic dissociation (Ozer et al., 2003), attributions, seeing others injured/killed (Maes et al., 2001), biological responses (Yehuda, 2004), immediate arousal and fear (Maes et al., 2001; Ozer et al., 2003), and feelings of a loss of control (Maes et al., 2001).

Gill (2002) found that the mode of injury might play a role in the development of PTSD. In a study of 337 injured patients younger than 17 years of age, 21% were diagnosed with PTSD, and those with gun shot wounds and abdomen wounds were found to be most at-risk. Falls were the least likely mode of injury to lead to PTSD.

Cline (2004) also found a significant effect for mode of injury in a subsample taken from the National Pediatric Trauma Registry, 1988-1994. Those with an injury due to a pedestrian or nonpersonal accident, including sports injuries, being struck by an object, animal bites, and falls, were significantly less likely to have psychological complications with their injuries than those with violent/weapon injuries (gun shots, stabbings, and beatings). Those with motor vehicular accidents, however, suffered from similar rates of psychological complications as those with violent/weapon injuries.

Except for Frommberger, Stieglitz, Nyberg, Schlickewei, Kuner, and Berger’s (1998) study examining adult MVA victims and Van Loey et al’s (2003) study following burn victims, most of the literature has failed to find a significant relationship between illness/injury severity, or objective threat, and PTSD. These include adult and child
studies involving MVAs (de Vries et al., 1999; Ehlers, Mayou, & Bryant, 1998; Mirza et al., 1998), injury (Daviss et al, 2000a; Gill, 2002; Mellman et al., 2001; Zatzick et al., 2003), MI (Ginzburg et al, 2003), and ARD (Kapfhammer et al., 2004).

The findings concerning perceived threat diverge though. Prior findings support the importance of assessing the subjective threat of an illness/injury. Dougall, Ursano, Posluszy, Fullerton, and Baum (2001), Ginzburg et al. (2003), Widows et al. (2000), and Ozer et al. (2003) found that the immediate perceived threat, severity, and fear ratings significantly predicted PTSD in adult samples with medical traumas. Ehlers, Mayou, and Bryant (2003) found a small but significant relation between perceived threat/fear and later PTSD in children who had experienced a MVA.

Prior studies found a relationship between having peritraumatic dissociation and an increased risk of PTSD (Birmes et al., 2003; Fullerton et al., 2000; Harvey & Bryant, 2002; Mellman et al., 2001; Ozer et al., 2003; Shalev, Peri, Canetti, & Schreiber, 1996). According to the dissociation theory, decreased awareness during a trauma, or dissociation, may lead to a decrease in encoding of the event and subsequent emotional reaction. This matches assertions of the cognitive theory of PTSD that having minimally elaborated memories of the trauma prevent retrieval and the needed processing in order to avoid PTSD symptoms (Shalev et al., 1996).

Birmes et al. (2003) examined the dissociation variable in hospitalized victims of assault two weeks and three months later. Of the thirty-five participants, twelve had PTSD. Those with PTSD had significantly higher peritraumatic dissociation and acute stress reaction scores than those without PTSD. Fullerton et al. (2000) documented that 79% of a sample of 122 MVA victims experienced peritraumatic dissociation with
younger participants, Caucasians, single participants, and those with injured passengers having more symptoms of dissociation. Prior traumas, prior dissociation, prior PTSD or depression, nor the severity of the trauma significantly predicted who would dissociate.

Acute dissociation has not been studied as well in child populations (Stoddard & Saxe, 2001). Due to developmental differences in the expression of PTSD, children may or may not display dissociative symptoms at the time of the trauma. Further exploration is required (Daviss et al., 2000b).

Some who develop PTSD never experience dissociation. Thus, it is possible that multiple pathways exist for developing PTSD. In fact, those with all of the acute stress disorder (ASD) symptoms except for dissociation have been found to have significantly higher heart rates, or arousal. Dissociation tends to decrease arousal. So, these two possible routes to developing PTSD require investigation (Creamer, O’Donnell, & Pattison, 2004; Harvey & Bryant, 2002).

Biological/arousal symptoms at the time of the trauma may also predispose one to developing PTSD. Shalev et al. (1998) reported that those with PTSD had higher heart rates (HR) but not blood pressure in the ED and one week later, although there was no difference in HR one and four months later. Bryant, Harvey, Guthrie, and Moulds (2000) also found that those with PTSD six months later had higher immediate heart rates. Greater than 90 beats per minute (bpm) had 88% sensitivity and 85% specificity in predicting PTSD status (Bryant, Harvey, Guthrie, & Moulds, 2003). Having ASD or a heart rate equal to or greater than 95 bpm was found to have 74% sensitivity (Bryant et al., 2003).
Children may have varying resting heart rate and reactivity though. Kassam-Adams, Garcia-Españoña, Fein, and Winston (2005) stated that higher resting heard rates are normal in children with 91 bpm as average for eight to eleven year olds and 85 bpm as average for 12-15 year olds. In their study of children experiencing an MVA and hospital treatment, 32% of the children experienced an elevated heart rate in the ED. Of the entire sample, 11% developed partial PTSD, and 6% developed full PTSD. These symptomatic children had significantly higher heart rates than the other children. A study examining the children living amongst the Branch Davidians found that they had resting heard rates of greater than 100 bpm. During interviews about the experiences and symptoms, the heart rates went as high as 150 bpm (Sauter & Franklin, 1998). This matches other findings of higher heart rates when recalling traumatic memories (Scheeringa, Zeanah, Myers, & Putnam, 2004).

However, Blanchard, Hickling, Galovski, and Veazey (2002) found that those having PTSD 13 months later actually had lower heart rates in the ED. This study was different in that it included treatment seekers who may differ in significant ways from those not seeking treatment for their symptoms. Further, dissociation, which may serve as a moderator, was not assessed in this study. Those with higher dissociation may have lower heart rates, thus explaining this discrepant finding (Bryant et al., 2003). More study examining this risk factor of immediate biological reactivity in the general population with the variable of dissociation included in the assessment may assist in parceling out these contradictions.

Initial arousal, including immediate reactions and dissociation (ASD), was a significant peritraumatic predictor of who developed PTSD in a sample of 83
hospitalized, injured adults (Mellman et al., 2001). The presence of ASD in the immediate aftermath of the event (Kassam-Adams & Winston, 2004) is an important variable to consider. Classen et al. (1998) found that symptoms of ASD in adults following an office shooting were associated with the development of eventual PTSD; however, this may or may not be true for children (Kassam-Adams & Winston, 2004). A focus on ASD and subsequent PTSD in children is necessary.

Overall, several peritraumatic variables appear to place individuals more at-risk for developing PTSD after a medical trauma. These include mode of injury, higher perceived versus objective threat, dissociation during the trauma, having a higher initial heart rate, and having immediate symptoms of ASD.

Posttrauma Factors

Finally, even variables following a trauma can protect against or place one at-risk for symptoms of PTSD. Issues such as the extent of physical injury/treatment and functional impairment (Blanchard, Hickling, Taylor, Loos, Forneris, & Jaccard, 1996; Maes et al., 2001; Mayou, Ehlers, & Bryant, 2002), attributions, coping strategies (Mayou et al., 2002), and family distress (Ozer et al., 2003) are paramount to consider. In fact, some research suggests these post-event variables may be the most impactful ones in connoting a continuing risk for PTSD. In fact, only the one pretrauma variable of gender was a significant predictor of PTSD in one study (Maes et al., 2001).

Research has fallen on both sides regarding hospital/treatment aspects and the risk for PTSD. Neither the length of the hospital stay (Ginzburg et al., 2003; Mellman et al., 2001), prior hospitalizations (Mabe et al., 1991), nor the number of medical procedures performed were found to be predictive of later PTSD in these samples of hospitalized
patients. However, a supportive link between PTSD and the following variables were found: length of the hospital stay (Aaron et al., 1999; Frommberger et al., 1998; Van Loey et al., 2003), number of invasive medical procedures (Rennick et al., 2002), and the number of days in ICU (Kapfhammer et al., 2004; Rothenhäusler et al., 2002) for samples of adults and children (Rennick et al., 2002) with MVAs (Frommberger et al., 1998), injuries (Aaron et al., 1999), burns (Van Loey et al., 2003), ARD (Kapfhammer et al., 2004), and liver transplants (Rothenhäusler et al., 2002). Cline (2004) found that the number of medical procedures performed while in the hospital significantly predicted psychological complications with injury. For every one additional procedure, the child had a 1.33 higher chance of this negative outcome. More focused research is needed.

Unfortunately, little research attention has been spent studying impairment even though it may serve as a constant reminder of and thus trigger recurring thoughts of the medical trauma (Martz and Cook, 2001). Having continuing medical problems after an MVA (Ehlers et al., 1998), having facial burns (Fukunishi, 1999), and having a permanent injury (Daviss et al., 2000b) all significantly predicted PTSD after an injury, though permanence of injury/disability was also found to be a nonsignificant predictor in another study (Daviss et al., 2000a).

Especially during certain key developmental periods (i.e., elementary school age, adolescence) certain impairments of disease/injury make it more difficult for the child to fit into the social environment. First of all, there may be physical restrictions placed on the child, so he/she cannot participate in the activities of peers. The consequences of this may be especially potent for males, who often have more active play (La Greca, 1990).
Demonstrating the importance of considering functional impairment following an injury, Aitken et al. (2002) found that all acutely injured children in their study had at least one functional disability at discharge, as rated on the Children’s Health Questionnaire –PR – 50 (CHQ-PR-50). By one month later, 59% still had an impairment, and by six months later, 37% still had at least one functional impairment. The injured children had significantly lower scores on the CHQ than the healthy, normed population, and there was not a significant difference between the acutely injured and the chronic health condition norms. Those children with the most severe injuries (ISS greater than 16) had the lowest CHQ scores.

Physical appearance issues are also essential to consider, as disfigurement is common in many conditions including burns, amputations, injuries, etc (Bronfman et al., 1998). Children who look different are often avoided. “…40% of the adolescent and young adult survivors of Hodgkin’s disease, who had returned to the same schools they had attended prior to treatment, reported unpleasant experiences with classmates, such as peers teasing them about their baldness or thinness, avoiding them because of possible contagion, or generally treating them as outcasts” (La Greca, 1990, p. 294). This sensitivity to physical anomalies is particularly strong during the adolescent years. Thus, impairment and disfigurement are a reality many injured children face; inclusion of these variables in the current study will help to progress the knowledge in this field.

When negative, and positive, life events occur, those affected attempt to explain their occurrence. Events can be attributed to many factors including an internal-external continuum, a global-specific continuum, and a stable-unstable continuum. Past research has suggested that these attributions have repercussions for the individual’s well-being.
A pessimistic style of internal, global, and stable attributions for negative events has been associated with higher rates of psychopathology. PTSD may be affected as well (Gray & Lombardo, 2003).

Contradictory findings have been found for the internal-external continuum. While one study with a medical trauma sample matches the research findings of worse psychological outcomes following sexual abuse/rape for those blaming themselves (internal) (Stallard et al., 2001b), most studies of these populations have reported the opposite, that placing the blame on oneself leads to better psychological outcomes (Gray & Lombardo, 2003). As seen in the study by Greenberg and Keane (2001), after a house fire, children experienced less PTSD if they blamed themselves in the first two weeks versus blaming others for the event. It has been theorized that blaming oneself helps increase the sense of control over events one has in life (Lambert, Difede, & Contrada, 2004).

Mellman et al. (2001), Williams, Evans, Needham, and Wilson (2002), and McMillan et al. (2003) all provide research support for the protective aspect of blaming oneself for an injury, MVA, or other medical trauma. Those blaming others were more likely to develop PTSD. In particular, Lambert et al. (2004) examined this “attribution of responsibility” (Lambert et al., 2004, p. 304) variable. Of 98 participants who had at least 5% of their bodies burned, 11.2% had ASD. More of those qualifying for this diagnosis blamed others for their injury. These studies only included adults, however, so children’s status is relatively unknown in this area. It is possible that different traumas and populations have varying best practice for attributional styles (Harvey & Bryant, 2002).
Coping is another variable of interest. Approach coping and humor has led to better outcomes for patients in prior studies (Stallard et al., 2001b), while increased avoidance coping and suppression has been associated with increased rates of PTSD (Aaron et al., 1999; Asarnow et al., 1999; Jacobsen, Sadler, Booth-Jones, Soety, Weitzner, & Fields, 2002; Nielsen, 2003; Stallard et al., 2001b; Widows et al., 2000).

Beck, Gudmundsdottir, and Shipherd (2003) reported similar results with pain patients. Adaptive copers had significantly lower scores on measures of PTSD, anxiety, and depression. Those classified as distressed or dysfunctional copers on the Multidimensional Pain Inventory (MPI) were similar in their higher risk. Thus, poor coping with pain, procedures, and traumatic events may serve as risk factors for PTSD.

Medical traumas affect whole families not just the individual patient. In recognition of this, the DSM-IV has added “learning about unexpected or violent death, serious harm, or threat of death or injury experienced by a family member or close associate” (American Psychiatric Association, 2000, p. 463) as a possible traumatic event. The literature provides some evidence that parents are negatively affected by children’s medical conditions and treatment (Balluffi, Kassam-Adams, Kazak, Tucker, Dominguez, & Helfaer, 2004). Of the 272 parents with children in the pediatric intensive care unit (PICU), 32% met criteria for ASD and 21% met criteria for PTSD at least two months later.

Thus, parents themselves are another unique aspect of pediatric injuries (Creamer et al., 2004). With adults, professionals focus on the patient, who is typically capable of making decisions and soothing him/herself. With children, come parents. In fact, the idea of the “injured child-injured family” (Athey et al., 1997, p. 465) has been proposed.
Thus, parental reactions and outcomes are an important corollary in their children’s recovery or continual symptom picture.

Once one person develops symptoms of PTSD, others in the family can “catch” them in a way (Lyons, 1987). In support of this, Boyer et al. (2000) found that mothers and children’s PTSD scores are significantly correlated, as are mothers’ and fathers’ scores. Temperament may be shared, children may elicit symptoms in their parents, or children may be more vulnerable when the parents have PTSD (Boyer et al., 2000). Longitudinal studies could help to provide more details for this symptom picture. Parents may also develop PTSD sooner than the children due to more mature processing abilities. Children may not yet grasp the traumatic nature or repercussions of the event until years later (Greenberg & Keane, 2001).

Parents’ distress also serves as a model for the child. If children observe parents’ distress concerning their injury/illness, suddenly their condition seems much more serious. Children may then cooperate less, have increased behavioral problems, and have higher anxiety (Kirkby & Whelan, 1996). In fact, research has supported this link with evidence that the childrens’ symptoms of PTSD were more closely aligned with the parents’ responses than to the actual exposure to the trauma (Kiliç, Özgüven, & Sayil, 2003). Younger children in particular may be most at-risk, as they rely more on parents for social referencing (Green et al., 1991). Older adolescents may be similarly negatively impacted by parents’ symptoms due to their taking on parenting responsibilities when their mother and/or father cannot fulfill them due to symptoms of PTSD (Green et al., 1991; Scheeringa & Zeanah, 2001).
Several studies highlight the findings regarding the risk factor of parental adjustment/functioning. Famularo, Fenton, Augustyn, and Zuckerman (1996) found that 36% of kids suffered from PTSD if their mothers had it too. A literature review found that in all studies but one, parental functioning significantly affected the child’s psychological outcome (AACAP, 1998; Scheeringa & Zeanah, 2001); however, no relation between parents’ distress and child’s PTSD rates has been reported as well (AACAP, 1998). It is possible that age moderates this effect, with stronger influences for younger versus older children (Scheeringa & Zeanah, 2001). In support of this, de Vries et al. (1999) found that 15% of parents met criteria for PTSD after a child’s MVA with higher rates present if the child was younger and if the parent witnessed the accident. Unfortunately, only 20% of these parents sought any treatment for themselves. Mayou (2002) reported that family distress is also likely after an MVA, finding that 12% of mothers in that study had ASD, and 4% had PTSD three or six months later (Mayou, 2002).

SCI and burn injuries may lead to the same reciprocal parental effects. A significant amount of parents of children with SCI have been found to have PTSS (Boyer et al., 2000). In fact, Boyer et al. (2000) found an even higher rate in parents of children with SCI than with other medical conditions. Current symptomology was discovered in 41% of the mothers and 35.6% of the fathers with even more having partial symptoms. Conducted in Japan with burn victims, Fukunishi (1998) reported that 18.8% of the mothers suffered from PTSS while only 6.3% of the actually burned children did. Rizzone, Stoddard, Murphy, and Kruger (1994) included more severely burned children. Current symptoms of PTSD were reported by 56% of the parents, with 52% qualifying
for acute PTSD. Having a larger body percentage burn and the larger the distance between the parent and child when the burn occurred was associated with more PTSS.

The hospitalization process itself can also be traumatizing. Landolt, Vollrath, Ribi, Gnehm, and Sennhauser (2003) found that 16% of fathers and 23.9% of mothers met full criteria for PTSD after their child was hospitalized for cancer, diabetes, or an accident. In 6.7% of the families, both parents suffered from PTSD. By five to six weeks later, mothers had significantly more severe symptoms than fathers. Further, more PTSS were found for those having a child injured in an accident versus a chronic condition, and less PTSD was reported for those with children having better overall functioning. Scheeringa and Zeanah (2001) reported on other family/parent variables that were associated with higher levels of PTSD including psychiatric disorders, family disruption, increased family withdrawal, and less cohesion.

There is still much to learn in the study of posttrauma factors. Divergent findings exist for hospital variables such as the length of stay in the hospital or the number of medical procedures performed, and little research has examined continuing physical impairment, attributions, or coping as risk factors for developing PTSD after a medical trauma. Finally, parental effects have been well documented and theorized about though they are not frequently included in studies of injured children. Children appear to be more at-risk if their parents display symptoms of PTSD and other symptoms of psychological distress.

Conclusions and Implications

Based on all of the above information, it is evident that children are at-risk for developing PTSD, that acute injuries and treatment can lead to the development of PTSD,
and that there are numerous, and often nondefinitive risk factors to consider when
determining which child patients may be most at-risk for PTSD.

It is also evident that contradictory findings regarding many of the possible risk
variables could be due to varying methodologies, trauma forms, age groups, assessment
methods, and diagnostic criteria. More clarification is required if professionals will be
able to specifically target those children truly at-risk, so the only definitive conclusion to
be drawn is that more reasoned research is required in order to parcel out true
risk/protective factors that explain more of the variance in PTSD outcomes following
acute injuries requiring medical treatment in children (AACAP, 1998; Davis & Siegel,
2000; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Pine, 2003; Seedat et al.,
2000). The development of sensitive and specific screeners including these significant
risk factors is required along with tests for their accuracy and practicality (Winston,

Having all of the above information and designing studies according to past
findings and cautions will ultimately allow for a more supportive and responsive family,
staff, and environment for injured children and their families. Possible iatrogenic trauma
from their experience in the hospital would be extinguished as well (Horowitz et al.,
2001).

These improvements that will be incorporated into this current study include
having as large a sample as possible, including multiple forms of injuries, using current
and psychometrically supported interviews for determining PTSD and symptoms,
including parental factors in the study along with pre, peri, and posttrauma variables,
聚焦 on a more circumscribed age group, assessing for immediate symptoms and risk
factors along with more long-term symptoms versus a retrospective or one-shot design, and making any findings practical by testing and improving upon a current screener for symptoms of PTSD following such an injury in children.

Purpose of Study

Spurred by the high incidence of childhood traumatic injuries and the problematic nature of many aspect of the field, the study of PTSD and its inherent negative effects following such an acute trauma is essential. This study intends to explore the pattern of PTSD in children following an acute injury requiring emergency medical treatment. It is believed that a substantial number of children will be negatively impacted by PTSD symptoms and that several risk factors are helpful in creating and improving upon a current screener to be utilized in medical settings. Specific hypotheses/research questions will be examined in this section.

Research Question 1

What is the incidence of significant symptoms of PTSD in children following an acute injury requiring medical treatment?

Research Question 2

What are the risk factors for developing significant symptoms of PTSD after such an injury? Based on the literature, the following variables were expected to show some relation to having symptoms of PTSD. Being younger, being female, having prior traumas, relying on avoidant coping or more overall coping strategies, feeling that the injury and hospital treatments were threatening, having more medical procedures, having parents with PTSD and other symptoms of psychological distress, having a more extreme initial reaction including dissociation and ASD, having a high, initial heart rate (> 90
bpm), and having some functional impairment and/or physical disfigurement will be associated with more symptoms of PTSD, while attributing the injury event to oneself will lead to fewer symptoms of PTSD.

Research Question 3

Is coping style affected by the injury/medical treatment experience? It is believed that negative/avoidant coping will become more predominant following the injury/medical treatment experience than was present initially at the time of the injury, as choice and control are often removed from children encountering emergency medical care within the hospital setting.

Research Question 4

Is a current screener for PTSD following an MVA, including pretrauma and trauma characteristics, associated with symptoms of PTSD in this acutely injured population? Further, are additional risk factors successful in predicting the outcome of significant PTSD symptoms? It is believed that adding posttrauma factors will increase the predictive ability of this screener.
Chapter Two: Research Design and Methodology

This chapter describes the methodology of the current study. Specific information regarding the participants, instrumentation, and data collection procedures will be provided.

Participants

This study examined 32 children ages seven to thirteen years of age and a parent following a moderate-severe acute injury requiring emergency medical care. All children and a parent within this age range who attended the University of Kentucky’s Emergency Department (ED) and hospital with an unintentional injury (e.g., not abuse, suicide attempt, etc.) and met the following inclusion criteria were asked to participate in the study:

1. had an injury severity score (ISS) of eight or higher,
2. spoke/understood English,
3. did not have a history of mental retardation,
4. had a Glasgow Coma Score (GCS) of greater than nine if a head injury, and
5. had a mailing address and phone contact availability.

The GCS, developed in 1974 and considered a strong indicator of patient clinical outcome, ranges from three to fifteen, with three being the worst score. It is based on the patient’s best eye, verbal, and motor response to stimuli. An eye score of one signifies no eye opening, whereas a score of four means the patient has spontaneous eye opening. A verbal score of one signifies the patient has no verbal response, whereas a score of five means the patient is oriented and able to converse. Finally, a motor score of one means the patient had no motoric response to pain, while a score of six signifies the patient’s
ability to follow commands for motor responses (Glasgow Coma Scale, n.d.). Typically, a coma score of eight or less signals a severe brain injury (Centers for Disease Control and Prevention, n.d.).

Those children still not able to participate by five days after the injury were excluded from the study. Appendix A provides the inclusion form to be used in determining appropriate participants. In the case of the presence of two parents, it was the parents’ choice as to which one completed the interview/forms.

Of the 55 participants able to receive a full description of the study, 32 consented to participate. This is a positive response rate of 58%. The majority of the parent participants were mothers, though eight fathers participated as well. Of families declining to participate, rationales ranged from the child feeling bad, to the parent being tired, to the parent wanting the child to forget what had happened, to the parent stating the child was fine and had no negative repercussions, to there being too much going on. Of the names sent to the researcher by the trauma registry, nine additional patients had already been discharged, two did not qualify either due to a diagnosis of mental retardation or to a lack of English speaking abilities, and three patients were not able to be interviewed within five days of their injuries.

Instrumentation

Several measures were used in this study to examine possible risk factors for the development and pattern of PTSS in children with acute injuries.
Predictor Measures

Participant Information Sheet.

A participant information sheet was collected to facilitate the four week follow-up contact. This sheet containing the family’s address, phone number, the child’s birthdate, etc. (see Appendix B) was kept under lock and key separate from all of the other data in order to maintain confidentiality. In order to access medical records, only the child’s birthdate was required, so the social security number information was not collected. Finally, the parent was asked whether he/she would like to be informed of significant PTSD symptoms in the child and the final results of the study.

Demographic Information Sheet.

The demographic information sheet collected general information about the participating child and his/her family (see Appendix C). This information helped to determine the representativeness of the sample compared to the general population along with assessing for some pretrauma risk factors for developing PTSD after an acute injury requiring hospital treatment. Factors that were assessed included: age, gender, ethnicity (coded as either White or Non-White due to the lack of abundant diversity in the study setting), SES, prior psychopathology, prior special education services, prior hospitalization, prior traumas, etc.

Injury and Impact Information Sheet.

The parent also completed an open-ended question describing the injury leading to their child’s medical treatment and what impact this had had on them (Appendix D).
Coping style.

Children completed the Kidcope measure at the time of the first assessment (in-hospital) and for the second assessment at least four weeks later to determine any impact of coping style on PTSD outcomes and whether any changes in coping style had emerged across the course of the child’s recovery from the traumatic injury.

The Kidcope (7-12 year old version), a 15 item self-report measure that assesses the child’s preferred coping style, was administered to the child. A ten-item format is available for children ages 13-18 years of age. For this measure, children are asked to think of a stressful situation related to having their injury and to rate if they tried various coping techniques and the effectiveness of these. The positive/approach style is composed of “cognitive restructuring, problem-solving, social support, and positive emotional regulation” (Frank, Blount, & Brown, 1997, p. 567). The negative/avoidance style is composed of “distraction, blaming others, wishful thinking, resignation, and negative emotional regulation” (Frank et al., 1997, p. 567-568). The Kidcope is becoming a popular measure in pediatric settings due to its short length (Thurber & Weisz, 1997), and Spirito, Stark, & Williams (1988) found that this brief measure had adequate test-retest reliability (.41 to .83 assessed across three to seven days) and validity as compared to other measures of coping including the Coping Strategies Inventory. For this study, the reliability was acceptable for the in-hospital assessment ($\alpha = .64$) and good for the follow-up assessment ($\alpha = .75$).

Sense of Threat.

The children were asked to rate their sense of threat/fear for both the injury event and the hospital/treatment experience (see Appendix E). The child was asked to rate how
much he/she was afraid at the time of the injury and separately during his/her medical
treatments. This gave a subjective sense of threat for both experiences. These questions
were administered at the follow-up assessment as well.

*Hospital Variables.*

As seen in Appendix F, medical information was also collected from the child’s medical records. These variables included: mode of injury, injuries received in the trauma, medical procedures performed, HR at the ED admittance (immediate physiological reactivity), whether the child was intubated/sedated, whether the child was admitted, the number of days of hospitalization, whether any injuries could result in physical disfigurement, and the injury severity score (ISS). After the researcher contacted the trauma registry with the child’s name and birthdate, the trauma registry recorded the above medical information; the researcher then collected this information sheet.

For the variable of injury severity, a study by Kamel, Kamel, Foda, Khashab, and Aziz (1999) found the Injury Severity Score (ISS) to be one of many factors used to evaluate injury severity. The ISS is a common measure used in hospitals to assess the severity of multiple injuries and was developed from the Abbreviated Injury Scale (AIS). On the ISS, scores above 19 typically result from a severe injury (Kassam-Adams et al., 2005). This scale has been shown to be a valid and reliable measure of injury severity, as the AIS’s interrater reliability, from which it is based, has been found to be strong (α=.87) (Richmond & Kauder, 2000).

The child’s current amount of pain at both assessments was also examined using the Wong-Baker Pain Rating Scale. Similar to findings with internalizing symptoms,
children have been found to be better reporters of their own pain, due to its subjective nature. Faces scales have been common practice in research, and in fact, in one study, the Wong and Baker (1988) pain rating scale was preferred by children and parents as compared to other commonly used measures (Chambers, Giesbrecht, Craig, Bennett, & Huntsman, 1999). Positive test-retest reliability has been reported (Wong & Baker, 1988), and this measure is significantly correlated to other similar measures (Chambers et al., 1999). The Wong-Baker Pain Rating Scale is appropriate for youth ages three to 18 years of age. In response to how much pain they are currently experiencing, participants choose from six faces that range from smiling to crying, which are scored on a scale of zero to five (Chambers et al., 1999). The children were also asked to rate their level of pain at the time of the follow-up assessment.

*Brief Symptom Inventory -18 (BSI-18).*

More general symptoms of parental psychopathology were assessed using the BSI-18. This measure is an abbreviated version of the BSI and is written at a sixth grade reading level. Consisting of eighteen questions and only requiring four minutes for administration, this screener assesses the factors of somatization, anxiety, depression, and a global severity score. Using a sample of cancer patients, the BSI-18 yielded a reliability of .89, and the global severity score was significantly correlated with the global severity score of the BSI ($r=.84$). Using this measure and a cut-off of ten for males and thirteen for females ($25^{th}$ percentiles), which will be used in the present study, the BSI-18 had an impressive sensitivity of 91.2% and a specificity of 92.6% (Zabora et al., 2001). The author reported a test-retest reliability of .68-.84, though the specific time frame was not specified (Boothroyd & Hanson, 2003).
In the hospital, the parent had the option of completing the BSI-18 on his/her own
or having the researcher read and mark questions/responses. This measure was mailed to
the parent for completion of the follow-up assessment. For this study, the BSI-18 had
strong internal reliability for the in-hospital (\(\alpha = .89\)) and follow-up assessment (\(\alpha = .82\)).

*PTSD Checklist – Parent Report (PCL).*

Commonly used in research, The PTSD Checklist – Parent Report (PCL) examines the 17 symptoms of PTSD in the DSM-IV over a month’s duration (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; Ventureyra, Yao, Cottraux, Note, & Mey-Guillard, 2002; Walker, Newman, Dobie, Ciechanowski, & Katon, 2002). The PCL is appropriate for many forms of trauma and has a civilian, military, and specific trauma version. Strong test-retest reliabilities (.80-.96) and internal consistencies (.86-.97) have been reported in the literature, and the PCL is strongly related to similar measures including the Clinician Administered PTSD Scale (CAPS) and IES (Blanchard et al., 1996; Foa, Keane, & Friedman, 2000; Ruggiero, Del Ben, Scotti, & Rabalais, 2003; Saigh & Bremner, 1999; Smith, Redd, DuHamel, Vickberg, & Ricketts, 1999; Ventureyra et al., 2002;).

Continuous scores based on the number and severity of symptoms result, though there is some controversy regarding the best way to interpret the scores. Andrykowski, Cordova, Studts, & Miller (1998) found a sensitivity of .60 and a specificity of .99 when using a cutoff of 50, while Ruggiero et al. (2003) found more accuracy with a cutoff score of 44. Others have found higher sensitivity (1.00; .82) and specificity (.83; .76) using a cutoff score of 30 (Andrykowski, et al., 1998; Walker et al., 2002). These latter studies focused on more typical populations, thus lower cutoff scores may be more
appropriate than those used with known traumatized groups and were used in this study (Blanchard et al., 1996; Ruggiero et al., 2003; Walker et al., 2002).

The PCL accompanied the BSI-18 in the mailed packet for the parent to complete. The parent marked his/her symptoms and returned both measures in self-addressed, self-stamped envelopes. In this study, the PCL presented internally reliable scores ($\alpha = .91$).

Measure of Dissociation.

The child completed the Acute Stress Checklist for Children (ASC-Kids), described below, which includes five dissociation symptoms needed as part of the diagnosis for acute stress disorder. The ASC-Kids criterion for the measure of dissociation symptoms requires at least 2 symptoms, so this cut-off was utilized for indicating significant dissociation symptoms.

Initial Symptoms (ASD).

The child completed the Acute Stress Checklist for Children (ASC-Kids). This measure assesses immediate reactions to a sudden trauma, or acute stress disorder symptoms including dissociation, social support, etc. Appropriate for children ages eight years to 17, this self-administered scale requires only ten minutes; however, the scale is written at a fourth grade reading level, so children younger than ten years old should have the scale read to them. This study includes ages downward to seven years, so all items were read to the children in order to increase their understanding. As a new instrument, few studies have yet documented its psychometric qualities; however, in a study by Kassam-Adams, Baxt, and Shrivastava (2003), an internal reliability of .86 was reported. The test-retest reliability was .93, and convergent and predictive validity were supported with significant correlations with the Child and Adolescent Trauma Survey (CATS) (.77),
a measure of PTSD symptoms. Three months later, the scores were still significantly correlated ($r=.63$) (Kassam-Adams, et al., 2003). For this study, the ASC-Kids had good internal reliability ($\alpha = .75$).

*Impairment.*

Several questions, such as those used with a medical population in the study by Garralda and Rangel (2004), were asked of the parent and children at the follow-up assessment to determine any impairment from the injury (see Appendix G). These qualitative questions were then coded into a severity ranking, as used by Garralda and Rangel (2004). The parent rated their own impairment remarks for the child, while the researcher ranked the child’s responses.

The participants were first asked if any impairment was present in school attendance. Based on their responses, possible ratings from the researcher ranged from none (no days off to only an odd day off) to mild (present at least 75% of the time) to moderate (present 50-75% of the time) to severe (present for less than 50% of the time). Next, impairment in typical home activities such as chores, leisure, etc. was queried. Ratings ranged from none to mild (more than half of usual tasks completed) to moderate (less than half completed) to severe (completely dependent on others). The same responses were possible for the question of impairment in typical school activities including sports, academics, thinking, etc. Finally, impairments in social, family, and peer relationships were considered separately. Ratings for each ranged from no impairment to severe impairment (Garralda & Rangel, 2004).
Attributions.

The participants were asked to consider their accident/injury and to determine its cause both for the in-hospital assessment and for the follow-up assessment at least four weeks later. (Appendix H). The child was asked to complete the following statement. “The accident/injury was: all my fault, partly my fault, no one’s fault, partly someone else’s fault, or all someone else’s fault.” These items were originally scored on an interval scale with higher (positive) scores signifying other blame and lower (negative) scores signifying self-blame. These scores were then transposed into an ordinal scale of zero through two with zero signifying no blame, one signifying other blame, and two signifying self-blame. Two dummy variables were also created in order to examine self-blame and other blame compared to those without these dispositions.

Screening Tool for Early Predictors of PTSD (STEPP).

An innovative study created by many of the leaders in the children, injury, and PTSD field attempted to test a more current screener, the STEPP, for PTSD after acute injury from a traffic accident, although post-trauma variables are not included. The following parent and child variables were assessed: if the parents witnessed the accident, if they accompanied the child to the hospital, if they had an immediate helpless response, if the child had premorbid behavioral or attentional issues, if anyone else was injured in the accident, if the child did not know where his/her parents were for some period of time, if he/she felt very afraid, if he/she though he/she might die, if there were any fractures, what the pulse rate was in the Emergency Department (ED), if the child was older than twelve years, and if the child was a female (Winston, Kassam-Adams, Garcia-España, Ittenback, & Cnann, 2003). In this study, 16% of the children and 15% of the
parents had symptoms of PTSD. With a score of four or greater being considered a
positive screen, the screener identified 59% of the kids and 56% of the parents as being
at-risk, and of these, the test-retest reliability for positive screens was very strong for
children (.86) and good for parents (.67). With the known negative sequelae
accompanying PTSD, it is considerably better to err on the side of over identifying those
who may need attention (Winston et al., 2003). The appropriate STEPP items were
administered to both the parent and the child at the time of the in-hospital assessment.
The other questions were answered following the collection of medical records after the
child’s discharge.

Criterion Measure

*Children’s PTSD Inventory (CPTSD-I).*

Heralded as one of the most comprehensive options available and thus widely
used, the Children’s Post Traumatic Stress Disorder Inventory (CPTSD-I) is appropriate
for youth 7-18 years of age (Perrin et al., 2000). Based on the DSM-IV, the CPTSD-I
includes five separate scales including situational reactivity, re-experiencing, avoidance
and numbing, hyperarousal, and significant impairment (Ohan, Myers, & Collett, 2002),
although these have not been confirmed with factor analysis. Diagnosis is possible with
the descriptors of: PTSD negative, acute PTSD, chronic PTSD, delayed-onset PTSD, and
no diagnosis (due to discrepant information), though continuous data of symptom
severity is also created (Eth, 2001). Administered by an individual with at least a
bachelor’s degree, this assessment only requires 15-20 minutes time, and its language is
developmentally appropriate for children (Ohan et al., 2002). Psychometrics have been
strong as well (Saigh et al., 2000). Internal consistency has been reported to be .95 with
strong interrater (98.1%) and test-retest agreement (97.6%) (Yasik, Saigh, Oberfield, Green, Halamandaris, & McHugh, 2001). The CPTSD-I has poor correlations with unrelated measures, low to moderate correlations with measures of anxiety and depression, and strong correlations with similar measures demonstrating both divergent and convergent validity (AACAP, 1998; Eth, 2001; Lonigan, Phillips, & Richey, 2003; Ohan et al., 2002; Perrin et al., 2000; Saigh & Bremner, 1999; Saigh et al., 2000; Yasik et al., 2001).

For this study, the initial items inquiring about other traumas were omitted in order to allow a focus only on the medical injury trauma experienced. Also, the final four impairment items were omitted in order to avoid redundancy, as the previously mentioned impairment items covered these areas. Overall, a strong internal reliability ($\alpha = .86$) was found for this study.

**Procedure**

This section will describe the specific procedure for the current study. The trauma registry at the University of Kentucky hospital notified the researcher by e-mail when a possible participant entered the hospital. Qualified parent(s) were approached to be given a description of the purpose of the study along with the procedure, instruments, duration with both an immediate, in hospital assessment and an at-home assessment at least four weeks later, any risks/benefits, and the incentive of two $5 gift cards to Walmart (one given after the hospital interview and the second given after the receipt of the mailed measures and the telephone follow-up). Any patients who had been discharged before informed consent were not included in the study.
Upon gaining the parental informed consent, if the child was too medically involved to be able to communicate responses verbally, the researcher followed-up with the family to complete the assessment within five days of the initial injury. If the child was still not able to participate after five days, this child was ineligible for the study.

Although a few parents did remain in the hospital room for the child’s in-hospital interview, the majority of the interviews for the study occurred individually with the researcher due to past research demonstrating that kids have been found to differentially report symptoms based on who is present at the interview. Children/adolescents tend to report more symptoms when interviewed alone, while reporting fewer symptoms when parents are present. In the child’s mind, this may serve to protect the parents from the seriousness of what the child is experiencing (Ronen, 2002).

In the hospital, the parent was asked to describe the injury event that prompted this hospital visit and the impact of the injury on him/herself. Following this, the parent completed questions on a demographics information sheet, the STEPP screener items, and the BSI-18 with the researcher. The parent was asked all of the above questions, although the option of completing the BSI-18 on his/her own was provided. Most parents asked for the researcher to read and mark these items as well.

The researcher gained the child’s assent to participate in the study before he/she was then asked to describe the traumatic injury experience, to evaluate the sense of threat both for the injury and for the emergency treatment experience, to determine his/her coping style (Kidcope) and attribution for the traumatic event, and to complete portions of the STEPP, the ASC-Kids, and a pain rating.
After the hospital assessment, the families and children were thanked for their time and reminded about the procedure for the second, follow-up assessment. At least four weeks following the injury, the parent received in the mail the BSI-18 and the PCL with a self-addressed, stamped envelope for easy return, to complete on his/her own. A reminder about the follow-up phone call was also included in the letter to the parent.

The researcher finally called shortly after the four week post-injury point and after the mailed materials had had time to arrive at the family’s home in order to answer any questions the parent may have had related to the questionnaires or study. At the time of this call or at a mutually agreed upon time for a second, third, etc. phone call, the researcher asked the parent about various child impairments since the injury. The researcher then administered follow-up assessments to the child including an evaluation of threat for the injury and for the medical treatment, a rating for current pain, a question concerning his/her attribution for the injury, an evaluation of the functional impact of the injury, the Kidcope, and the CPTSD-I, the measure of PTSD.

If the parents indicated they desired this information, any significant symptoms of PTSD were reported to the parents of that child via a letter that was included with the child’s second gift card. This was sent to the parent after the receipt of the mailed measures and after the completion of the telephone follow-up for that particular child/family. A reminder phone call was made two weeks after the follow-up telephone call if the mailed measures had not yet been received. A second set of measures was sent if the first set had been misplaced or lost in the mail.

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Chapter Three: Results

This chapter will discuss sample characteristics including demographic and medical variables and the results for the four research questions described for this study. Based on these results, possible screening items and a screening measure will also be reviewed and evaluated according to their ability to predict the presence or lack thereof of significant PTSD symptoms.

Sample Descriptives

The average age of the participants in the study was 10.31 years ($SD = 1.97$), and the majority of the participants were male (23 of 32 participants) supporting research trends of finding a male predominance in injury events. Though the University of Kentucky Children’s Hospital is a Trauma 1 medical center, possibly leading to a more diverse patient population, this study primarily consisted of Caucasian families (29 participants). Incomes were appropriately distributed among the various categories with a median of $21,000-39,000 a year. In this sample, prior psychological diagnoses/treatment was not uncommon (28.1%; N=9) nor were prior hospitalizations (59.4%; N = 19) or the receipt of special education services (31.3%; N= 10). Finally, ten participants (31.3%) reported a chronic illness including allergies, asthma, and/or epilepsy.

Medically, the children had an average of 5.97 ($SD = 2.21$) different medical procedures performed in the hospital for this injury including x-rays, CT scans, blood work, IVs, ultrasounds, MRIs, NG tubes, chest tubes, surgery, etc., and all participants were admitted with an average of 4.25 days ($SD = 3.55$), though the admission time ranged from one to twenty-two days. On average, the in-hospital interviews occurred
2.19 days (SD = 1.00) following the injury with the child follow-up being completed an average of 34.67 days (SD = 3.38) later. The parental mean follow-up time, including the researcher’s receipt of the mailed measures, was 36.44 days (SD = 7.56).

Injury Modes and Primary Forms.

Modes of injury for this sample included penetrating injuries (9.4%, N = 3), falls (28.1%, N = 9), sports injuries (3.1%, N = 1), horse injuries (3.1%, N = 1), wheeled, nonmotorized vehicle injuries (i.e., skateboard, bike, wagon) (12.5%, N = 4), motorized bikes/ATV injuries (34.4%, N = 11), and MVA injuries (9.4%, N = 3). Within these categories, there were several primary injury forms. External lacerations (6.3%, N = 2), spinal cord injury (3.1%, N = 1), internal organ lacerations and contusions (12.5%, N = 4), fractures (59.4%, N = 19), and head injuries (18.8%, N = 6) were all represented. For these injuries, the average ISS was 9.72 (SD = 2.13) with a range of 9-20. Nine patients (28.1%) were intubated/sedated outside of a surgical setting, and two patients received disfiguring injuries as coded by the trauma registry (6.3%).

Research Question 1

For the first research question, the proportion of the total sample qualifying as having PTSD, as measured on the CPTSD-I, following acute injuries requiring medical care was determined. In this study, 31.3% (N = 10) of the sample reported a significant number of symptoms of PTSD with missing data for two participants (6.3%). An additional four participants (12.5%) reported symptoms that could qualify as partial PTSD. Overall, 50% (N = 16) of the sample reported symptoms that did not qualify as significant, though no participants reported zero symptoms. For the remainder of this
study, only those meeting full criteria for PTSD will be considered in the PTSD positive group. Descriptives for those participants with and without PTSD can be seen in Table I.
Table I

Descriptives for Participants With and Without Significant PTSD Symptoms (Means, SD, and Percentages)

<table>
<thead>
<tr>
<th>Variables</th>
<th>PTSD (N=10)</th>
<th>No PTSD (N= 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age**</td>
<td>9.00 (1.70)</td>
<td>11.37 (1.46)</td>
</tr>
<tr>
<td>Female*</td>
<td>50%</td>
<td>15.7%</td>
</tr>
<tr>
<td>White</td>
<td>90%</td>
<td>94.7%</td>
</tr>
<tr>
<td>Prior psych.</td>
<td>40%</td>
<td>15.7%</td>
</tr>
<tr>
<td>Special ed</td>
<td>30%</td>
<td>21.0%</td>
</tr>
<tr>
<td>Medex*</td>
<td>50%</td>
<td>84.2%</td>
</tr>
<tr>
<td>Traumex</td>
<td>70%</td>
<td>57.8%</td>
</tr>
<tr>
<td>Chronic ill*</td>
<td>10%</td>
<td>36.8%</td>
</tr>
<tr>
<td>Prior hosp.</td>
<td>.70 (1.06)</td>
<td>1.53 (3.10)</td>
</tr>
<tr>
<td># injuries</td>
<td>2.20 (1.69)</td>
<td>2.21 (1.08)</td>
</tr>
<tr>
<td># procedures</td>
<td>5.80 (2.20)</td>
<td>6.05 (2.22)</td>
</tr>
<tr>
<td>HR</td>
<td>101.90 (14.06)</td>
<td>105.21 (15.06)</td>
</tr>
<tr>
<td>Days admitted</td>
<td>5.10 (6.06)</td>
<td>4.00 (1.56)</td>
</tr>
<tr>
<td>ISS</td>
<td>9.40 (1.26)</td>
<td>9.84 (2.57)</td>
</tr>
<tr>
<td>Intubate</td>
<td>30%</td>
<td>26.3%</td>
</tr>
<tr>
<td>Income 0-20,999</td>
<td>20%</td>
<td>15.7%</td>
</tr>
<tr>
<td>21,000-39,999</td>
<td>30%</td>
<td>36.8%</td>
</tr>
<tr>
<td>40,000-59,999</td>
<td>30%</td>
<td>10.5%</td>
</tr>
<tr>
<td>60,000-79,999</td>
<td>10%</td>
<td>21.0%</td>
</tr>
<tr>
<td>80,000-99,999</td>
<td>10%</td>
<td>5.2%</td>
</tr>
<tr>
<td>100,000+</td>
<td>0%</td>
<td>10.5%</td>
</tr>
<tr>
<td>Injury Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetrating</td>
<td>10%</td>
<td>10.5%</td>
</tr>
<tr>
<td>Fall</td>
<td>50%</td>
<td>15.7%</td>
</tr>
<tr>
<td>Sports</td>
<td>0%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Horse</td>
<td>0%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Wheeled</td>
<td>20%</td>
<td>10.5%</td>
</tr>
<tr>
<td>ATV*</td>
<td>10%</td>
<td>42.1%</td>
</tr>
<tr>
<td>MVA</td>
<td>10%</td>
<td>10.5%</td>
</tr>
<tr>
<td>Injury Form</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Externlaceration</td>
<td>10%</td>
<td>5.2%</td>
</tr>
<tr>
<td>SCI</td>
<td>0%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Interorg</td>
<td>20%</td>
<td>10.5%</td>
</tr>
<tr>
<td>FX</td>
<td>60%</td>
<td>63.1%</td>
</tr>
<tr>
<td>TBI</td>
<td>10%</td>
<td>15.7%</td>
</tr>
</tbody>
</table>

*p<.10 (trend), **p<.005
Independent t-tests found one significant difference between groups and several trended differences. Age was significantly different between the group of those with PTSD ($M = 9.00, SD = 1.70$) and the group without PTSD ($M = 11.15, SD = 1.73$), $t(28) = 3.23, p = .003$. Younger children reported more PTSD symptoms than older children. Equal variances were not assumed for the following variables that trended towards significance: gender, ($t(13.5) = -1.89, p = .081$), prior medical experience ($t(13.5) = 1.89, p = .081$), chronic illness ($t(26.25) = 1.99, p = .057$), and having an ATV injury mode ($t(25.25) = 1.99, p = .057$).

**Research Question 2**

What are the risk factors for developing significant symptoms of PTSD after such an injury? For this second question, a correlation matrix explored any significant relationships among the various predictor variables, including being younger, being female, having prior traumas, relying on avoidant coping and the overall number of coping strategies attempted, feeling that the injury and treatment experiences were threatening, having more medical procedures, having parents with symptoms of PTSD and other forms of psychological distress, having a more extreme initial reaction including dissociation and ASD, having a high initial heart rate, having some functional impairment/disfigurement, attributing the event to him/herself, and the criterion variable, or symptoms of PTSD as measured by the CPTSD-I at least four weeks following the injury.

In studies using multiple dependent variables, it is important to appropriately balance Type I and Type II errors. One approach, focusing on Type I errors, is the use of the Bonferroni correction, which divides the desired alpha level by the number of
dependent variables. Although this minimizes the possibility of Type I error, it also maximizes Type II error. For example, a study with ten dependent variables all at a univariate $p$ value of .051 would find no significant differences using the Bonferroni approach. Running a large number of correlations automatically increases the chances of finding some significance; however, in a study with fewer participants and thus weaker power, evaluating significance at the Bonferroni corrected alpha level increases the chances of Type II errors, or finding no significant findings, due to the smaller sample size (Tabachnick & Fidell, 2001). The Bonferroni correction is also more appropriate for independent variables; this study includes interrelated variables, thus making its use less meaningful.

With a small sample and research goals directed at the development of a prototype for a screening instrument to predict PTSD, the danger of Type II errors may be more problematic than Type I errors for the long-term success of the project goals; however, both are important to consider. One approach to assessing the likelihood that the pattern of findings (without the Bonferroni correction) is a result of random factors is the binomial expansion, which computes the probability of finding a pattern of statistically significant results when multiple independent variables are tested. This would inform interpretations of significant findings (i.e., due to chance, or based on probability, more likely to be a clinically significant finding). The binomial expansion (Guilford, 1965) was computed in order to determine the likelihood of finding $x$ number of significant correlations within these analyses. For the in-hospital variable correlations found in this study, the likelihood of finding six or more significant correlations (.05 probability) by chance was .000031. This means that the results are most likely
meaningful versus due to statistical chance and that the use of the Bonferroni corrected alpha level may not be necessary for these correlations.

For the follow-up variable correlations, the likelihood of finding the five significant correlations or more by chance was .0002. This also suggests that the Bonferroni corrected alpha level may not be the most appropriate method to interpret the significance of findings for a research hypothesis aimed at potential “inclusion” of variables for screening for PTSD.

Thus, it is likely that the pattern of results found in this study was not simply the result of random factors. For this reason, those variables meeting the .05 alpha level and those with trends in that direction were further examined, though those variables meeting the stiffer Bonferroni criteria used in studies with multiple correlations are noted. Skewness statistics were appropriate for all of the continuous variables.

*Nonsignificant Correlations*

*In-hospital Variables.*

Nonsignificant correlations were observed for the following hypothesized in-hospital predictor variables: prior traumas in general \( r = .10 \), injury threat in the hospital \( r = .21 \), procedure threat in the hospital \( r = .09 \), the number of medical procedures \( r = -.02 \), dissociation symptoms \( r = .15 \), heart rate \( r = -.12 \), blaming someone while in the hospital \( r = .13 \), and blaming him/herself while in the hospital \( r = -.12 \).

*Follow-Up Variables.*

The following follow-up variables were not significantly related to PTSD outcomes in this study: procedure threat at follow-up \( r = .11 \), parental PTSD symptoms
as measured on the PCL ($r = .13$), blaming someone at follow-up ($r = .18$), nor blaming him/herself at follow-up ($r = -.05$).

**Significant Correlations**

The significant correlations for the in-hospital and follow-up predictor variables can be seen in Table II and Table III respectively.
### Table II

**Significant Correlations for In-Hospital Predictor Variables**

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
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<th>No Dis</th>
<th>Medex</th>
<th>BSI-18</th>
<th>Chronic Illness</th>
<th>Gender</th>
<th>Coping #1</th>
<th>Negcope</th>
<th>Pain 1</th>
<th>PTSD Dx</th>
<th>PTSD Total</th>
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<tr>
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<tr>
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<td>-.13</td>
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<td>.27</td>
<td>-.29</td>
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<tr>
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<td>Negcope 1</td>
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<td>-.26</td>
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<td>.24</td>
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<td>***.86 1.00</td>
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<td><strong>-.38</strong></td>
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<td>.13</td>
<td>.23</td>
<td>**.39 1.00</td>
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<tr>
<td>PTSD Total</td>
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<td><strong>.38</strong></td>
<td><strong>-.37</strong></td>
<td>*.32</td>
<td>-.31</td>
<td><strong>.37</strong></td>
<td><strong>.37 .17</strong></td>
<td>.14</td>
<td>*+.33 1.00</td>
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</tbody>
</table>

*p<.10 (trend), **p<.05, ***p<.003 (Bonferroni level)
### Table III

**Significant Correlations for Follow-Up Predictor Variables**

<table>
<thead>
<tr>
<th></th>
<th>BSI-18 2</th>
<th>Coping #2</th>
<th>Negcope 2</th>
<th>Poscope 2</th>
<th>Injury Threat 2</th>
<th>Total Imp. (Child)</th>
<th>Total Imp. (Parent)</th>
<th>PTSD Dx</th>
<th>PTSD Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSI-18 2</td>
<td>1.00</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coping #2</td>
<td>0.23</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negcope 2</td>
<td>0.26</td>
<td><strong>.95</strong></td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Poscope 2</td>
<td>0.13</td>
<td><strong>.84</strong></td>
<td><strong>.63</strong></td>
<td>1.00</td>
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<tr>
<td>Injury Threat 2</td>
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<td><strong>.45</strong></td>
<td><strong>.61</strong></td>
<td>1.00</td>
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<tr>
<td>Total Imp. (Child)</td>
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<td>0.28</td>
<td>0.27</td>
<td>0.24</td>
<td>0.31</td>
<td>1.00</td>
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</tr>
<tr>
<td>Total Imp. (Parent)</td>
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<td>0.30</td>
<td>0.22</td>
<td><strong>.37</strong></td>
<td>*.35</td>
<td><strong>.37</strong></td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSD Dx</td>
<td>0.29</td>
<td><strong>.56</strong></td>
<td><strong>.45</strong></td>
<td><strong>.62</strong></td>
<td>*.34</td>
<td><strong>.42</strong></td>
<td><strong>.45</strong></td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>PTSD Total</td>
<td><strong>.40</strong></td>
<td><strong>.72</strong></td>
<td><strong>.66</strong></td>
<td><strong>.65</strong></td>
<td><strong>.38</strong></td>
<td><strong>.60</strong></td>
<td><strong>.51</strong></td>
<td><strong>.77</strong></td>
<td>1.00</td>
</tr>
</tbody>
</table>

*p<.10 (trend), **p<.05, ***p<.005 (Bonferroni level)
Ethnicity was significantly correlated with the total number of PTSD symptoms \( (r = -.41) \). This means that being Caucasian was associated with having fewer PTSD symptoms; however, due to the minimal variance in ethnicity within this sample, no statistics or interpretations are reported for this variable.

**Relationship among Predictor Variables.**

As a subanalysis, the dual pathway to developing PTSD, whereby participants with dissociation have lower heart rates and those with ASD except for the dissociative criteria have higher heart rates, was also examined. There was not a significant correlation between dissociation nor ASD without dissociation and heart rates. However, there was a negative significant correlation between having a positive ASD screen status and heart rate \( (r = -.38) \). This means that having acute stress disorder (ASD) (with dissociation) was associated with having a lower heart rate. In contrast, there was a positive, though nonsignificant, relationship between having ASD without dissociation and heart rate \( (r = .20) \). Having acute stress disorder except for the dissociative symptoms was associated with a higher initial heart rate.

The controversy of physiological arousal and its relation to the later development of PTSD was also not settled in this study \( (F(1,28) = .40, p = ns) \). Participants with later PTSD had neither statistically significantly higher nor lower heart rates at admittance to the UK emergency department, though the non-PTSD group did have a higher mean heart rate \( (M = 105.35, SD = 14.67) \) than the PTSD group \( (M=101.90, SD = 14.06) \).

In exploration of the relationship between age and coping, a significant negative correlation was found between age and the number of coping strategies attempted both in
the hospital \(r = -0.37\) and at follow-up \(r = -0.43\). Thus, older participants reported the use of fewer coping strategies.

**Research Question 3**

For the third research question, a dependent t-test was performed to examine whether negative/avoidant coping changed significantly for the child from the time of the initial injury to after the hospital treatment experience at least four weeks later. The results of this test did not support a change in negative/avoidant coping across time \(t(27) = 0.64, p = 0.53\). Participants reported the use of as many negative/avoidant coping strategies in the hospital \((M = 4.82, SD = 1.61)\) as at follow-up \((M = 4.57, SD = 2.15)\). All of the following variables did significantly decrease over time: procedure threat \(t(29) = 2.05, p = 0.05\), BSI Screening \(t(25) = 5.84, p = 0.000\), BSI Total \(t(25) = -4.91, p = 0.000\), and pain \(t(29) = 7.87, p = 0.000\). Positive coping \(t(27) = 1.98, p = 0.058\) showed a downward trend as well.

**Research Question 4**

**STEPP Analyses.**

For the fourth and final research question, the correlations between the STEPP and a PTSD diagnosis and the STEPP and total symptoms outcome were computed (see Table IV). The STEPP positive screening status was not significantly correlated with a PTSD diagnosis nor the total number of PTSD symptoms; however, the total score of the child on the STEPP did show a trend towards significance in predicting a PTSD diagnosis.
Table IV

*STEPP Correlations*

<table>
<thead>
<tr>
<th></th>
<th>STEPP C Dx</th>
<th>STEPP C Total</th>
<th>PTSD Dx</th>
<th>PTSD Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEPP C Dx</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STEPP C Total</td>
<td><strong>.87</strong></td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSD Dx</td>
<td>.29</td>
<td>.34*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSD Total</td>
<td>.19</td>
<td>.29</td>
<td><strong>.77</strong></td>
<td>1.00</td>
</tr>
</tbody>
</table>

*\*p<.10 (trend), **p<.05, ***p<.001*
Using the STEPP’s current scoring criteria of four or more positive items as a positive screen, the STEPP was then tested as to its sensitivity and specificity in predicting a PTSD outcome for these participants (Table V). Research sensitivity, or true positive rate, describes how well a particular factor predicts accurate positive group membership (i.e., scoring positively on a screening item/device and actually having a significant amount of PTSD symptoms). A sensitivity of 1.00 signifies that every person with a positive screening has the condition of interest. Specificity, or true negative rate, however, describes how well a particular factor predicts non-group membership (i.e., scoring negatively on a screening item/device and actually not having a significant amount of PTSD symptoms). Thus, a specificity of 1.00 signifies that every person with a negative screening truly does not have the condition of interest. Overall, these descriptive terms signify the screener’s ability to discriminate between those with and those without significant PTSD symptoms, in the case of this study (Dumont, Willis, & Stevens, n.d.; University of Missouri-Kansas City Medical School, n.d.).
Table V

*Prediction of PTSD Status based on STEPP Screener*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Percent Correct</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>ROC Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEPP C Dx</td>
<td>66% (19/29)</td>
<td>.60</td>
<td>.68</td>
<td>.65</td>
</tr>
</tbody>
</table>
Ultimately, this screener was found to successfully predict PTSD at a level only slightly greater than chance. Only 60% of those with PTSD and 68% of those without PTSD were correctly classified. As an end result, four of ten participants with eventual PTSD were missed, and six more of the twenty participants without PTSD were predicted to have PTSD, even though they did not qualify at the follow-up assessment.

The ROC area under the curve is another measure of discrimination evaluating the true positive rate as a function of the false positive rate of a discriminator (Ward, n.d.). A ROC curve of .90 to 1.00 is considered to be excellent, while a ROC curve of .80-.90 is good, .70-.80 is fair, and .60-.70 is poor (Tape, n.d.). The STEPP’s ROC area for this sample was not impressive (.65), meaning that the STEPP did not accurately differentiate between those with and those without later PTSD.

*New In-Hospital Screener Items.*

In hopes of producing practical data, those in-hospital predictor variables with significant correlations to a PTSD diagnosis were examined for cut-points to be included as possible items on a screening device for this population. The results are presented in Table VI.
Table VI

Percent Correct, Sensitivity, Specificity, and ROC area for In-Hospital Predictor Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Percent Correct</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>ROC Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Age</em>, **</td>
<td>80% (24/30)</td>
<td>.80</td>
<td>.80</td>
<td>.80</td>
</tr>
<tr>
<td>ASCNoDis*, **</td>
<td>70% (21/30)</td>
<td>.70</td>
<td>.70</td>
<td>.70</td>
</tr>
<tr>
<td><em>Pain 1</em>, **</td>
<td>77% (23/30)</td>
<td>.70</td>
<td>.80</td>
<td>.75</td>
</tr>
<tr>
<td><em>BSI 1</em>*, **</td>
<td>67% (20/30)</td>
<td>.70</td>
<td>.65</td>
<td>.68</td>
</tr>
<tr>
<td><em>Gender</em>*, **</td>
<td>73% (22/30)</td>
<td>.50</td>
<td>.85</td>
<td>.68</td>
</tr>
<tr>
<td>Chronic Illness</td>
<td>57% (17/30)</td>
<td>.90</td>
<td>.40</td>
<td>.35</td>
</tr>
<tr>
<td>Medex</td>
<td>73% (22/30)</td>
<td>.50</td>
<td>.85</td>
<td>.33</td>
</tr>
<tr>
<td><em>Coping #1</em></td>
<td>66% (19/29)</td>
<td>.56</td>
<td>.70</td>
<td>.65</td>
</tr>
<tr>
<td><em>Negcope 1</em></td>
<td>55% (16/29)</td>
<td>.67</td>
<td>.50</td>
<td>.60</td>
</tr>
<tr>
<td>2 on 5 item screener</td>
<td>77% (23/30)</td>
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<td>.65</td>
<td>.83</td>
</tr>
<tr>
<td>2 on 3 item screener</td>
<td>83% (25/30)</td>
<td>.80</td>
<td>.85</td>
<td>.83</td>
</tr>
</tbody>
</table>

*3 item screener, ** 5 item screener
Age, acute stress disorder with or without the dissociation criteria being met, the total score on the parent’s BSI-18, having a prior chronic illness, having prior medical experience, pain, gender, the number of coping strategies, and the total number of negative coping strategies reported in the hospital were included, though these last two variables are obviously correlated.

For age, children ten years of age or younger were considered to be at-risk. With this cut-point, 80% of the children with PTSD were correctly identified (sensitivity), and 80% of those without PTSD were also correctly identified (specificity). Fifty percent correct prediction would be expected by chance. This screener missed two participants with PTSD, and four participants without PTSD were considered to be at-risk. The ROC area for age in this sample was .80, or in the good range.

Those children having a significant level of acute stress disorder symptoms on the ASC-Kids excluding the dissociation criteria were considered to be at-risk for PTSD. With this criterion, 70% of the participants with PTSD and 70% of those without PTSD were correctly identified. This item missed three participants with PTSD, and six participants without PTSD were incorrectly classified as being at-risk. The ROC area was .70.

Pain was also a successful predictor with a sensitivity of 70% and a specificity of 80%. Those participants ranking their pain as being three or more on the pain rating scale were more at-risk for the development of PTSD. The ROC area for pain was .75.

A parent having a BSI-18 score of 17 or greater while the child was still in the hospital signified a risk factor in this study. With this criterion, 70% of those child participants with later PTSD were correctly identified, and 65% of those without PTSD
were correctly identified. Three participants with PTSD were missed, and seven participants were misclassified as being at-risk. The ROC area for parental symptoms on the BSI-18 was .68.

A t-test was also performed in order to determine if the sample’s BSI-18 scores were significantly different from the norm sample of the BSI-18. For the in-hospital measure, parents did have significantly higher t-scores ($M = 58.25$, $SD = 9.89$) than the norm sample’s mean t-score of 50, $t(31) = 4.72$, $p = .000$. However, it is expected that parents would exhibit increased distress in the immediate aftermath of a child’s trauma, so it is not surprising that 19 of the parents met the clinical screening criteria during the in-hospital assessment.

Further, being female was a risk factor in this study. The sensitivity of this criterion was 50%, while the specificity was 85%. It appears that gender more successfully predicted non-PTSD status in that only three participants were misidentified as being at-risk when they did not subsequently qualify as having PTSD. Five participants with later PTSD were missed. The ROC area for gender was .68.

Several other variables that were significantly correlated with a PTSD diagnosis outcome did not strongly predict later PTSD. These variables were not included in the screener. Using the criterion of having no history of chronic illness, 90% of those with PTSD were correctly identified; however, the specificity was much lower with only 40% (or less than chance) being correctly identified. It appears that chronic illness is a more sensitive than specific item. Having prior medical experience was also protective in this study. Having no prior medical experience led to a prediction sensitivity of 50% and a specificity of 85% in identifying later PTSD.
Finally, the number of coping strategies reported in the hospital led to a sensitivity of only 55.5%, a specificity of 70%, and a ROC area of .65. These rates are not strong enough to be included in further screener measures. The rates of success for negative coping within the hospital were also not impressive with only 67% sensitivity and 50% specificity. The ROC area was .60.

**Combined Item In-Hospital Screener.**

Several of the above variables had strong sensitivity, specificity, and ROC area statistics; however, a combined item screener was the strongest model. Two models were successful in predicting later PTSD. The most parsimonious model with three variables (age (10 years or younger), acute stress disorder with or without dissociation, and pain (rating of 3 or more) would be easier and less expensive to implement than the screener with five variables (age, ASD with or without dissociation, parent’s BSI-18 total, the pain rating, and gender). As can be seen in Table VI, if a child scored positively on two or more items on this screener, 80% of the children with later PTSD were correctly identified and 85% of those without PTSD were correctly identified. The ROC area under the curve was in the good range (.83) for these screening criteria, thus successfully separating those with and without the condition. This prospective screening form can be seen in Appendix I.

**New Follow-up Screener Items.**

Variables at the follow-up assessment were also examined for their sensitivity and specificity in predicting PTSD (see Table VII); however, this study focuses only on the parental variables, as the child could actually be given a measure of PTSD at this point.
versus using possible risk factors. Two parental measures could be simple to administer and require fewer resources than administering such a full child assessment.
Table VII

Percent Correct, Sensitivity, Specificity, and ROC area for Follow-Up Predictor Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Percent Correct</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>ROC Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injury Threat</td>
<td>63% (19/30)</td>
<td>.60</td>
<td>.65</td>
<td>.63</td>
</tr>
<tr>
<td>Coping #2</td>
<td>76% (22/29)</td>
<td>.80</td>
<td>.74</td>
<td>.70</td>
</tr>
<tr>
<td>Negcope 2</td>
<td>62% (18/29)</td>
<td>.70</td>
<td>.58</td>
<td>.63</td>
</tr>
<tr>
<td>Poscope 2</td>
<td>79% (23/29)</td>
<td>1.00</td>
<td>.68</td>
<td>.83</td>
</tr>
<tr>
<td>Totimpc</td>
<td>69% (20/29)</td>
<td>.60</td>
<td>.74</td>
<td>.65</td>
</tr>
<tr>
<td>Totimpp*</td>
<td>73% (22/30)</td>
<td>.70</td>
<td>.75</td>
<td>.50</td>
</tr>
<tr>
<td>BSI-18 2*</td>
<td>77% (20/26)</td>
<td>.67</td>
<td>.82</td>
<td>.70</td>
</tr>
<tr>
<td>1 item on 2 item parent screener</td>
<td>73% (22/30)</td>
<td>.90</td>
<td>.65</td>
<td>.70</td>
</tr>
<tr>
<td>2 items on 2 item parent screener</td>
<td>77% (23/30)</td>
<td>.40</td>
<td>.95</td>
<td>.50</td>
</tr>
</tbody>
</table>

*2 item screener
If a parent reported ten or more symptoms on the BSI-18 four to five weeks following the child’s injury, the child was considered to be at-risk for the development of PTSD. Alone, this resulted in 67% of those children with PTSD and 82% of those without PTSD being correctly identified. The ROC curve was .70 for parental symptoms at follow-up. In a t-test, there was no significant difference between this sample’s t-score mean at follow-up ($M = 57.16$, $SD = 22.14$) and the norm sample’s t-score mean of 50, $t(31) = 1.83$, $p = .077$. At the follow-up, three parents met the clinical screening criteria, though there were missing data for six parents.

Secondly, the number of impairments the parent reported for the child appeared to be related to the presence of PTSD. A parent reporting four or more impairments in his/her child led to a sensitivity of 70% and a specificity of 75%, while the ROC curve was only .50. Thus, this item alone does not appear to reliably differentiate between those with and without PTSD.

**Combined Item Follow-up Screener.**

In combination, requiring that a parent meet at least one of these criteria, led to a ROC curve of .70. The sensitivity, however, was very strong (.90), while the specificity was not as impressive (.65). With the research goals and nature of PTSD, though, it is best to err on the side of caution. It is better to identify possible risk even in those who do not develop PTSD than to miss several who later suffer from it. Thus, correctly identifying 90% of those with actual PTSD is more important than only correctly identifying 65% of those without PTSD. This prospective follow-up screener can be seen in Appendix J.

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Chapter Four: Discussion

The reality is that children 7-13 years of age do suffer from significant PTSD symptoms following an acute injury requiring medical treatment. With 31.3% of this sample qualifying as having a significant amount of PTSD symptoms and 12.5% reporting symptoms that rank at a more partial diagnostic level, certainly a need for further research attention has been validated. These rates are commensurate with to slightly higher than some prior studies have found. This could be due to the more focused age range of this study or the more focused injury severity found within this sample. Further investigation is required to affirm or disaffirm this rate of one-third of pediatric patients suffering from significant PTSD symptoms post-injury.

Several variables were also found to be related to this PTSD outcome four-five weeks after the child’s injury and hospital treatment. This adds hope for our ability to screen for possible negative effects following an injury even while the child/family is still in the hospital. These factors included: age, ASD with or without meeting dissociation criteria, prior medical experience, parental symptoms of psychological distress while in the hospital, prior chronic illness, female gender, the number of coping strategies reported by the child in the hospital, the amount of pain reported by the child while still in the hospital, injury threat at follow-up four to five weeks later, parental symptoms of psychological distress at follow-up, the number of impairments reported by the child at follow-up, the number of impairments reported by the parent at follow-up, and the number of coping strategies reported by the child at follow-up. These findings help explicate past conflicting research findings in a new sample.
Positive Findings.

Specifically, the finding of female gender and younger age placing an individual at-risk matches the past research findings of several researchers highlighted earlier in this paper. However, for age, others have suggested a possible linkage with coping in that younger individuals may not attempt as many coping strategies and thus may be more at-risk for PTSD. This study did not support this contention, however, as older participants reported using fewer coping strategies than younger participants. It is possible that the younger participants reported the use of more coping strategies due to higher distress levels and/or that by adolescence, individuals have settled on one or two, typical coping strategies. The risk of continuing impairment was also supported in this study, as was the risk factor of parental psychological distress. All of these aspects merit further evaluation and confirmation.

Most prior studies have examined past traumas in general as a risk factor. In this study, there was no relation between prior traumas in general and later PTSD; however, specifically having prior medical traumas/experiences was significantly correlated with PTSD. Having prior medical experiences proved to be protective in this sample. It is believed that having prior medical experiences may provide expectations for what to expect in medical interventions. Having these prior conceptualizations may protect the child from misunderstandings and the shock of a lack of preparation. Future studies may benefit from including both the general variable of prior traumas and the specific variable of prior medical traumas/experiences as possible predictors.

An immediate negative reaction to the injury in the form of acute stress disorder was found to be important in this study, though the dissociation items on the scale were
not vital. A person meeting this criterion was found to be more at-risk, matching several prior studies’ findings.

Finally, related to the controversy of traumatic brain injury and the development of PTSD, in this sample, TBI and PTSD did co-occur. This lends support to the inclusion of patients with this serious injury in future research work.

Negative Findings.

Opposite of some prior studies, no relation was found between mode of injury and later PTSD. This sample, however, did not include the more violent injuries of gunshots, stabbings, beatings, etc. that prior studies incorporated. Interestingly, half of the participants who experienced falls in this study developed PTSD, while prior studies found less of a risk with fall injuries. More study is needed to understand specific features of the various injury forms and the subsequent risk of PTSD. Also, the hospitalization length, number of prior hospitalizations, nor the number of medical procedures performed were significant predictors despite past research hints at importance.

The attributional style of the participant also did not demonstrate a significant relation despite past evidence of an association; however, past studies have examined adult attributions. Perhaps children’s attributions are more or less accurate as influenced by development. A concentrated focus on children’s attributions and the other dimensions of this variable including the global-specific and stable-unstable continuum could provide more insight into the understanding of attributions and injury.

This study also matches several prior studies finding no relation between the following variables and PTSD: objective injury severity and prior psychological
problems. Surprisingly, no relation was found between immediate perceived injury threat and later PTSD either. Participants ranking the injury as more threatening at follow-up, though, were more likely to have PTSD. This finding could be due to an increase of threat with a re-evaluation of the injury or due to PTSD symptoms themselves.

*Coping Predictors*

Negative coping was not found to change over time, as was predicted, though several variables did decrease from the time of the in-hospital interview to the time of the follow-up assessment. In this study, it appears that the number of coping strategies may be more important than the specific types used. This may serve as an indication that the child is having difficulties and thus requires more coping techniques in attempting to manage this distress. Future researchers may wish to explore this finding with other coping measures and medical groups.

*STEPP conclusions*

A current screener for PTSD, the STEPP, was neither significantly correlated with nor able to successfully predict PTSD outcomes with the population in this study. It is possible that the STEPP may be more appropriate for MVAs for which it was developed. However, the total score of the child on the STEPP did demonstrate a trend towards significance in its correlation with later PTSD, so it is possible that the screening criteria may require further refinement versus altering the content of the items. Further research evaluating the STEPP and other screening tools is necessary in order to ensure empirically supported assessments.
In-Hospital Screener

Researchers must be responsible for interpreting findings and connecting them to useful purposes in the real world they have attempted to study. For this reason, the variables of age, ASD with or without dissociation, and pain were combined in a possible screening device to be given within the hospital to test with this study’s sample. In combination, it appears that having two or more points on this inexpensive and minimal time intensive measure has very strong sensitivity and specificity. Administering the screener/measures during the child’s hospitalization could assist in providing the holistic care heralded by medical and mental health professionals.

Targeted education and referral for treatment could provide the final degrees in the complete 360° model of care. Any identified children/families could be targeted for education, intervention, and/or follow-up. In truth, some without later PTSD would be targeted, as the specificity of the screener is not 100%, but education and intervention would not be detrimental to the few incorrectly classified in this case. Not identifying and intervening with those truly in need of support/education would be the largest danger. Unfortunately, as of the analysis of these findings, little to no empirical work exists to evaluate specific interventions for child medical trauma survivors, particularly for those with injuries. This is fertile ground for future research.

Follow-up Screener

A parent follow-up screener including parental symptoms of psychological distress and parental reported child impairments was also able to correctly identify 90% of the children with PTSD and 65% of the children without PTSD, though this screener was less powerful than the in-hospital version. These two measures would allow for a
quick screener for the child’s symptoms without even requiring direct child contact. Parents could be contacted by telephone, mail, or in a web-based format in order to complete the two quick measures that appear to relate to the child’s PTSD outcome. Any positive screenings could result in referral for further assessment/education/intervention.

Other Research Findings

Several interesting findings within the study also deserve mention. First, there is controversy regarding children and dissociative symptoms. Researchers have questioned whether or not children display dissociative symptoms following a trauma. In this study, it was found that few children met the required dissociative symptoms for acute stress disorder and that ASD with or without dissociative symptoms was a risk factor for children. This adds support to the argument questioning the validity of requiring children to meet the same dissociative symptoms criteria as adults. Developmental differences may alter the presentation of acute stress disorder symptoms.

Secondly, a dual pathway to PTSD has been hypothesized, whereby participants with dissociation have lower heart rates, while those with ASD except for the dissociative criteria have higher heart rates. The contention is that any form of dissociation may lead to lower physiological reactivity (i.e., heart rate). Though all of the findings were not statistically significant, they do add some confidence to the proposed pathway between dissociation and lower heart rates. Having a full ASD denotation was significantly associated with lower heart rates, while there was a nonsignificant, positive relationship between ASD without dissociation and heart rate. Possibly with a larger sample, more definitive results could be gathered. More concentrated testing of this model is necessary.
Though not significant, the finding of lower initial heart rates among those with PTSD matches the results of Blanchard et al. (2002). Questions were raised in that study as to if their findings of lower initial heart rates for those with PTSD could be due to the presence of dissociation, which was not assessed. The current study did not lend support to that possibility; more dissociation was not found in those with lower heart rates. As possible explanations for this study’s findings, a majority of the participants in this study had attended a local emergency department before traveling to UK, so the heart rate measure in this study may not be a pure measure of initial physiological reactivity for all of the patients. It is possible that the initial heart rate collected at the first point of contact with the medical system would be related to eventual PTSD outcomes. Further, children have varying resting heart rates from adults, thus it is possible that this finding is unique for the younger population.

Finally, when examining those variables that did lend themselves to the prediction of PTSD, it is evident that the post-trauma variables are essential to consider. In this study, parent’s psychological distress and ratings of child impairments were significant contributors to the sensitivity and specificity of PTSD prediction. Thus, in the design of future studies and other screening devices, it is incumbent upon the researchers to include variables at each level of effect (pre, peri, and post-trauma) and to recognize that post-trauma factors are vital to consider for assessment and eventual treatment purposes as well. The STEPP, a screening measure that includes pre and peri-traumatic factors, was not successful in this study in sensitively or specifically identifying those children at-risk for the development of PTSD.
Study Limitations

For this study, there are limitations that require mention. First, considering that this is a high stress time and population, it is not surprising that participation is not 100%. For this study, 58% of the families presented with full study information consented to participate. This is commensurate with similar studies’ participation rates. However, it is possible that these consenting families and children are different in some important ways from those who did consent. More troubling, is the possibility that families choosing not to participate may actually have higher rates of PTSD and distress as evidenced by their avoidance of injury reminder stimuli such as this research study.

In this study, the immediate assessment in the hospital may be overwhelming for some families due to the stressors of pain, lack of sleep, financial and health worries, etc., but the passage of several weeks could allow these families to strengthen their abilities to participate and benefit from the results of the study. For this reason, a possible solution to lower participation rates could include allowing these non-consenting families to be re-contacted at the follow-up time period only. Some families may be better prepared to participate at this time, and this arrangement would allow for the assessment of PTSD and other post-trauma variables that could strengthen our understanding of the aftermath of child acute injury.

A few other limitations deserve mentioning. Only one hospital in a Midwestern urban setting was included. Other hospitals in other locations may have differing outcomes. Also, there was minimal ethnic diversity. Including other hospital settings and more urban locations in future studies could heal the rift of incomplete understanding of injury and its effects in diverse families. Finally, the nature of this study does not
allow for easy recruitment. For this reason, the sample size is smaller than optimal, and this could limit the power of the study in finding important trends and relationships.

Study Strengths

There are several study strengths to highlight as well. The current study did not focus on single injury modes/forms. Thus, the results may be applicable to more children. The longitudinal design also allowed for stronger findings related to change and relationships of variables over time. Psychometrically supported measures were included with strong reliabilities. This allows for more confidence in the results of the various instruments. It is also important to consider parental effects with both mothers and fathers, so the inclusion of either parent, including some fathers, was another strength of this study. Finally, there was a high follow-up success rate with the families that did participate. For the telephone follow-ups, 93% of the families fully participated, and 79% of the parents completed and mailed their follow-up measures as well.

Future Needs

The results of this study are vital for future child patients, yet we need more studies in order to replicate and further refine the information gleaned. Larger study samples including more ethnically diverse participants and possible multiple hospital locations could broaden our understanding of a more diverse child patient/family population. A longer follow-up period may also explicate chronic and delayed-onset PTSD occurrences that are just as traumatic as acute PTSD outcomes. Further, parent/child factors should be explored in order to determine the direction and possible causes of the effects seen in this study. Variables such as family communication, attachment, and overprotectiveness may differentially affect child following an injury,
and the combination of cumulative child and parental risk factors may be beneficial to examine. It is clear that an ecological model is required to explore and explain the relationships discovered.

Finally, other health outcomes may require further investigation. Anecdotal accounts of after effects including hypervigilance related to health were described in this study. This and possible medical anxiety could be vital health outcomes requiring further study and intervention in the traumatically injured child population. Including comparison groups such as less acutely injured children attending the emergency department and non-injured, hospitalized children may also help to specify affects from injuries versus the hospitalization experience alone. Focused older and younger age groups of children may also help to clarify differential effects for varying age groups.

Importantly, the screening tools developed with this sample should be tested with other samples in order to determine its validity with a more representative segment of our population. Study of the practicality of implementing such a screening tool within the hospital setting and for follow-up is also required. Having a successful screening device is moot if there are not adequate personnel to administer it and then to follow-up with the education and intervention needed for these families. An understanding of participants in the medical system and their roles would be beneficial along with their acceptance of and ability to implement this type of screening device.

Finally, as the number of children negatively affected by acute injury /medical treatment and salient risk/protective factors become clear, it is essential to move to intervention studies. We may be able to identify a child who is at-risk for the development of PTSD, but if we do not have concrete recommendations for the family,
what benefit can we hope to instill? Are we indeed stretching the trauma to parents without empirically supported treatment options? Learning more of specific interventions for these children with acute injuries/medical treatment would allow for the mandated holistic child approach that we know must take hold within our current system of care. It is also possible that a screening in itself may serve as an intervention due to cognitive processing of the injury event and symptoms. Including this form of psychoeducation for affected families for future outcome studies would be an important first step in intervening for injured children.

Thus, we end where we began. An “ideal emergency care system should be able to manage both the psychological and medical aspects of critical illness and injury (Athey, O’Malley, Henderson, & Ball, 1997, p. 466). This study highlights just one impactful psychological aspect of injury (PTSD) that demands our time and attention. Trauma should end once help arrives for the child, and recognizing risk factors for the development of PTSD is the first step of many in creating such holistic care.
Appendix A. Screening Questionnaire for Triage

Child Acute Injury Study

A research study is being conducted here at UK Hospital focusing on children who have experienced sudden injuries and their adjustment to this experience. There is no connection between your child’s treatment and decision to participate or not – it is completely voluntary. If your child qualifies to be in the study and if you have not yet been discharged, would you be interested in the researcher telling you more about this voluntary research project?

_____ Permission to Contact    _____ No permission to contact

************************************************************************

MEDICAL STAFF: Please complete the following questions in order to determine eligibility for the study.

1. Is the child between the ages of seven and thirteen years of age?
   YES    NO

2. Does the family have a current mailing address and phone number for future contact?
   YES    NO

3. Does the child/guardian speak and understand English?
   YES    NO

4. Was the child injured by an unintentional injury? (i.e., not possible abuse (need for reporting) or a suicide attempt)
   YES    NO

5. Does the child have an ISS of 8 or greater?
   YES    NO

6. If the child has a head injury, is the Glasgow Coma Scale score greater than 9?
   YES    NO

7. Does the child have mental retardation?
   YES    NO

************************************************************************
Appendix B. Participant Information Sheet

This form will be kept separate from all study materials in order to protect your confidentiality. From here on, your child and his/her forms will only be identified with the above participant number.

Name of child: ___________________________________________________________

Child’s Birth date: __________________________
(for medical record access only)

Child’s Social Security Number: __________________________
(for medical record access only)

Name of parent/guardian: __________________________________________________

For the follow-up assessment to be conducted at least four weeks after the injury, what is your contact information.

Mailing Address: ______________________________________________________
____________________________________________________
____________________________________________________

Phone Number: ______________________________________________________

If your child has significant symptoms of PTSD, would you like to be notified?

YES  NO

If you would like to have a copy of the results of this research study, please check “Yes” below and provide an e-mail address.

_______ YES, please send the results of this research study

E-mail: ______________________________________________________
Appendix C. Demographic Information Sheet

Please respond to the questions below. Please print and make your responses as readable as possible. Thank you!

Date of injury: __________________

Age of child: ___________________

Gender of child: ________________   Ethnicity of child: ______________

Relation of respondent to patient: ____________________

Gender of respondent: _________________   Age of respondent: ______________

Occupation of respondent: ________________________________________________

Approximately what is your yearly salary?

$0 - $20,999
$21,000 - $39,999
$40,000 - $59,999
$60,000 - $79,999
$80,000 - $99,999
$100,000 +

Has the child ever been diagnosed and/or treated for psychological problems (i.e., depression, anxiety, oppositional defiant disorder (ODD), attention deficit/hyperactivity disorder (ADHD), etc.)

YES   NO

If yes, please describe:
________________________________________________________
________________________________________________________
________________________________________________________

Has the child ever received special education services in school?

YES   NO

If yes, please describe what disability the child qualified as having and any services received:
________________________________________________________
________________________________________________________
________________________________________________________
Has the child ever had to stay overnight at the hospital or have an operation?

YES  NO

If yes, please describe (include approximate age and reason for each hospitalization):
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Has your child ever been in a serious accident like a car accident, a fall or a fire?

YES  NO

If yes, please describe and give the number of times:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Has your child experienced any other significant traumas in his/her life?

YES  NO

If yes, please describe:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Does the child currently have any chronic illnesses?

YES  NO

If yes, please describe:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Appendix D. Injury Description and Impact Information Sheet

1. Describe the injury event that led to your (your child’s) hospital visit and treatment.

2. How has this injury/accident affected you?
Appendix E. Sense of Threat

**Brief word instructions:** Rate how afraid you were during the injury event. Ask the child to choose the description that best fits his/her own fear and record the appropriate number.

0 = Not afraid  
1 = A little afraid  
2 = Pretty afraid  
3 = Very afraid  

**Brief word instructions:** Rate how afraid you were during your medical treatments at the hospital. Ask the child to choose the description that best fits his/her own fear and record the appropriate number.

0 = Not afraid  
1 = A little afraid  
2 = Pretty afraid  
3 = Very afraid
Appendix F. Medical Records

1. Mode of injury:

2. Injuries received in event:

3. Disfiguring injury? YES NO

4. Medical procedures performed:

Total: _____

5. Heart rate at ED admittance: ______________

6. Presence of intubation/sedation? YES NO

7. Was child admitted to the hospital? YES NO

8. Number of days of hospitalization: __________

9. Injury Severity Score: ________
Appendix G. Measure of Impairment (Garralda & Rangel, 2004)

Circle one: PARENT CHILD

1. Describe any impairment in school attendance (How much school have you missed due to your injury?).

2. Describe any impairment in home activities (e.g., chores, leisure, self-care) (Have there been any changes since your injury in your home activities?)

3. Describe any impairment in school activities (e.g., sports/leisure, academics, thinking, etc.) (Have there been any changes since your injury in your school activities?).

4. Describe any impairment in peer relationships (Have there been any changes since your injury in your friendships?).

5. Describe any impairment in family relationships (Have there been any changes since your injury in how your family gets along?).
Possible Ratings for previous page:

Rate any impairment in school attendance.

0 = None (No days off to only an odd day off)
1 = Mild (Present at least 75% of the time)
2 = Moderate (Present 50-75% of the time)
3 = Severe (Present less than 50% of the time)

Rate any impairment in home activities (e.g., chores, leisure, self-care)

0 = None (Can complete all to most all usual tasks)
1 = Mild (Can complete more than ½ of usual tasks)
2 = Moderate (Can complete less than ½ of usual tasks)
3 = Severe (Completely dependent on others)

Rate any impairment in school activities (e.g., sports/leisure, academics, thinking, etc.)

0 = None (Can complete all to most all usual tasks)
1 = Mild (Can complete more than ½ of usual tasks)
2 = Moderate (Can complete less than ½ of usual tasks)
3 = Severe (Unable to participate in typical school activities)

Rate any impairment in peer relationships.

0 = None (Symptoms have no effect on interactions)
1 = Mild (Relationships described as slightly affected by the symptoms)
2 = Moderate (Interactions markedly affected by the symptoms)
3 = Severe (Symptoms interfere a great deal with child’s ability to interact with others – e.g., frequent arguments, extremely irritable or severely withdrawn, has contact with previous friends only by phone and only occasionally)

Rate any impairment in family relationships.

0 = None (Symptoms have no effect on interactions)
1 = Mild (Relationships described as slightly affected by the symptoms)
2 = Moderate (Interactions markedly affected by the symptoms)
3 = Severe (Symptoms interfere a great deal with child’s ability to interact with others – e.g., frequent arguments, extremely irritable or severely withdrawn)
Appendix H. Measure of Attributions

The accident/injury was: (circle one option)

-2 All my fault
-1 Partly my fault
0 No one’s fault
1 Partly someone else’s fault
2 All someone else’s fault
Appendix I. Prospective In-Hospital Screener for PTSD Risk

<table>
<thead>
<tr>
<th>Question</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is child 10 years of age or younger?</td>
<td>___</td>
<td></td>
</tr>
<tr>
<td>2. Does the child qualify as having ASD w/ or w/o dissociation symptoms?</td>
<td>___</td>
<td></td>
</tr>
<tr>
<td>3. Does the child report pain equal to or greater than 3?</td>
<td>___</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Screener Outcome (Check one)

___ Greater than or equal to 2 = Positive screen for later PTSD
___ Less than 2 = Negative screen for later PTSD
Appendix J. Prospective Follow-up Screener for Parent and Child PTSD Risk

To be given at least 4 weeks following the child’s discharge from the hospital.

1. Does the parent report 10 or more symptoms on the BSI-18?  
   YES  NO  
   ___ (1) ___ (0)

2. Does the parent report 4 or more impairments in his/her child?  
   YES  NO  
   ___ (1) ___ (0)

Total ________

**Screener Outcome** (Check one)

___ Score of 1 or more = Positive screen for child risk for PTSD
___ Score of 0 = Negative screen for child risk for PTSD
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