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# Predicting Posttraumatic Stress Disorder in Single-Incident Trauma Survivors with an Acute Injury

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PREDICTING POSTTRAUMATIC STRESS DISORDER IN SINGLE-INCIDENT  
TRAUMA SURVIVORS WITH AN ACUTE INJURY

by

Joshua C. Hunt, M.A.

A Dissertation Submitted in  
Partial Fulfillment of the  
Requirements of the Degree of

Doctor of Philosophy  
in Educational Psychology

at

The University of Wisconsin-Milwaukee

May 2015

ABSTRACT  
PREDICTING POSTTRAUMATIC STRESS DISORDER IN SINGLE-INCIDENT TRAUMA  
SURVIVORS WITH AN ACUTE INJURY

by

Joshua C. Hunt, M.A.

The University of Wisconsin-Milwaukee, 2015  
Under the Supervision of Professor Marty Sapp, Ed.D.

The objective of this study was to create a brief and easily administered screen that can be used by hospital staff to identify those at risk for the later development of PTSD. Utilizing previous research examining pretrauma, peritrauma, and posttrauma risk factors for the development of PTSD among single-incident trauma survivors with an acute injury, an item pool was created and reviewed by experts in the field. This item pool along with a previously created screen were given to patients admitted to two level 1 trauma centers in the U.S. A follow-up was conducted at one month in which participants were administered two psychometrically valid PTSD diagnostic tools. A stepwise bivariate logistic regression was used to determine the items from the item pool that were most strongly associated with PTSD diagnosis at approximately one month post injury. The logistic regression yielded a five item model which outperformed a previously created screen. ROC curve analysis was used to determine sensitivity (100%), specificity (81.33%), negative predictive value (100%), positive predictive value (66.7%), and to yield an optimal cutoff score ( $\geq 1$ ). The clinical implications of this tool along with a rationale for item retention is provided.

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## Chapter 1

### Introduction

In the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, ([DSM-5] American Psychiatric Association [APA], 2013), a person is considered to have experienced a traumatic event if the person has been exposed “to actual or threatened death, serious injury, or sexual violence” either directly, witnessed, through learning that the event happened to a friend or family member, or through the experience of repeated exposure to details of the event (APA, 2013, p.271). Epidemiological studies utilizing various methodologies have demonstrated the lifetime prevalence of exposure to such an event ranges from 51% to 89.6% (Breslau et al, 1998; Flett, Kazantzis, Long, MacDonald, & Miller, 2002). Once exposed to such an event, estimated lifetime prevalence rates of the development of a posttraumatic stress disorder (PTSD) in the general population have varied from 6.8% to 9.2% across various demographics and types of events (Breslau et al., 1998; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Kessler et al., 2005). One unique subset of trauma survivors that is subsumed in these numbers are single-incident injured trauma survivors.

According to the 2009 national hospital ambulatory medical care survey, 22% of primary diagnoses at emergency department visits were due to injury and poisoning (Center for Disease Control and Prevention, 2011). Concordantly, each year approximately 2.5 million people in the U.S. are involved in a single-incident traumatic experience (e.g., motor vehicle crash, industrial accidents, falls, gunshot wounds, stabbings and blunt assaults) resulting in severe injuries requiring care at a level 1 trauma center (Bonnie, Fulco, & Liverman, 1999). Of these individuals, research indicates that 10-42% will develop symptoms consistent with PTSD within one year of injury (Blanchard, Hickling, Taylor, & Loos, 1996; Holbrook, Anderson, Sieber,

Browner, & Hoyt, 1999; Michaels et al., 1999a; Ursano et al., 1999; Zatzick et al., 2002; Zatzick et al., 2007). Despite this variability, serious injury and physical impairment have been identified as risk factors for the development of PTSD in those who have experienced a traumatic event (Verger et al., 2004).

For the significant minority of injured trauma survivors who go on to develop PTSD the effects can be debilitating. The symptoms that constitute the unique characteristics of PTSD fall into four symptom clusters: re-experiencing, avoidance, negative alterations in cognitions and mood, and arousal or hyper-arousal (APA, 2013). Re-experiencing symptoms include unwanted or spontaneous, intrusive, distressing recollections of the trauma, sometimes in the form of nightmares or flashbacks. Avoidant symptoms include effortful avoidance of thoughts and feelings, or places and people reminiscent of the trauma. Negative alterations in cognitions and mood may include difficulty remembering aspects of the event, a sense of self blame or negative beliefs about oneself, and a diminished capacity for positive feelings. One might lose interest in formerly pleasurable activities and feel detached and numb in relation to others. Arousal symptoms include insomnia, irritability, difficulty concentrating, feeling jumpy and on guard, and being easily startled. Additional criteria are that these symptoms persist for more than one month and that they cause clinically significant distress or impairment.

### **Definition of Terms**

Within the literature there are several terms that are used to describe the various types of trauma, many of which overlap conceptually. The clearest distinction can be made between a typically short lived, unanticipated, and isolated traumatic event, versus a prolonged and ongoing traumatic situation (Terr, 1991). *Type-I*, or *single-incident trauma*, typically refers to a single event such as a motor vehicle crash, industrial accident, fall, gunshot wound, stabbing or blunt

assault. *Type-II* trauma is characterized as multiple-incident, longstanding or repetitive trauma, often of an interpersonal nature (i.e. sexual or physical abuse, child abuse), and also referred to as *complex trauma*, *developmental trauma*, or *complex developmental trauma* (Courtois, 2008; van der Kolk & Courtois, 2005; van der Kolk, 2009). This does not preclude type-I traumas from being of an interpersonal nature (i.e. physical assault by a loved one). *Potentially traumatic event* (PTE) refers to any event that falls into the aforementioned type-I or type-II categorizations. Since resilience is the norm for most people who experience a traumatic event (Brewin, Andrews, & Valentine, 2000), it is appropriate to refer to these events as PTEs. *Traumatic injuries* or *acute injuries* are the sometimes fatal physical injuries caused by external sources that result from car accidents, gunshot wounds, falls and other single-incident traumas (NIH, 2013).

Hospital trauma centers, or trauma care facilities, are a part of the overall trauma care system overseen by surgeons to ensure that the trauma needs of individual communities are met. The American College of Surgeons (ACS) is the accrediting body that oversees trauma care systems and is responsible for designating trauma center levels ranging from 1 to 4. A level 1 trauma center is designated as such because it represents the highest level of care and meets the additional requirements set forth by the ACS. These include standards related to patient volume, access to board certified emergency physicians and other specialists, and requires these centers to see patients with the most severe degrees of injury (American College of Surgeons, 2014).

This study focuses on type-I, single-incident trauma in those who have suffered a traumatic injury and have been admitted to a level 1 trauma center. The screen is intended to be administered after the advent of a specific potentially traumatic event resulting in physical injury and subsequent hospitalization. In other words, this screen would be most relevant in screening

hospital patients that might be at risk for PTSD after being admitted with a physical injury due to a single traumatic event; however, this does not preclude those with a trauma history from completing the screen after experiencing a traumatic injury. The ACS has recommended that screening begin in all trauma centers, and there is currently no screen created for and normed on this population in the U.S.

### **Statement of the Problem**

PTSD is a salient public health concern due to its impact on an individual's psychological and physical health, as well as the consequent cost to society. This concern is further exacerbated by the relationship between PTSD and suicide as PTSD has been identified as a predictor of attempted (Wilcox, Storr, & Breslau, 2009) and completed suicide (Gradus et al., 2010). A growing body of research conducted both on veteran and civilian samples has demonstrated the association between poorer general physical health outcomes and decreased health-related quality of life for people with PTSD (Pacella, Hruska, & Delahanty, 2013).

In a study that reviewed current research and examined the relationship between PTSD and autoimmune diseases for example, Boscarino (2004) wrote that "there is growing evidence that exposure to psychologically traumatic events is related to increased medical morbidity, including the onset of different diseases and premature mortality" and found that those "with comorbid PTSD had a greater risk for autoimmune diseases, especially rheumatoid arthritis, psoriasis, and hypothyroidism" (Boscarino, 2004, p.148). Batten, Aslan, Maciejewski, and Mazure (2004) stated that depression and heart disease contribute a large part to overall disability rates, and life stress is a common risk factor for developing these conditions. The authors wrote that "reviews of the literature have consistently shown that exposure to traumatic stress is associated with subsequent psychiatric and physical health problems, as measured by adverse

health reports, increased medical utilization, morbidity, and later mortality” (Batten, Aslan, Maciejewski, & Mazure, 2004, p. 249).

In addition to the psychological and physical health costs of PTSD, there are financial costs as well. In a study examining the economic costs of anxiety disorders in the 1990s, PTSD and panic disorder were identified as the two disorders with the highest rate of service use contributing to a total cost of 42.3 billion dollars in the United States in 1990 (Greenberg et al., 1999). Functional outcomes such as return to work are also compromised. In a study of 2,707 patients with traumatic injuries admitted to hospitals, those with PTSD or depression were three times less likely to have returned to work after one year (Zatzick et al., 2008). This contributes to an estimated annual loss in productivity of greater than 3 billion dollars due to missed work (Kessler, 2000).

### **Rationale**

Involvement in a life threatening accident or natural disaster, or witnessing others being injured or killed are the most commonly occurring types of trauma in the U.S. (Kessler et al., 1995). In spite of the large numbers of injured trauma survivors that pass through level 1 trauma centers in the United States, few centers routinely use this opportunity to screen for PTSD, and even fewer employ mental health professionals in their trauma departments. Those that do screen typically use instruments such as the PTSD Checklist 5 (PCL5) which is a diagnostic tool for PTSD, not a tool for predicting the later onset of PTSD. This is due in part to the fact that most extant measures focus on current symptoms and diagnosis of PTSD, rather than the future risk of developing PTSD (Brewin, 2005). Given the limited mental health resources available in hospitals even those attempting to screen for PTSD do not have the resources needed to screen all of those who might be at risk.

Most instruments available are not predictive of the development of PTSD based on the known risk factors in the literature in a format that is relevant for this population. Early assessment and screening for the injured trauma survivor population could aid in identifying those in need of early intervention and assist in making mental health referral as appropriate. In order to address this, data for the current study were collected in two level 1 trauma centers located in metropolitan settings. The primary recruitment site treated approximately 3,000 patients annually on average between 2009 and 2013, and admitted approximately 2,000 patients on average between 2007 and 2011 (Adult Level 1 Annual Trauma Center Report, 2014). Of the admitted patients in 2013, 1,408 were male, 749 were female, 1,407 identified as White, 572 identified as Black, 119 identified as Hispanic, 11 identified as Asian, 11 identified as American Indian, 2 identified as Native Hawaiian and 35 identified as other.

### **Risk Factors, Comorbidity and Early Intervention**

There are many factors that can affect a person's response to trauma or traumatic injury. These risk factors are typically delineated temporally into the categories of pretrauma, peritrauma, and posttrauma. Examples of pretrauma risk factors include a family history of psychiatric disorders, life stress before injury, and a history of trauma (Koenen et al., 2002; Marmar et al., 2006; Ozer, Best, Lipsey, & Weiss, 2008). Examples of peritrauma risk factors include perceived injury severity, peritraumatic emotionality, and perceived threat to life (King, King, Bolton, Knight, & Vogt, 2008; Ozer et al., 2008). Examples of posttrauma risk factors include posttrauma emotional and cognitive responses, lack of social support, and severity of early symptoms of acute stress (Ozer et al., 2008; Zatzick et al., 2002). These risk factors and many others have been linked with an increased vulnerability for the development of PTSD;

however, reviews of the literature indicate that the psychopathology caused by traumatic events is not limited exclusively to the development of PTSD (Breslau, 2002).

Several studies have consistently linked traumatic injury with the occurrence of PTSD, depression, and comorbid PTSD and depression (O'Donnell, Creamer, & Pattison, 2004; O'Donnell et al., 2004; Shalev et al., 1998; Zatzick et al., 2008). In one study examining the rates of development of mental health disorders after trauma it was found that PTSD ranked third amongst the most commonly occurring disorders among injured trauma survivors following depression and generalized anxiety disorder (GAD) and the sequela was not limited to these disorders (Bryant et al., 2010). Also, substance abuse has been identified as a risk factor for PTSD in the acute injury population and although behaviors such as hazardous drinking may decrease immediately following injury, they often return to baseline or worsen over time (Dunn et al., 2003; Zatzick et al., 2002). Although comorbid conditions are not the focus of this study, substance abuse, depression, and anxiety symptoms are integrated into the screen as they increase the risk for developing PTSD.

Although there is a fair amount of research dedicated to identifying the risk factors for and comorbidities of PTSD, there is less research examining preventative early intervention. This is of integral importance as PTSD has been shown to be more difficult to treat as time passes following the traumatic event, and sufferers may experience symptoms for years (Rauch & Foa, 2003). This issue is complicated by the fact that there has been mixed evidence for the efficacy of some treatment approaches; in a review examining evidence for and against the various early intervention approaches for PTSD the authors acknowledge that an older method known as psychological debriefing has been shown to be harmful in some efficacy trials (Kearns, Ressler, Zatzick, & Rothbaum, 2012).

However, the results of a meta-analysis examining the efficacy of early interventions found that there were modest effects for trauma focused CBT (Roberts, Kitchiner, Kenardy, & Bisson, 2009). These treatments involve addressing early changes in thinking related to perceptions of safety and personal competence following a traumatic event (Foa, Hearst-Ikeda, & Perry, 1995). Studies examining various intervention approaches have found that relative to treatment as usual there are better mental health outcomes for those receiving these early interventions (O'Donnell et al, 2012; Zatzick et al., 2004). Taken as a whole, these studies elucidate the need for a valid and reliable screen to effectively identify those who may develop PTSD.

One significant problem with using early symptoms of PTSD as the sole means of screening for the later development of PTSD is illustrated by research that describes the symptom trajectories, or recovery patterns, seen in survivors of trauma. Bonanno, Westfall and Mancini (2011) describe four symptom trajectories that emerge in studies that take into account the heterogeneity of responses to potentially traumatic events (PTEs). A resilient trajectory “characterized by transient symptoms, minimal impairment, and a relatively stable trajectory of healthy functioning even soon after the PTE”, which is the most common; a recovery trajectory characterized “by elevated symptoms and some functional impairment after the PTE followed by a gradual return to normal levels of functioning”; a chronic trajectory “characterized by a sharp elevation in symptoms and in functional impairment that may persist for years after the PTE”; and a delayed trajectory “characterized by moderate to elevated symptoms soon after the PTE and a gradual worsening across time” (Bonanno et al., 2011, p. 1.4-1.5).

Evidence for these trajectories has been found in a study of injured trauma survivors (deRoon-et al., 2010). Latent growth mixture modeling is a statistical procedure that is useful in



“identifying homogenous subpopulations within the larger heterogeneous population” which in the case of acutely injured individuals allows for a better understanding of responses to potentially traumatic events (Jung & Wickrama, 2008, p. 302). Utilizing this statistical methodology, patients admitted to a level 1 trauma center were followed for 6 months post injury and given measures of coping self-efficacy, anger, depression, ASD and PTSD, ( $n = 210$ ). deRoos-Cassini et al. (2010) found that these trajectories represented the best fit for their data for both PTSD and depression measures; including the common finding that most participants fell into the resilient trajectory. These findings have been corroborated by empirical investigations of different trauma populations including survivors of terrorist attacks and disease epidemics (Bonanno, Rennie, & Dekel, 2005; Bonanno et al., 2008).

### **Purpose of the Study**

The purpose of this study is to create an accurate and brief screening tool (the Injured Trauma Survivor Screen, [ITSS]) to assess who among adult injured trauma survivors admitted to a level 1 trauma center are at the most risk for the later development of PTSD. Currently there are two other measures designed to achieve a similar objective. One designed and normed on an Australian sample (O'Donnell et al., 2008), and another developed to predict PTSD in an emergency department sample (Richmond et al. 2011) in the U.S. Given the many differences between an emergency department sample and those admitted to a hospital for their traumatic injuries, the Richmond et al. (2011) screen was tested along with a unique set of items based on a thorough literature review of known risk factors in the traumatically injured adult population. This unique set of yes/no questions was then reviewed by experts in the field. These items were then administered to adults admitted to the hospital for their injuries while they were still

inpatients. Follow-up was conducted at one month post injury in order to assess for PTSD.

Simultaneously, the external validity, or generalizability, of the Richmond screen was assessed.

.

## Chapter 2

### Literature Review

#### PTSD: History and Definition

Evidence for stress related disorders can be seen throughout history in art, literature, and other forms of communication and media (Andreasen, 2010; Friedman et al., 2011). There have been a number of attempts to categorize these ostensibly disparate disorders, which over the course of history came to be known by many names, including “soldier’s heart, Da Costa’s syndrome, neurocirculatory asthenia...railway spine, shell shock...nostalgia” and “traumatic neurosis” (Friedman et al., 2011, p. 738). The attempt to connect the symptomatic phenomena seen in traumatized individuals to organic causes is evident in names such as railway spine, a name given to survivors of train crashes exhibiting symptoms of psychological distress (Friedman et al, 2011).

Nonorganic psychological trauma as the specific etiological cause of posttraumatic symptoms has its formal roots in psychoanalytic writings from the end of the 19<sup>th</sup> century. For example, in Breuer and Freud’s (1895) text, *Studies on Hysteria*, an etiological description of trauma involving *psychical trauma* (i.e., psychological trauma) was proposed:

In traumatic neuroses the operative cause of the illness is not the trifling physical injury but the affect of fright - the psychical trauma...Any experience which calls up distressing affects such as those of fright, anxiety, shame or physical pain may operate as a trauma of this kind; and whether it in fact does so depends naturally enough on the susceptibility of the person affected... (Breuer and Freud, 1895, p. 5-6).

Despite these earlier recognitions it was not until 1980 that PTSD appeared as a formal diagnosis in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM) - III. A similar

diagnosis, *gross stress reaction*, appeared in the *DSM – I* under the category of *transient situational personality disorders* which was a diagnosis to be applied to “normal” people experiencing unusual amounts of stress during “combat or in civilian catastrophe” (APA, 1952, p. 40). As the title of the category to which this disorder was ascribed implies, it was expected that this condition would remit relatively quickly, and if not, it was recommended that an alternative diagnosis be made. In the next edition of the DSM, gross stress reaction was removed. In the *DSM – II* (APA, 1968) the closest designation was the *adjustment reaction of adult life* found under a category entitled *transient situational disturbances*. This was a slightly broader diagnosis, again limited to symptoms of a shorter duration but including “fear associated with military combat and manifested by trembling, running and hiding” (APA, 1968, p. 49).

In the absence of any *DSM-II* diagnosis and prior to the *DSM-III* PTSD diagnostic criteria, many syndromes had been proposed and often times bore the name of the specific trauma theorized to be causally linked to the symptoms (e.g., rape trauma syndrome, war sailor syndrome) (Friedman et al., 2011). In the *DSM-III* the diagnosis of PTSD was placed under the classification of *anxiety disorders* and the symptom clusters were presented within the context of four criteria. The first of criteria was the need for an identifiable traumatic experience “outside the range of usual human experience” (APA, 1980, p.236). These included experiences varying from combat experience to car accidents and natural disasters. The other three criteria were precursors to the modern symptom clusters and included re-experiencing, numbing, and a broader third category that included symptoms of hyperarousal and avoidance. This edition also required diagnosticians to distinguish between the two subtypes of acute onset, or chronic or delayed onset.

In the next revision, the *DSM-III-R* (APA, 1987) these subtypes were dropped, the second symptom cluster was refocused on avoidance symptoms, and the third symptom cluster was now focused specifically on symptoms of increased arousal. A fifth criterion was added which was that the symptoms must persist for one month and an emotional component was added to the description of the stressor in which the trauma survivor experienced “intense fear, terror and helplessness” (APA, 1987, p. 247). The *DSM-IV* (APA, 1994) and *DSM-IV-Text Revision* (DSM-IV-TR, APA, 2000) replaced the notion in the stressor criterion that the experience had to be outside of the range of normal human experience stating, “the person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others” and officially made the experience of intense fear, terror and helplessness part of the stressor criterion (APA, 2000, p. 467). The specifiers of acute, chronic, or with delayed onset were reintroduced and a sixth criterion stating that the symptoms must cause clinical distress in some area of functioning was added.

Most importantly this edition introduced *acute stress disorder* (ASD) into the nosology. This disorder is distinct from PTSD in a number of ways. In the *DSM-IV-TR* criteria the onset of this disorder is within four days of the traumatic event and lasts a maximum of four weeks, in part to provide an intermittent diagnosis for PTSD which cannot be diagnosed until 1 month following the traumatic event. Critically, although the new ASD criteria were very similar to that of PTSD they included the distinct dissociative symptom cluster. This was at the behest of the Dissociative Disorders Subcommittee who cited observations that those who suffered dissociative symptoms during or in the aftermath of trauma were at increased risk for PTSD (Friedman, Keane, & Resick, 2007).

Some significant changes to the PTSD diagnosis have come with the most recent iteration of the DSM (Figure 1). The *DSM-5* (APA, 2013) introduced an entirely new classification called *trauma- and stressor-related disorders*. Thereby reassigning PTSD to this classification and removing it from anxiety disorders where it had been since the *DSM-III*. The trauma- and stressor-related disorders category encompasses several disorders, all of which have exposure to a traumatic/stressful event listed in the criteria. This section is intentionally situated in the *DSM-5* between anxiety disorders and dissociative disorders to reflect the relationship between these different classifications (APA, 2013). This current conceptualization is more focused on behavioral symptoms and again removes the acute or chronic specifiers. ASD remains demarcated primarily based on the stipulation that the duration of ASD is from 3 days to 1 month, following a traumatic event.

The component of the stressor criterion that specified that a person needs to experience intense fear, helplessness and hopelessness was removed due to consistent findings in the research that it did not contribute to accurate diagnosis (Friedman, Resick, Bryant & Brewin, 2010). A fourth symptom cluster was added to the three symptom clusters present since the *DSM-III*. Most factor analytic studies revealed a four factor model of PTSD and avoidance and numbing (combined in the *DSM-IV-TR*) have been found to be discrete symptoms across research findings (Friedman et al., 2010; Miller et al., 2013). These four factors are theorized to be the four symptom clusters currently in the *DSM-5* which are re-experiencing, avoidance, negative alterations in cognitions and mood, and arousal or hyper-arousal symptoms. A dissociative specifier was added for those individuals experiencing either depersonalization or derealization. This was added due to consistent neurobiological and factor analytic findings as

well (Lanius et al., 2010; Lanius, Brand, Vermetten, Frewen, & Spiegel, 2012; Steuwe, Lanius, & Frewen, 2012).

Clinical observations for these factors, or symptom clusters, can be quite obvious. Perhaps most evident in the individual's hyperarousal symptoms, or overly responsive autonomic nervous system arousal (i.e., increased heart rate), in the presence of reminders of the trauma. This stimulation is then interpreted by the individual as a signal that they are in danger as the fight or flight, or physiological stress response, is being activated. Typically, major effort is made on the part of the individual to avoid any thoughts, feelings, or other physical reminders of the traumatic event that might cause this reaction. As a result, they are often seeking help due to failed efforts to avoid the intrusive re-experiencing symptoms such as nightmares or flashbacks. Negative alterations in thinking and feeling as a direct result of the trauma itself, or the ensuing psychological distress, coalesce with these other clusters to produce a debilitating posttraumatic reaction.

Figure 1

### *DSM-5 309.81 Posttraumatic Stress Disorder*

#### **309.81 Posttraumatic Stress Disorder**

**Note:** The following criteria apply to adults, adolescents, and children older than 6 years.

- A. Exposure to actual or threatened death, serious injury, or sexual violence in one (or more) of the following ways:
  1. Directly experiencing the traumatic event(s).
  2. Witnessing, in person, the event(s) as it occurred to others.
  3. Learning that the traumatic event(s) occurred to a close family member or close friend. In cases of actual or threatened death of a family member or friend, the event(s) must have been violent or accidental.
  4. Experiencing repeated or extreme exposure to aversive details of the traumatic event(s) (e.g., first responders collecting human remains; police officers repeatedly exposed to details of child abuse).  
**Note:** Criterion A4 does not apply to exposure through electronic media, television, movies, or pictures, unless this exposure is work related.
- B. Presence of one (or more) of the following intrusion symptoms associated with the traumatic events(s), beginning after the traumatic event(s) occurred:
  1. Recurrent, involuntary, and intrusive distressing memories of the traumatic event(s).  
**Note:** In children older than 6 years, repetitive play may occur in which themes or aspects of the traumatic events are expressed.
  2. Recurrent distressing dreams in which the content and/or affect of the dream are related to the traumatic events.  
**Note:** In children, there may be frightening dreams without recognizable content.

3. Dissociative reactions (e.g., flashbacks) in which the individual feels or acts as if the traumatic events were recurring. (Such reactions may occur on a continuum, with the most extreme expression being a complete loss of awareness of present surroundings.)  
**Note:** In children, trauma-specific reenactment may occur in play.
4. Intense or prolonged psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.
5. Marked physiological reactions to internal or external cues that symbolize or resemble an aspect of the traumatic events.
- C. Persistent avoidance of stimuli associated with the traumatic events, beginning after the traumatic events occurred, as evidenced by one or both of the following:
  1. Avoidance of or efforts to avoid distressing memories, thoughts, or feelings about or closely associated with the traumatic events.
  2. Avoidance of or efforts to avoid external reminders (people, places, conversations, activities, objects, situations) that arouse distressing memories, thoughts, or feelings about or closely associated with the traumatic events.
- D. Negative alterations in cognitions and mood associated with the traumatic events, beginning or worsening after the traumatic events occurred, as evidenced by two (or more) of the following:
  1. Inability to remember an important aspect of the traumatic events (typically due to dissociative amnesia and not to other factors such as head injury, alcohol, or drugs).
  2. Persistent and exaggerated negative beliefs or expectations about oneself, others, or the world (e.g., “I am bad,” “No one can be trusted,” “The world is completely dangerous,” “My whole nervous system is permanently ruined”).
  3. Persistent, distorted cognitions about the cause or consequences of the traumatic events that lead the individual to blame himself/herself or others.
  4. Persistent negative emotional state (e.g., fear, horror, anger, guilt, or shame).
  5. Markedly diminished interest or participation in significant activities.
  6. Feelings of detachment or estrangement from others.
  7. Persistent inability to experience positive emotions (e.g., inability to experience happiness, satisfaction, or loving feelings).
- E. Marked alterations in arousal and reactivity associated with the traumatic events, beginning or worsening after the traumatic events occurred, as evidenced by two (or more) of the following:
  1. Irritable behavior and angry outbursts (with little or no provocation) typically expressed as verbal or physical aggression toward people or objects.
  2. Reckless or self-destructive behavior.
  3. Hypervigilance.
  4. Exaggerated startle response.
  5. Problems with concentration.
  6. Sleep disturbance (e.g., difficulty falling or staying asleep or restless sleep).
- F. Duration of the disturbance (Criteria B, C, D, and E) is more than 1 month.
- G. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.
- H. The disturbance is not attributable to the physiological effects of a substance (e.g., medication, alcohol) or another medical condition.

*Specify whether:*

**With dissociative symptoms:** The individual’s symptoms meet the criteria for posttraumatic stress disorder, and in addition in response to the stressor, the individual experiences persistent or recurrent symptoms of either of the following:

1. **Depersonalization:** Persistent or recurrent experiences of feeling detached from, and as if one were an outside observer of, one’s mental processes or body (e.g., feeling as though one were in a dream; feeling a sense of unreality of self or body or of time moving slowly).
2. **Derealization:** Persistent or recurrent experiences of unreality of surroundings (e.g., the world around the individual is experienced as unreal, dreamlike, distant, or distorted).

**Note:** To use this subtype, the dissociative symptoms must not be attributable to the physiological effects of a substance (e.g., blackouts, behavior during alcohol intoxication) or another medical condition (e.g., complex partial seizures).

*Specify if:*



**With delayed expression:** If the full diagnostic criteria are not met until at least 6 months after the event (although the onset and expression of some symptoms may be immediate).

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*DSM-5* official diagnoses for posttraumatic stress disorder. Adapted from “*Diagnostic and Statistical Manual of Mental Disorders (DSM-5) 5<sup>th</sup> Ed.*”, by the American Psychiatric Association, 2013, p. 271-272. Copyright 2013 by the American Psychiatric Association.

## Cultural Specificity in the DSM-5

The modern psychiatric conceptualization of culture “refers to systems of knowledge, concepts, rules, and practices that are learned and transmitted across generations” (APA, 2013, p. 749). Increasingly, researchers and clinicians are acknowledging the need to integrate contextual and cultural variables into the diagnostic process. The most obvious acknowledgement of the empirical evidence for the cultural expression of mental health disorders started with the *DSM-IV* (APA, 1994). This edition exhibited greater cultural sensitivity by introducing new components including descriptions of cultural features under many of the diagnoses, broadening the definition of Axis-IV (the psychosocial portion of the former multi-axial system of diagnosis), and creating an appendix with a glossary of 25 culture-bound syndromes and an outline for cultural formulation. This edition also added new culturally relevant “V codes” (i.e., V62.89, religious or spiritual problem) in a section of the manual dedicated to areas other than mental disorders that may be the focus of clinical attention.

In the *DSM-5* it is stated that “mental disorders are defined in relation to cultural, social, and familial norms and values. Culture provides interpretive frameworks that shape the experience and expression of the symptoms, signs, and behaviors, that are criteria for diagnosis.” (APA, 2013, p.14). In this version of the DSM an attempt to reflect different cultural presentations in the diagnostic criteria was made. For example, according to an American Psychiatric Association press release, a fear of offending others was included in the description of social anxiety disorder to integrate Japanese social norms into the criteria (APA, 2013). Also,

the appendix of culture bound syndromes no longer appears in the *DSM-5* and this section has been renamed the “glossary of cultural concepts of distress” (APA, 2013, p.833). Most significantly, the “outline for cultural formulation” has been updated and no longer appears in the appendices. Along with the updated formulation there is a field tested “Cultural Formulation Interview (CFI)” to help guide practitioners interpretations of clinical presentations.

With regard to PTSD in the DSM, the culturally related diagnostic issues highlighted in this section are quite generalized, and it is more of a superficial review of the need to be aware that culture may impact onset, clinical expression, risk for developing PTSD, and the severity of and specific types of symptoms. This section does make mention of the importance of the idioms of distress and suggests that cultural concepts of distress be included via the CFI. Idioms of distress “are those particular ways in which members of sociocultural groups convey affliction”, they “vary across cultures, depending on the salient metaphors and popular traditions that pattern the human biological capacity for experiencing distress...” (Hinton & Lewis-Fernández, 2010). These idioms of distress are integral in understanding how distress manifests across cultures and give way to cultural syndromes such as those listed in the *DSM-5*.

Since the *DSM-5* was released in May of 2013 there are no published studies regarding the cultural validity of the PTSD diagnosis in its current iteration. In a review of research conducted between 1994 and 2010 on the *DSM-IV-TR* criteria and in preparation for the *DSM-5*, the authors concluded that PTSD exhibited several types of cross-cultural validity (biomarker validity, general and trauma-specific validity, content validity and structural validity) and that the symptoms are consistent across culturally diverse settings (Hinton & Lewis-Fernández, 2011). However, they caution that the expression is not the same in different cultures and that there is

significant variation in the symptom profiles that may affect content validity if cultural syndromes and variations are not taken into consideration by researchers and clinicians.

### **Early Intervention**

As previously mentioned, the nonorganic explanation of posttraumatic psychological distress has its formal roots in the psychoanalytic writings from the end of the 19<sup>th</sup> century. In Breuer and Freud's (1895) text *Studies on Hysteria* an account of how the expression of emotions related to the detailed recalling of a trauma narrative could bring about relief was provided:

For we found, to our great surprise at first, that each individual hysterical symptom immediately and permanently disappeared when we had succeeded in bringing clearly to light the memory of the event by which it was provoked and in arousing its accompanying affect, and when the patient had described that event in the greatest possible detail and had put the affect into words (Freud & Breuer, 1895, p. 6).

Many modern approaches share features of this type of intervention and empirical evidence has mounted both for their efficacy and the utility of providing such interventions as early as possible.

Primary prevention refers to preventing the development of a disorder before it can begin to develop. Secondary prevention is the implementation of an intervention following the onset of a disorder designed to stop the progression of the disorder. Tertiary prevention focuses on treating an already established disorder and represents the status quo for most psychological intervention and healthcare research (Crossley, 2000). Early intervention serves as a type of secondary prevention for chronic PTSD. This is vitally important as there is evidence that PTSD becomes more difficult to treat once it has reached chronic status which can result in sufferers

experiencing symptoms for many years (Rauch & Foa, 2003). In a meta-analysis of 25 early intervention studies, trauma focused CBT was found to be effective for participants experiencing traumatic stress symptoms (Roberts et al., 2009). The suggested appropriate timing for early intervention (once a person is safe) is between two days and one month following the experience of a potentially traumatic event (Litz & Maguen, 2007).

A review of evidence for the effectiveness of various psychotherapeutic interventions for PTSD was conducted by the Institute of Medicine Committee on Treatment of Posttraumatic Stress Disorder in their report entitled *Treatment of Posttraumatic Stress Disorder: An Assessment of The Evidence* (2008). In their review they examined 52 randomized control trials (RCT) of psychotherapies for PTSD: 23 cognitive behavioral exposure based therapies, 10 eye movement desensitization, four coping skills based treatment, four other (hypnotherapy, eclectic, psychodynamic, neurofeedback), four group therapy, and three cognitive restructuring. They report that “the evidence is sufficient to conclude the efficacy of exposure therapies in the treatment of PTSD” but that the evidence is inadequate for other therapies (2008, p.8). Many of these methods are promising and are regularly used in practice despite a lack of current research.

One commonly used type of exposure therapy is Prolonged Exposure (PE) therapy which is based on Emotional Processing Theory (Foa, Rothbaum, Riggs, & Murdock, 1991). This theory posits that traumatic events can cause a pathological alteration in one’s healthy fear response and associated cognitions (i.e., one’s beliefs about safety) (Foa, Hembree, & Rothbaum, 2007). In order to repair this, the thoughts and feelings associated with the traumatic memory must be modified. The core components of the treatment include: providing psychoeducation regarding trauma and PTSD symptoms; helping clients to breathe in a calming way that reduces autonomic nervous system arousal; encouraging clients to engage in repeated in-vivo exposure to

situations or objects that cause PTSD related distress outside of the therapists office; repeated imaginal exposure in which the traumatic event is recounted in enough detail to cause emotional engagement in the memory; and thorough processing of associated thoughts and feelings.

Within injured trauma survivor research, researchers have focused on implementing stepped interventions that begin by screening for potential at risk patients, providing the least intrusive and cost effective interventions first, and then implementing CBT and other appropriate interventions for those patients who are in need. Zatzick et al. (2011) utilized what they call a collaborative care stepped intervention consisting of case management, motivational interviewing, behavioral activation, evidence-based pharmacotherapy, and CBT components similar to those mentioned previously. Zatzick and colleagues have demonstrated in two pilot studies and one large scale study that these stepped interventions can increase the overall population impact in the most cost-effective way (Zatzick et al., 2001; Zatzick et al., 2004; Zatzick et al., 2011; Zatzick et al., 2013). There remains critical need in this area of research in correctly identifying not just those who already have PTSD but those who may be good candidates for early intervention to prevent onset of the disorder. The best way to achieve this is through the use of evidence based assessments.

### **Evidence Based Assessment**

Reliability and validity are the fundamental building blocks of evidence based psychometric scale construction and psychodiagnostic assessment. Reliability refers to the consistency and dependability of a measure or psychometric instrument (Devellis, 2012; Leary, 2001). Underlying these instruments is a theoretical latent variable, also known as the variable of interest. In order for an instrument to be evaluated as reliable it must demonstrate that it can accurately measure a particular variable and that changes in the score are a direct result of an

alteration in that variable (Devellis, 2012). The model developed to describe this is known as true score theory or classical test theory (Sapp, 2006). This theory posits that an observed value ( $X$ ) is equal to a theoretical true score ( $T$  = expected value of  $X$ ) plus some amount of error ( $E$ ) (e.g.,  $X = T + E$ ) (Brennan, 2011). Ideally, scores from a reliable measure will closely represent this theoretical true score and the reliability of a scale can be quantified as “the proportion of variance attributable to the true score of the latent variable” (DeVellis, 2012, p.31).

Sapp (2006) describes several ways to measure and calculate reliability. Test-retest reliability involves giving a test to the same participants on multiple occasions which allows researchers to calculate a coefficient of stability. Alternate forms reliability is when participants are given an equivalent measure theorized to assess the same construct, allowing researchers to calculate the coefficient of equivalence. Interrater reliability is relevant when there is a possibility for some subjectivity in the scoring process. The scores from two or more scorers should agree and this can be assessed by correlating the scores. Internal consistency reliability is used to assess the consistency of scores across items within a test, and it is typically calculated via Cronbach’s alpha ( $\alpha$ ).

Validity is whether or not the items on the instrument measure the construct they are intended to. DeVellis (2012) describes three types of validity that are relevant for scale construction. Content validity is the degree to which the items on a test reflect the intended variable as opposed to other related variables. This is established by carefully defining the variable, reviewing relevant research and concepts, and working with experts and/or the intended audience to develop relevant items. Criterion-related validity refers to empirical evidence of the predictive abilities of a measure, usually by comparison to an already validated measure. Criterion-related validity may be established by measuring the criterion at a later time following

the administration of the scale that is in development (predictive), or concurrently by measuring the criterion at the same time as the scale that is being developed; predictive validity is especially relevant for this study.

Construct validity refers to the latent variables theoretical relationship to the latent variables of other scales. That is, the measure being developed should correlate with other instruments that measure the same variable and it should not correlate with unrelated instruments. This can be assessed via the use of the multitrait-multimethod matrix to determine convergent and divergent validity; two types of construct validity (DeVellis, 2012; Sapp, 2006). In his discussion of validity, DeVellis (2010) is also clear in making a distinction between predictive accuracy and predictive validity. Predictive accuracy is established by selecting a cutoff score that would yield the most true positives (sensitivity) and true negatives (specificity).

**Evidence based measures for PTSD diagnosis.** There are many self-report measures of PTSD and they are typically delineated by their intended use for either a military or civilian population. For example, the National Center for PTSD website lists twelve self-report measures and seven shorter screens all developed to measure current PTSD symptoms. The most commonly used of those measures is the PTSD checklist (PCL) (McDonald, & Calhoun, 2010; Weathers et al., 1993). Historically the PCL came in three versions: the PCL-Military (PCL-M), PCL-Specific (PCL-S), and PCL-Civilian (PCL-C). Selected for this study is the PCL-5, the newest iteration of this measure, due to the PCL's history of demonstrating sound psychometric properties and its common usage in hospital settings.

This measure does not take long to administer (5-10 minutes) and is used in many clinical settings including hospitals for the screening, diagnosing, and monitoring of symptoms (Orsillo, 2001). The measure itself consists of 20 items worded to avoid any linkage to a specific

traumatic event. Participants are instructed to answer the items based on their experience of their symptoms in the last month. Each item corresponds to a symptom in the *DSM-5*; five items correspond to the re-experiencing cluster, two questions for the avoidance cluster, six for the negative alterations in cognition and mood, and six for the increased arousal cluster. Items are scored on a Likert scale from 0-4 and scores on the measure can range from 0-80. The cut point is dependent on the population and use of the measure. Additionally, one can use *DSM-5* criteria for items rated from 2 (moderately) to 4 (severely) on the Likert scale to see if the participant endorses the appropriate pattern of symptoms for diagnosis. Since the PCL-5 was initially released around the time that this study began, the psychometric properties of its predecessor will be presented.

Consistent and strong reliability and validity of the PCL-C have been demonstrated in many trauma-exposed populations (McDonald & Calhoun, 2010; Norris & Hamblen, 2004, Orsillo, 2001; Wilkins, Lang, & Norman, 2011). McDonald and Calhoun (2010) conducted a critical review of the literature and found that like most psychometrics, the test characteristics such as the sensitivity and specificity of the PCL differ as a function of the populations, test versions, and cut off scores used in each study. With regard to reliability and validity among non-clinical civilian samples the PCL-C has demonstrated strong internal consistency ( $\alpha = .94$ ); good retest reliability ( $r = .66$  to  $.68$  at two weeks). It has also demonstrated good convergent and divergent validity across many measures; meaning that the items of this test correlate with items of other tests designed to measure the same construct and do not correlate highly with items of tests designed to measure different constructs (Conybeare, Behar, Solomon, Newman, & Borkovec, 2012; Ruggiero, Del Ben, Scotti, & Rabalais, 2003). In a study of motor vehicle accident survivors and sexual assault survivors conducted by Blanchard, Jones-Alexander,



Buckley, & Forneris (1996), using the recommended cutoff score of 50, sensitivity was .778 and specificity was .864. Blanchard et al. recommended a cutoff score of 44 as this improved their sensitivity to .944, specificity to .864. Their internal consistency for the whole measure was .939 and the overall correlation with the Clinician Administered PTSD Scale was .929.

Another type of assessment known as the clinician-administered structured diagnostic interview is a category of assessment instrument that is more routinely used in research than in clinical practice (Keane, Brief, Pratt, & Miller, 2007). The National Center for PTSD lists four such instruments on its website, the most commonly used and the one used in this study is the Clinician Administered PTSD Scale (CAPS), created by Blake and colleagues (Blake et al., 1990; Blake et al., 1995). The administration of this clinical interview takes between 45 minutes to one hour. In previous versions of the CAPS, in order to establish that criterion A of the DSM diagnosis was met, up to three potentially traumatizing events were chosen via the empirically validated life events checklist (Gray, Litz, Hsu, & Lombardo, 2004) and the subsequent questions regarding the symptoms clusters were answered regarding those events (Orsillo, 2001). In the current version participants are instructed to identify a single index trauma on which they base their answers. They then answer specific questions regarding symptoms in each symptom cluster.

There is a corresponding test item for each PTSD criterion and follow up questions regarding frequency and intensity. Further questions assess the onset, duration, and level of distress and impairment caused by the symptoms. Scoring can produce dimensional (symptom severity) or categorical (yes/no) results (Weathers, Ruscio, & Keane, 1999). In a review conducted by Weathers, Keane, and Davidson (2001) of 29 studies, including 15 with at least partial civilian samples, the authors conclude that there is “considerable validity evidence that

supports the use of the CAPS as a measure of PTSD diagnostic status and symptom severity” (p. 153).

**Evidence based measures for predicting PTSD in injured trauma survivors.** A review of the literature yielded two studies in which creating a theoretically derived predictive screen of PTSD in injured trauma survivors based on risk factor data was the topic. In a study by O’Donnell et al. (2008) risk factor data were used to create a 10 item measure scored on a Likert scale. This study was normed on an Australian sample of patients and only gender demographics were provided (Male = 72%, Female = 28%). The 10 items on the measure were designed to predict PTSD (sensitivity = .82, specificity = .84) and five of those same items can yield a predictive score for depression (sensitivity = .72, specificity = .75).

Some of the limitations of their scale design are that they utilized a Likert format which is a more cumbersome style of item response which can be confusing for patients and staff in the hospital setting. Also, in their original item pool the authors did not include any items to assess dissociation, personality traits, life stress prior to the event, substance abuse, or whether the injury was intentional. Importantly, this screen may not be predictive of outcomes in a U.S. sample for several reasons including that it was created using outcome data from an Australian sample. Additionally, rates of assaultive violence are much higher in the U.S. than in Australia (i.e. <5% vs up to 35%) (O’Donnell, Creamer, Pattison, & Atkin, 2004) and posttrauma stress may have accounted for less variance in patient outcomes in their study than it does in the U.S. due to significant differences in accessibility to and financial coverage for healthcare (Australian Government Centrelink, 2009).

Richmond et al. (2011) created a measure normed on a U.S. sample in an urban emergency department (ED) demographically similar to the sample in this study (Male = 52%,

Female = 48%; Black = 55%, White = 34%, Asian = 3%, and Hispanic = 3%). It consists of eight questions and utilizes a yes/no item response format that is more conducive to the hospital environment (Appendix A). Similar to the O'Donnell measure their measure was developed to measure risk for PTSD and depression concurrently using risk factor data for PTSD. In addition to the survey they examined acute physiological arousal via heart rate, current pain level, and participant injury severity scores; none of which were retained in their model. The measures were collected and the survey was given to a random sample of participants who went through the emergency department within two weeks post injury. These individuals were not necessarily admitted to the hospital for their injuries.

Their survey has not yet been evaluated in patients admitted to the hospital exclusively, and their method of sampling (all patients presenting to the ED) led to a low average injury severity score (ISS = 4.2). The authors suggest that this may have impacted perceptions of the severity of the event and ensuing injuries, both of which are related to PTSD risk. A portion of the screener was developed to predict depression and as such they excluded participants with a current diagnosis of depression. This is a risk factor for PTSD and although it made sense for their methodology, it does not make sense for predicting PTSD. They also excluded participants with preexisting psychotic disorders which ignores risk factor research that finds that pre-existing psychopathology puts injured trauma survivors at increased risk for PTSD. In the development of their items they did not include items to assess personality traits, life stress prior to the PTE, substance abuse, intentional injury, and previous psychopathology (including anxiety) other than depression.

Together, these limitations may have contributed to the relatively low incidence of PTSD at six month follow-up in their sample ( $n = 4$ , 2.4%). Richmond et al. (2011) posit that this may

in turn have contributed to their positive predictive value ( $PPV = .07$ ) and negative predictive value ( $NPV = 1.00$ ). These values essentially mean that the measure is strong with regard to predicting who will not get PTSD (NPV) but less strong with regard to accurately predicting who will (PPV). Finally, the authors note that it is important that this measure be validated in patients who are still in-hospital as they included follow-up with patients who were not admitted, for up to two weeks following injury.

### **Risk Factors**

These screens were created based on risk factor data. There are a multitude of risk factors that have been tied to the development of PTSD following a PTE (Bromet, 1998). Reviewed herein are pretrauma, peritrauma, and posttrauma risk factors that have been empirically tested in the injured trauma survivor population, other civilian populations, and military populations. Due to the fact that the research in this area comes from a variety of populations the generalizability is limited; however, there is a clear recognition in the field that while most people will not develop PTSD in the wake of a trauma, those who do, tend to share some common vulnerabilities regardless of the type of trauma (Vogt, King, & King, 2007). In their review of risk factor studies Vogt, King and King (2007) assert that most risk factors cannot be proven to be causal and that even when they are, the underlying reasons for the association is often not understood. They also state that the literature in this area tends to yield small effect sizes for the predictors and the research is full of contradictory findings, indicating major heterogeneity for causes of PTSD.

The focus in this section is on the injured trauma population when data are available, and all of the studies included are prospective and/or longitudinal studies unless otherwise specified. Prospective research is utilized to bolster the predictive validity of the potential factors to be

included in the measure (Sapp, 2006). The majority of the studies present the odds ratio (OR) which is essentially an effect size measure for categorical data and is the alternative to the correlation coefficient used with continuous variables (Azen & Walker, 2011; Field, 2009). Odds ratios are often used in medical outcome research and can be thought of as an estimate of risk (Ferguson, 2009). Odds ratios are determined by calculating the probability of the outcome for each dependent variable, then the probability of the event occurring is divided by the probability of the event not occurring; in logistic regression designs they are the exponentiated  $\beta$  coefficients (Azen & Walker, 2011), an example of this is provided in the results section of this paper. If the OR equals 1, this indicates that the variables are independent and if the OR deviates from 1 then the variables are theorized to be dependent or associated (Stevens, 2009).

### **Pretrauma Risk Factors – Sociodemographics**

**Age.** Being of a younger age has been found to be associated with PTSD risk in a number of populations, although inconsistently. Most studies that point to age as a predictor do not comment on what constitutes younger age, and since it varies by sample, it is hard to draw meaningful conclusions from this. Age has been associated with an increased probability of developing acute stress disorder in a study of disaster rescue workers ( $n = 628$ ,  $OR = .35$ , 95%  $CI = .18, .68$ ,  $p = .002$ ), the development of which increased the risk of PTSD by a factor of 7.33 ( $p < .001$ ) (Fullerton, Ursano, & Wang, 2004). In prospective and retrospective studies examining American and non-American veterans, predeployment age was shown to be moderately correlated with PTSD among males (Bramsen, Dirkzwager, & van der Ploeg, H. 2000; King, King, Foy, Keane, & Fairbank, 1999). The generalizability of these measures is limited due to the populations on which the research was conducted.

Michaels et al. (1999b) administered the civilian Mississippi Scale for PTSD ( $\alpha = .86-.89$ ; Orsillo, 2001) to injured adults admitted to a level 1 trauma center and a regional burn center six months after injury. They found that younger age accounted for a small portion of the variance in the development of PTSD in stepwise linear regression ( $n = 176$ , *adjusted*  $R^2 = .037$ ) (Michaels et al., 1999b). This study did not provide data regarding the reliability (i.e., Cronbach's alpha) of the measure within their sample which is a ubiquitous limitation of the research in this area. Also, they used stepwise linear regression which, although common, is less preferable to forced entry methods, or secondarily, hierarchical methods, since in the stepwise method the statistical software determines the order in which variables are entered into the equations (Sapp, 2006). In a split-group analysis, or cross-validation, age was no longer significant (Michaels et al., 1999b). This study was also limited by retrospective baseline assessment.

Holbrook, Hoyt, Stein, & Sieber, (2001) conducted a large epidemiological study ( $n = 1,048$ ) enrolling participants in the Trauma Recovery Project (TRP) which collected data from four trauma centers in San Diego. Using an interview based on *DSM-IV-TR* criteria they found that PTSD occurred more frequently in younger low-income individuals. In their sample, younger is 34.3 on average in the PTSD group vs. 37.4 in the non-PTSD group. Regardless, there is no way to know if this is causal or a composite of SES or other variables not controlled for. In a meta-analysis by Brewin et al. (2000), sixteen studies with civilian samples were identified as having addressed age as a risk factor and the effect size for them was  $-.01$ , indicating that being of a younger age is not a stable predictor for PTSD in civilian samples.

**Education.** Koenen et al. (2002) utilized the Vietnam Era Twin (VET) Registry ( $n = 6,744$ ), which used the Mental Health Diagnostic Interview Schedule Version III – revised (DIS-

III-R) to assess PTSD ( $\kappa = .27$ ), major depression ( $\kappa = .54$ ), and GAD ( $\kappa = .23$ ). They found that having less than a high school education was shown to be associated with an increased probability of the development of PTSD (OR = 1.81, 95% CI = 1.28, 2.56) in adjusted analyses while controlling for combat exposure. However, in a study examining non-American veterans, predeployment educational level was not found to be significant when age was controlled for (Bramsen et al., 2000). The generalizability of these studies is limited due to the populations on which the studies were conducted. The training and exposures are not direct analogs to typical civilian traumas.

In a study that utilized data from the US National Comorbidity Study (NCS) ( $n = 5,877$ ), having more education was not a significant predictor of PTSD in those who had been exposed to a trauma (Male OR = .89, Female OR = .91) (Bromet, Sonnega, & Kessler, 1998). The NCS used a modified version of the Diagnostic Interview Schedule ( $\kappa = .75$ ) to diagnose PTSD. This data is not directly analogous to the adult injured trauma survivor population as it looked at all types of trauma (type-I and type-II; military and civilian) and included adolescents (15 and older). The authors used logistic regression which is a type of multiple regression commonly used when the dependent variable is categorical such as being diagnosed with PTSD, and is the same statistical process used in this study (Field, 2009). Education was found to account for only a small portion of the variance in the development of PTSD ( $R^2 = .025$ ) in the Michaels et al. (1999b) study and this finding did not hold up in cross-validation. Finally, the Brewin et al. (2000) meta-analysis of 20 studies found that a lack of education had a small effect on the development of PTSD ( $r = .09$ ) but that this variable seemed to be impacted by the unique study characteristics and methods.

**Married/Partnered, employment, income.** Being married/partnered has been shown to be protective in studies examining PTSD risk factors in U.S. rescue workers and urban firefighters (Corneil, Beaton, Murphy, Johnson, & Pike, 1999; Fullerton et al., 2004); however, in a retrospective study utilizing data from the NCS, marital status was not found to be predictive of PTSD in those who had experienced a trauma (Female OR = 1.12, Male OR = .99) (Bromet et al., 1998). One major limitation in the study looking at U.S. rescue workers and the study using data from the NCS is they did not specify if they examined domestic partnerships as well. Also, like military samples, firefighters and rescue workers are exposed to very different types of PTEs and they typically receive specialized training, greatly limiting the generalizability of these findings.

In a study of injured emergency department patients ( $n = 152$ ) in the U.K. the Posttraumatic Diagnostic Scale (PDS) ( $\alpha = .92$ ; Orsillo, 2001), the Impact of Event Scale (IES) ( $\alpha = .78 - .86$ ; Orsillo, 2001) and the Hospital Anxiety and Depression Scale (HADS) were administered 1-3 weeks after injury (Joy, Probert, Bisson, & Shepherd, 2000). They found that employment accounted for a small portion of the variance in their model ( $R^2 = .062$ ) in stepwise regression. The related variable of income has been examined in U.S. samples across trauma centers and for various types of trauma and has produced mixed results (Holbrook et al., 2001; Ursano et al., 1999). One explanation for the incongruence in these findings may be that when additional risk factor data is included, marital/partnered status, employment and income may be subsumed by factors such as posttraumatic social support, life stress and access to resources.

**Gender.** In studies utilizing data from the Trauma Recovery Project (TRP), the frequency of PTSD was 39% in women compared to 29% in men (Holbrook et al., 2001) and



women were at a significantly higher risk for developing PTSD (OR =2.8,  $p = .001$ ) in logistic regression (Holbrook, Hoyt, Stein, & Sieber, 2002). Additional studies of acutely injured trauma survivors have demonstrated that female gender was significantly associated with the development of PTSD (Michaels et al., 1999b; Zatzick et al., 2002) although this did not hold up in cross-validation (Michaels et al., 1999b). In a meta-analysis of 23 civilian studies gender was found to have a small effect ( $t = -3.23$ ,  $p < .01$ ,  $r = .13$ ) on the development of PTSD (Brewin et al., 2000) and this effect was impacted significantly by the study methods and population.

In a study examining PTSD among motor vehicle accident (MVA) survivors in the U.K., gender demonstrated a small significant correlation with PTSD ( $r = .13$ ) at three months ( $n = 888$ ) and was no longer significant at one year ( $n = 781$ ) (Ehlers, Mayou, & Bryant, 1998) on the Posttraumatic Stress Symptom Scale (PSS). In another study of MVA survivors, using the Structured Clinical Interview for DSM-III-R (SCID), the SCID for DSM-IV and the SCID PTSD supplement ( $\kappa > .95$ ) (Ursano et al., 1999) researchers found that one month post injury ( $n = 164$ ), women were at 6.53 times greater risk for PTSD using logistic regression (Wald  $\chi^2 = 12.60$ ,  $p = .002$ , 95% CI = 2.32 – 18.39); however, this difference did not remain significant at three and six month follow-up. In a large ( $n = 4,075$ ) retrospective study that utilized multivariate regression for the type of trauma and stepwise regression for the risk factors in a community sample, female gender was not retained in their model ( $\chi^2 = 102, 247$   $p < .001$ ) (Hapke, Schumann, Rumpf, John, & Meyer, 2006). The authors posit that type of trauma remained significant and female gender did not due to the fact that women are more likely to be the victims of assaultive traumas such as sexual assault or physical attack.

Tolin and Foa (2006) suggest there are additional factors involved in the different rates of PTSD seen between the sexes and they conclude that this difference cannot be attributed solely

to the type of PTE, but that other methodological limitations (i.e., using an index PTE) and factors not captured by many studies (i.e., cognitive and affective reactions) also contribute to this difference. In a review of gender related issues in PTSD research, Kimerling, Ouimette and Weitlauf (2007) suggest that more meaningful differences can be derived when considering the context. Important contextual variables such as culture can act as moderators in understanding gender differences that yields a more accurate gender-interactional model. The results of the Brewin et al. (2000) meta-analysis support this supposition as do the back and forth findings within the injured trauma survivor data presented here. As such, gender-informed assessments will provide more valid output for both men and women.

**Race.** Similar to gender, race tends to be consistently examined in the PTSD risk factor literature from an ethnocentric standpoint, and is often linked to the development of PTSD. However, in nuanced critiques of the literature it is pointed out that when other variables are controlled for, race often does not remain significant (Breslau et al, 1998; Brewin et al., 2000). For example, African-American families have been subjected to racism and poverty for centuries (Marbley & Rouson, 2011). One result of protracted economic oppression is that it changes ones risk for certain types of stressors and the ways in which one copes (positively and negatively), requiring examination beyond the categorical race variable via ecological models (Mezuk et al., 2010).

Similar to gender, the application of social-contextual models yields more robust variables. In the risk factor data for example, Breslau et al. (1998) found in their study of the Detroit area, that there were higher rates of assaultive violence among non-whites and that this relationship between race and assaultive violence was stronger than the relationship between city residence and assaultive violence. Clearly there is more at work than a fixed demographic

predictor. This is an example of a variable that is essentially better understood when the context is considered and it likely overlaps with other variables such as access to resources.

Understanding the way race, ethnicity and culture inform assessment helps researchers to not engage in ethnocentric scale construction by taking an inclusive emic (culturally specific vs. universal) approach to research (Osterman & de Jong, 2007; Sue & Sue, 2013).

### **Pretrauma Risk Factors – Psychosocial**

**Parental psychopathology.** In their study utilizing the VET Registry, Koenen et al. (2002) found that parental depression and parental antisocial behavior were significant predictors of PTSD, and results from the NCS indicated that parental history of mental illness was a significant predictor for both men and women (Bromet et al., 1998). In a meta-analysis of nine studies, researchers found a statistically significant relationship between having a family history of psychiatric disorders and PTSD symptoms, however, the effect size was small ( $r = .17$  CI = .04, .29) (Ozer et al., 2008). This variable was one of three risk factors that was not affected by study characteristics in the Brewin et al. (2000) meta-analysis. The other two were psychiatric history and family psychiatric history and there is likely some overlap with these variables. Another meta-analysis of 7 civilian studies did not find this relationship to be statistically significant and also found a small effect size ( $r = .13$ ). This difference was also found to be non-significant in a study of MVA survivors (Ursano et al., 1999).

**Childhood abuse/adversity/ trauma.** In a meta-analysis of civilian populations small effect sizes were found for childhood abuse ( $r = .13$ ) and having a history of childhood adversity ( $r = .13$ ) (Brewin et al., 2000). This meta-analysis found a similar effect size for having had any previous trauma ( $r = .11$ ). This is similar to the results of another meta-analysis that yielded identical effect sizes for having a history of trauma and having a history of trauma in childhood

( $r = .17$ ) (Ozer et al., 2008). The authors of this meta-analysis posit that this seems to indicate that childhood trauma does not have any greater impact on the development of PTSD than prior trauma at any time in one's life which seems to be corroborated by the risk factor data on having had any previous trauma.

**Previous trauma.** Koenen et al. (2002) found that multiple trauma exposure in a military sample was a significant predictor of PTSD (OR = 2.25, CI = 1.86, 2.72) using data from the VET Registry. In a study examining risk factors among a German community sample ( $n = 3,021$ ) using the Munich-Composite International Diagnostic Interview (M-CIDI), they found that having experienced more than one trauma was associated with PTSD in logistic regression analyses (OR = 7.97 CI = 3.86, 16.40) (Perkonig, Kessler, Storz, & Wittchen, 2000). A meta-analysis of 23 studies found that having a prior trauma was moderately associated with PTSD when the trauma was the result of interpersonal violence ( $r = .27$ ) and also found that previous trauma in general had a statistically significant but small effect ( $r = .17$ ) (Ozer et al., 2008).

In a study examining injured adults admitted to a level 1 trauma center and a regional burn center, having a prior life threatening illness was statistically significant and accounted for a small portion of the variance in the development of PTSD (*adjusted*  $R^2 = .056$ ) but this did not hold up in cross-validation (Michaels et al., 1999b). In a study examining injured trauma survivors of MVA or assaults ( $n = 101$ ), using the PCL-C ( $\alpha = .94$ ; Ruggiero, Ben, Scotti, & Rabalais, 2003) level of prior trauma was significantly associated ( $t = 3.61$ ,  $p = .0005$ ) with a higher occurrence of PTSD symptoms at one year (Zatzick, et al., 2002) in random coefficients regression, a type of multilevel regression that is useful when data are clustered.

In examining PTSD among patients with facial injuries via the PDS ( $n = 193$ ), univariate analyses demonstrated that prior exposure to trauma was significantly associated with PTSD at one year follow-up ( $t = 2.64, p < .01$ ) (Glynn et al., 2007) but this did not hold up in multiple regression equations. In a study of MVA survivors ( $n = 99$ ) prior traumatic events were more common among the participants that developed PTSD ( $F = 8.04, P < .01$ ) in one way ANOVA using the IES one month after the accident (Delahanty, Raimonde, Spoonster, & Cullado, 2003). Finally, a prospective study of MVA survivors found that those with a history of PTSD diagnosis were 8.02 times more likely to develop PTSD (Ursano et al., 1999). Notably, items designed to assess this were not retained in the Richmond et al. (2011) study and the data indicate there is a great deal of variability with regard to this risk factor among injured trauma survivors.

**Pre-existing psychopathology.** Pre-existing psychopathology such as anxiety, mood and personality disorders have been shown to consistently predict PTSD following traumatic injury (Mason, Turpin, Woods, Wardrope, & Rowlands, 2006; Michaels et al., 1999b). A study of MVA survivors identified several significant findings including that those with major anxiety disorder or an axis II disorder were at increased risk for PTSD (Anxiety OR = 4.60, Axis II OR = 7.68) (Ursano et al., 1999). In the study by Glynn et al. (2007) examining patients with facial injuries, having a “mental health need” was significantly associated with the development of PTSD ( $t = 2.76, p < .01$ ) (p.414). In a study of assault survivors ( $n = 222$ ) treated in a metropolitan emergency department pre-existing psychopathology, as measured on the SCID, was significant in univariate (OR = 2.10,  $p < .001$ , CI 95% = 1.50, 2.95) and in overall hierarchical multivariate logistic regression (OR = 1.95,  $p = .014$ , 95% CI = 1.14, 3.31) (Kleim, Ehlers, & Gluckman, 2007).

This finding holds up across other research designs and samples. For example, in a retrospective study of a civilian sample in Germany ( $n = 4,075$ ) using the M-CIDI, having an existing anxiety disorder (OR = 4.02, 95% CI = 2.21, 7.30), depressive disorder (OR = 5.21, 95% CI = 2.10, 12.93), or somatoform disorder (OR = 4.81, 95% CI = 2.50, 9.25) were all associated with increased risk of developing PTSD in univariate analyses (Hapke, Schumann, Rumpf, John, & Meyer, 2006). In stepwise logistic regression pre-existing anxiety disorders (OR = 2.84, 95% CI = 1.36, 5.93,  $p = .005$ ) and somatoform disorders (OR = 2.84, 95% CI = 1.25, 6.45,  $p = .012$ ) were retained; however, due to the retrospective nature of the study no temporal relationship can be inferred. In meta-analyses effect sizes for pre-existing psychopathology are consistently small, ranging from .11 (Brewin et al., 2000) to .17 (Ozer et al., 2008); however, it is a stable predictor across study designs and samples (Brewin et al., 2000). Also, the effect size is moderate in accident survivors (weighted  $r = .28$ ) and survivors of interpersonal violence (weighted  $r = .31$ ) (Ozer et al., 2008).

**Personality.** Several aspects of personality such as higher levels of hostility, and lower levels of self-efficacy, agreeableness and conscientiousness have been found to be associated with PTSD among professionals exposed to traumatic events (Heinrichs et al., 2005; Hodgins, Creamer, & Bell, 2001); however, this data has limited generalizability to the injured trauma population. In a study examining correlates of personality and PTSD among burn survivors ( $n = 40$ ), researchers used the SCID ( $\kappa > .85$ ) and the NEO personality inventory (NEO-PI) ( $\kappa = .80-.90$ ) at four and twelve months post injury (Fauerbach, Lawrence, Schmidt, Munster, & Costa, 2000). They found that higher neuroticism scores ( $F = 4.34$ ,  $p < .007$ ) and lower extraversion scores ( $F = 3.47$ ,  $p < .02$ ) were associated with increased risk for PTSD. With regard to personality disorders, two studies of MVA survivors have found evidence that having an Axis II

diagnosis predicted higher scores on measures of PTSD at 12 months (Blanchard et al., 1996; Malta, Blanchard, Taylor, Hickling, & Friedenberg, 2002).

**Life stress and substance abuse before injury.** In a study of first responders ( $n = 715$ ), researchers using hierarchical logistic regression found that “routine work environment stress” contributed significantly to the variance in PTSD symptoms in their model ( $\beta = .182, p < .001$ ) (Marmar et al., 2006, p. 1). This type of trauma (i.e., repeated exposure to trauma) is not analogous to the first-hand experience of being injured in a traumatic event and therefore limits generalizability to this study. In a study examining PTSD among patients with facial injuries multivariate regression analyses demonstrated that the number of stressful events a person experienced in the past year was significantly associated with PTSD ( $R = .21, p < .01$ ) (Glynn et al., 2007). In studies examining injured trauma MVA survivors and assaults, testing positive for stimulants at admission ( $t = 2.69, p = .01$ ) (Zatzick et al., 2002) and having a history of alcohol abuse (Blanchard et al., 1996) were predictive of PTSD in the year following traumatic injury.

### **Peritrauma Risk Factors**

**Trauma severity.** In the meta-analysis by Brewin et al. (2000) trauma severity produced an effect size of .18 across 30 studies of community samples. The effect size of trauma severity was higher across military samples ( $r = .26$ ) and the authors state that this may be due to a necessary lack of consistency with which trauma severity is measured in civilian samples. In general this construct may lack validity as it is used as an aggregate for different aspects of the trauma including injury severity for example. One case in point is a prospective study of MVA survivors in which trauma severity was found to be associated with the development of PTSD; however, the trauma severity construct in their study consisted of injury severity, persistent medical problems, and persistent financial problems (Ehlers et al., 1998). In the case of this

screen all participants will have sustained injuries sufficient to warrant admission to a trauma recovery unit.

**Injury severity.** Studies of injured trauma survivors admitted to trauma centers have consistently found that injury severity as an independent construct is not associated with the development of PTSD (Holbrook, et al., 2001; Michaels et al., 1999b). In a study of 100 patients admitted to a level 1 trauma center there was no correlation between scores on a measure of perceived injury and injury severity score; however, they did find a significant correlation between perceived injury severity and PTSD severity at both one and six months post injury (Brasel, deRoon-Cassini, & Bradley, 2010). Furthermore, in two separate studies of MVA survivors, participants in the symptom groups had less severe injuries than those who did not develop posttraumatic psychological symptoms (Delahanty et al. 2003; Dougall et al., 2001). Findings are consistent that objective injury severity is not predictive of PTSD; stronger evidence has been found for perceived injury severity which may be closely associated with perceived threat to life.

**Perceived life threat.** In the Holbrook et al. (2001) study using the TRP dataset, they found that at 6 months post injury, having believed one's life was in danger was predictive of PTSD in their model ( $OR = 1.6$ ,  $95\% CI = 1.2, 2.2$ ,  $p < .01$ ). In a study of MVA survivors, those who believed that their lives were in danger (7 point Likert scale) to a greater degree, were more likely to develop PTSD ( $F = 4.6$ ,  $p < .05$ ) despite having scored significantly lower on average on a quantitative measure of injury severity ( $F = 7.6$ ,  $p < .01$ ) (Delahanty et al., 2003). In a study of participants who had been exposed to a terrorist attack ( $n = 180$ ) in Isreal, those with PTSD reported higher overall scores on a measure of perceived physical or emotional threat (Likert scale 0-10) ( $t = 2.6$ ,  $p < .001$ ) in hierarchical logistic regression (Gil & Caspi, 2006) using the



SCID. In their meta-analysis, Ozer et al. (2008) found that perceived life threat had a small-to-medium effect ( $r = .26$ ) on PTSD and that this increased to a medium effect in survivors of interpersonal violence (weighted  $r = .31$ ).

**Intentional injury.** The nature of PTEs have been consistently associated with the development of PTSD (Breslau et al., 1998; Holbrook et al., 2001; Michael et al. 1999; Wohlfarth, Winkel, & van den Brink, 2002). Utilizing data from the National Study on the costs and Outcomes of Trauma (NSCOT) ( $n = 2931$ ) and the PCL-C, Zatzick et al. (2007) found that intentional injury was predictive of PTSD among injured trauma survivors ( $RR = 1.32$ , 95% CI 1.04,1.67) in poisson regression, a type of regression that takes into account the effect of count data (Cohen, Cohen, West, & Aiken, 2003). In the study by deRoos-Cassini et al. (2010), 25.4% of their sample suffered injury as the result of human intention. These researchers were interested in seeing how certain risk factors covary with different symptom trajectories (i.e. low symptom, recovery, delayed, and chronic) and found that human intention was strongly associated with the groups exhibiting consistent and chronic PTSD ( $OR = 5.65$ ,  $p < .001$ ), and depression symptoms ( $OR = 6.42$ ,  $p < .05$ ) on the PDS ( $\alpha = .87-.91$ ) and the Center for Epidemiologic Studies Depression Scale (CESD-R) ( $\alpha = .92-.94$ ) in logistic regression analyses.

**Peritraumatic emotional response.** An overall effect size of peritraumatic emotion of .26 was reported in a meta-analysis of five studies with community samples (Ozer et al., 2008). The emotions examined in the studies used in this meta-analysis “included fear, helplessness, horror, guilt, and shame” (Ozer et al., 2008, p .20). Utilizing the DSM-IV criterion A2, crime victims ( $n = 138$ ) were asked about their levels of peritraumatic fear, helplessness and horror, as well as, anger and shame (Brewin, Andrews, & Rose, 2000). Using the PTSD Symptom Scale (PSS) these researchers found that all of the emotion variables were significantly predictive of

PTSD at six months using logistic regression ( $\chi^2(2, N = 138) = 13.81, p < .001$ ). In another study of assault survivors treated in a metropolitan emergency department peritraumatic emotionality was significant as well (OR = 2.43,  $p < .001$ , CI 95% = 1.32, 4.50) (Kleim et al., 2007).

**Peritraumatic dissociation.** In the meta-analysis by Ozer et al. (2008) a medium effect was found for dissociation in medical ( $r = .33$ ) and community samples ( $r = .35$ ). In the prospective study of MVA survivors conducted by Ehlers et al. (1998) dissociation was assessed by taking the average of responses to two questions scored on a Likert scale. They found that their dissociation score correlated with both the severity and diagnosis of PTSD at both three months and one year. This finding was replicated in the study of MVA survivors conducted by Michaels et al. (1999b), using the five item Michigan Critical Events Perception Scale (MCEPS) it was found that the patients that developed PTSD were more likely to have experienced a peritraumatic dissociation ( $p = .002$ ), this finding was robust to cross-validation as well. In a study of injured trauma survivors conducted by Shalev, Peri, Canetti and Schreiber (1996) they administered the Peritraumatic Dissociative Experiences Questionnaire (PDEQ) ( $\alpha = .79$ ) to injured patients ( $n = 51$ ) admitted to a general hospital. Utilizing logistic regression they found that peritraumatic dissociation accounted for 29.4% of the variance of participants' scores on a civilian version of the Mississippi Scale for Combat-Related Posttraumatic Stress disorder.

### **Posttrauma Risk Factors**

**Memory of traumatic event.** Most of the research involving memory of the traumatic event is conducted on those who experience a traumatic brain injury (TBI). In a study conducted in Israel utilizing patients that had suffered a mild traumatic brain injury (mTBI) ( $n = 120$ ) a relationship between memory of the event and PTSD was demonstrated via logistic regression

analyses, among others. Memory was assessed with a nine item scale created for the study that demonstrated strong internal consistency ( $\alpha = .91$ ) and PTSD was assessed with the PSS.

Participants were recruited from those admitted to the surgical ward of a medical center, and it was found that those with a good memory within twenty four hours of the event were approximately twice as likely to develop PTSD at six month follow-up (OR = 2.2, CI = 1.0, 10.1) (Gil, Caspi, Ben-Ari, Koren, & Klein, 2005). A review of the literature found that the majority of those who lack memory of the PTE seem protected from the development of PTSD but that it remains to be proven that this can be generalized beyond those with a TBI (Klein, Caspi, & Gil, 2003).

**Posttraumatic cognitions and emotions.** In a study of assault survivors treated in a metropolitan emergency department many cognitive factors were significant in univariate analyses, and in an overall logistic regression mental defeat (OR = 2.07,  $p = .014$ , 95% CI = 1.16, 3.70) and rumination (OR = 2.99,  $p = .002$ , 95% CI = 1.50, 5.96) remained significant (Kleim et al., 2007). Mental defeat was measured by the Mental Defeat Scale ( $\alpha = .90$ ) and rumination by the Response to Intrusions Questionnaire ( $\alpha = .84$ ) and both were assessed at two weeks after the event. In a study of MVA survivors researchers measured trait worry (rumination) and initial anger while participants were still hospitalized (Ehlers et al., 1998). Using single questions scored on a Likert scale, the researchers found that when they entered only variables collected at initial assessment, initial anger ( $\beta = .16$ ) was associated with PTSD at three months. DeRoos-Cassini et al. (2010) found that anger was associated with an increased likelihood of depression in the chronic (OR = 1.22, 95% CI = 1.04, 1.42) and delayed (OR = 1.16, 95% CI = 1.03, 1.32) trajectories, and PTSD in the chronic (OR = 1.10, 95% CI = 1.00, 1.20) and recovery (OR = 1.14, 95% CI = 1.00, 1.35) trajectories.

**Coping.** In a study conducted on MVA survivors ( $n = 115$ ) by Dougall, et al. (2001), a style of coping denoted as wishful thinking was found to be associated with the development of PTSD in logistic regression analyses at both six months ( $Wald = 5.18, p < .05$ ) and twelve months ( $Wald = 3.98, p < .05$ ). They utilized the SCID and the Ways of Coping Inventory which includes problem-focused coping, wishful thinking, and self-blame among others. No other cognitive coping strategies were found to be significant. deRoos-Cassini et al. (2010) found that there may be an ideal level of coping self-efficacy, neither too high or low, that is protective. Although difficult to assess, Richmond et al. (2011) examined this via an item intended to measure maladaptive coping by asking “have you been staying away from people, even people you are usually close to?” It was retained as a predictor of depression and is an example of a question that might not make sense to ask a patient who is admitted to a hospital in the acute aftermath of a trauma.

**Severity of early symptoms of acute stress, PTSD, anxiety and depression.** There has been consistent evidence in studies of MVA survivors demonstrating the association between symptoms of acute stress and the development of PTSD (Blanchard et al., 1996; Koren, Arnon, & Klein, 1999). In the Holbrook et al. (2001) study utilizing the TRP data, scores on the IES greater than 30 were associated with increased rates of PTSD (adjusted OR = 2.9, 95% CI = 2.1, 4.1). In the Zatzick et al. (2002) study of survivors of assault and MVA they found that PTSD symptom levels during hospitalization were a significant predictor of later PTSD development ( $t = 6.19, p < .0001$ ). A study of male patients ( $n = 96$ ) utilizing the Hospital Anxiety and Depression Scale (HADS) ( $\alpha =$  from .67- .90 across samples in a recent literature review; Bjelland, Dahl, Haug, & Neckelmann, 2002) found that anxiety while in the hospital was associated with increased PTSD symptoms at 6 months ( $\beta = .27$ ) and that depression was

associated with increased PTSD symptoms at 18 months ( $\beta = .23$ ) in multivariate regression (Mason, Turpin, Woods, Wardrobe, & Rowlands, 2006).

**Pain severity.** Another construct that has support in the literature that may not be feasible to assess and/or integrate into a screen is pain. In two studies pain was found to be associated with PTSD; however, it was assessed at ten days post injury in one study and three months in another (Glynn et al., 2007; Zatzick et al., 2007). The primary difficulty with assessing pain severity in this study is that since data were collected within several days of the accident, and since all admissions had been injured, this could artificially increase the score of those whose pain that will diminish over time. Additionally, current and ongoing pain was not retained in the Richmond et al. (2011) study.

**Lack of social support.** In the study examining patients with facial injuries, those who reported having unmet social needs ( $\beta = .345$ ,  $p < .01$ ) and no emotional support ( $\beta = -.143$ ,  $p < .05$ ) at ten days post injury had higher levels of PTSD symptoms at 12 month follow-up (Glynn et al., 2007). Lack of perceived social support was also found to be significant in a study of assault survivors treated in a metropolitan emergency department ( $OR = .64$ ,  $p < .05$ ,  $95\% CI = .42, 3.16$ ) (Kleim et al., 2007). This finding is consistent in the literature and studies of severely injured trauma survivors, and MVA survivors have produced similar findings (Fuglsang, Moergeli, & Schnyder, 2004; Mellman, David, Bustamante, Fins, & Esposito, 2001). In meta-analyses of community samples, lack of social support was found to have a medium effect ( $r = .30$ ) (Brewin et al., 2000) and small-to-medium inverse effect ( $r = -.28$ ) on the development of PTSD (Ozer et al., 2008).

**Life stress/resource loss following injury.** Life stress as a general construct has also been supported in the research literature. In a meta-analysis of three civilian studies, life stress

was found to have a medium effect ( $r = .36$ ) on the development of PTSD (Brewin et al., 2000). In the injured trauma survivor population, Zatzick et al. (2007) found that whites with no insurance were twice as likely to be diagnosed with PTSD at twelve months after injury and in the Glynn et al. (2007) study of facial injury survivors, they found that “unmet current social service need” ( $\beta = .276, p < .03$ ) was a significant predictor of PTSD in their model.

### **Summary Review**

In general, sociodemographic pretrauma variables tend not to hold up in more rigorous statistical and theoretical designs that include more robust variables. In brief the variables for each category that appear to have consistent empirical support in the literature are: (1) Psychosocial pretrauma variables: previous trauma, pre-existing psychopathology, certain personality traits (i.e., neuroticism, introversion), life stress prior to injury, and substance abuse; (2) Peritraumatic variables: perceived life threat, intentional injury, peritraumatic emotionality, and peritraumatic dissociation (3) Posttraumatic variables: memory of the event, posttraumatic cognition (i.e., trait worry) and emotion (i.e., initial anger), symptoms of ASD, PTSD, depression and anxiety, poor social support, and posttraumatic life stress.

Risk factors that were assessed and not retained in the Richmond et al. (2011) screen were prior trauma, trauma severity, acute physiological arousal, acute depression symptoms, other acute responses (i.e., angry, feel alone), negative beliefs about the future, and current ongoing pain. Risk factors that were assessed and retained for the depression portion of the screen were history of depression, maladaptive coping, resource loss, and acute stress symptoms. Risk factors that were assessed and retained for the PTSD portion of the screen were subjective response (peritraumatic emotion), peritraumatic dissociation, acute stress symptoms, and lack of perceived social support. Risk factors that were not assessed were personality traits, life stress

prior to the PTE, substance abuse, intentional injury, and previous psychopathology (including anxiety) other than depression.

### **The Present Study**

The present study sought to address the need for an empirically evidenced predictive screening tool for the hospitalized injured trauma survivor population. This was achieved by creating a uniquely derived set of items based on this literature review. Simultaneously, participants were administered the Richmond et al. measure which was created for and normed on an emergency department sample in the U.S. (Richmond et al., 2011).

### **Hypotheses**

(H1) It is hypothesized that a subset of unique items created for the production of the Injured Trauma Survivor Screen (ITSS) will account for a larger percentage of variance than the Richmond et al. measure in a sample of acutely injured single-incident trauma survivors admitted to the hospital for their injuries.

(H2) It is hypothesized that the ITSS will more accurately predict the incidence of PTSD in the sample than the Richmond et al. measure at one month follow-up as evidenced by higher sensitivity, specificity, negative predictive value, and positive predictive value.

## **Chapter 3**

### **Methods**

This chapter is comprised of seven subsections (a) Participants, (b) Creation of Screen Items for the Injured Trauma Survivor Screen (ITSS), (c) Procedures, (d) Funding and collaboration, (e) Measures, (f) Description of Variables and Research Design, (g) Statistical Analyses. Figure 2 at the end of this chapter presents a flow chart for the study (p. 62).

#### **Participants**

This sample consisted of adult injured trauma survivors admitted to the trauma service. Potential participants were identified using the trauma census, a real time list of all trauma patients admitted to the trauma service. Any individual admitted for traumatic injury was considered for inclusion in the study. Exclusion criteria were as follows: 1) younger than 18 years of age, 2) if the participant experienced a head injury that resulted in a serious alteration of consciousness (Glasgow Coma Scale score <13 on emergency department arrival) or moderate to severe TBI, 3) individuals admitted for self-inflicted injuries, and 3) injuries that resulted in an inability to communicate.

Sample size for participants who completed the original questionnaire while inpatient, as well as the one month follow-up interview conducted on the phone, was 103. The dropout rate was 44.3% with 185 participants consenting to the study, 6 of whom formally withdrew. The average age was 41.59 with a standard deviation of 17.44. The sample was 26% female ( $n = 27$ ), 45.63% White/Caucasian ( $n = 47$ ), 40.78% Black/African American ( $n = 42$ ), 11.65% Latino/Hispanic ( $n = 12$ ), and 1.94% American Indian ( $n = 2$ ). Average education level was 13.14 (12 = high school graduate).



Proportionally, mechanism of injury rates were similar to what is seen in the overall population with the exception of falls and were as follows: 27.2% motor vehicle crash ( $n = 28$ ); 18.4% motorcycle crash ( $n = 19$ ); 17.5% gunshot wound ( $n = 18$ ); 9.7% falls ( $n = 10$ ); 8.7% stabbings ( $n = 9$ ); 7.8% pedestrians hit by motor vehicles ( $n = 8$ ); 5.8% recreational accidents ( $n = 6$ ); 2.9% other ( $n = 3$ ); and 1.9% industrial accidents ( $n=2$ ). Of the original 185 participants that consented to the study 82 did not participate in the one month follow-up and 6 of these participants formally withdrew from the study. Results indicated no significant differences among completers and non-completers based on sex,  $X^2(1) = .164, p = .685$ , age ( $U = 3351.0, p = .100$ ), race and/or ethnicity,  $LR(5) = 10.899, p = 0.053$ , and mechanism of injury  $LR(9) = 12.541, p = .184$ .

Average time from injury to the first data collection time point (while the participant was on the inpatient trauma/critical care service) was 2.5 days. Average time from injury to the second data collection period in which they were evaluated for PTSD was 40 days (1 month needed for diagnosis). The rate of PTSD was 27.2% ( $n = 28$ ) and fell towards the middle of the 10-42% range found during the literature review for this study (Blanchard, Hickling, Taylor, & Loos, 1996; Holbrook, Anderson, Sieber, Browner, & Hoyt, 1999; Michaels et al., 1999a; Ursano et al., 1999; Zatzick et al., 2002; Zatzick et al., 2007).

Of those with PTSD 9 were female; 19 were male; 21 self-identified as Black or African Americans; 3 as Latino or Hispanic; 3 as White or Caucasian; 1 as American Indian; and none were Veterans ( $n = 6$ ). The group with the highest rate of PTSD was Black or African American males ( $n = 15$ ) followed by Black or African American females ( $n = 6$ ). Within the PTSD group, 3 had experienced another traumatic event since their injury and only 6 were receiving some type

of mental health intervention (i.e., medication or psychotherapy). Table 1 presented here displays a breakdown of diagnosis by injury type.

Table 1

<i>Injury type by PTSD diagnosis at one month follow-up</i>		
Injury Type	PTSD criteria met?	
	No	Yes
GSW	8	10
MVC	19	9
Stabbing	5	4
MCC	16	3
Pedestrian	6	2
Fall	10	0
Industrial Accident	2	0
Recreational	6	0
Other	3	0
Total	75	28

### **Creation of Screen Items for the Injured Trauma Survivor Screen (ITSS)**

**Step 1.** Scale development began with the creation of an item pool of questions based on current and critical research describing risk factors for the development of psychological distress following trauma. The item pool was created based on the factors identified as risk factors for the development of PTSD in the literature review. This review yielded the following risk factors: (1) Psychosocial pretrauma variables: previous trauma, pre-existing psychopathology, personality traits (i.e., neuroticism, introversion), life stress prior to injury, and substance abuse; (2) Peritraumatic variables: perceived life threat, intentional injury, peritraumatic emotionality, and peritraumatic dissociation (3) Posttraumatic variables: memory of the event, posttraumatic cognition (i.e., trait worry) and emotion (i.e., initial anger, depression), symptoms of ASD, PTSD, depression and anxiety, poor social support, and posttraumatic life stress.

In designing the items a binary response option was selected due to the nature of bedside hospital evaluation following a traumatic injury. Bedside assessment can be confusing for the patient who is often sedated and simultaneously bombarded with health care professionals including, doctors, nurses, physical therapists, phlebotomists, social workers, and so on. The administration of Likert scale, semantic differential or other graded scales can be time consuming and confusing to patients. Additionally, while the risk factors are put into temporal categories they are otherwise unrelated and not a measure of a common underlying theoretical construct. The original item pool contained 48 original items. Experts in the area of scale development have stated that with initial item pool development, a large pool is desirable (DeVellis, 2012).

**Step 2.** This item pool was evaluated by experts to reduce redundancy and ambiguity while ensuring relevance, accuracy and parsimony (DeVellis, 2012). Expert reviewers were: 1) Douglas Zatzick, M.D., Trauma Psychiatrist and Traumatic Injury Researcher at University of Washington and Harborview Medical Center Level 1 Trauma Center; 2) Ann Marie Warren, Ph.D., Trauma Psychologist for the Baylor University Medical Center, Level 1 Trauma Center, 3) Karen Brasel, M.D., Trauma Surgeon for the Medical College of Wisconsin, Level 1 Trauma Center, and; 4) Terri deRoos-Cassini, Ph.D., Trauma Psychologist for the Medical College of Wisconsin, Level 1 Trauma Center.

Each reviewer received an email with detailed instructions, a copy of the item pool and a copy of the Richmond et al. measure. A Likert scale was used to assess each item on the measure to ensure that differences and variability were accounted for. They assessed each item on a scale from 1 to 5 (1 = not clear or appropriate; 5 = very clear or appropriate), and provided additional edits and suggestions (Heppner, Wampold & Kivlighan, 2008). Any item averaging

less than three on the Likert scale was removed. Feedback and edits from these reviewers included changes to wording and rearranging of items for simplicity and clarity. This left 39 original items that were reassessed and altered if the item score was close to three or if other suggestions were made by reviewers. Two of these items (7 and 18, appendix B) were reverse scored in order to be able to ask the question in the affirmative. Answering yes was then scored as a 0 as opposed to 1 in order to maintain dummy coding consistency in statistical analysis and to potentially reduce agreement bias (DeVellis, 2012).

**Step 3.** This prototype was given to a small pilot group of 15 participants who were asked to provide feedback regarding clarity and wording (Heppner et al., 2008). This subgroup reported no problems with clarity or understanding for any of the items.

## **Procedures**

Following approval from the Institutional Review Board (IRB) at the primary data collection site, data were collected at two Level 1 trauma centers in metropolitan settings. The collaboration was overseen by the two institutions IRB panels. All materials were identical and reimbursement was provided at both institutions to ensure that all aspects and procedures of the protocol were congruent. At the primary recruitment site approximately 3,000 patients pass through the emergency services. Approximately 2,000 patients on average were admitted to the hospital between 2009 and 2014 with an average length of stay of four days (Adult Level 1 Annual Trauma Center Report, 2014). Of the admitted patients in 2013, 1,408 were male, 749 were female, 1,407 identified as White, 572 identified as Black, 119 identified as Hispanic, 11 identified as Asian, 11 identified as American Indian, 2 identified as Native Hawaiian and 35 identified as other. The various mechanisms of injury were primarily gunshot wounds, stab wounds, MVA, industrial accidents, home accidents, and falls.

If a potential participant qualified for recruitment, a trained psychology graduate or undergraduate research associate approached the individual, explained the purpose and process of the study, and conducted the process of informed consent. If the individual agreed to participate, the participant was enrolled in the study. Once enrolled in the study during hospitalization, the participant was asked their age, sex, race and/or ethnicity, highest level of education, occupation, and Veteran status (Appendix C). The mechanism of injury obtained from the trauma registry was reviewed and confirmed with the participant. The participant was then administered the ITSS item pool along with the items from the Richmond et al. measure. At one month, follow-up was conducted with 103 of the participants. At this time participants were administered the CAPS-5 and the PCL-5.

### **Funding and Collaboration**

This study was embedded in a larger study that received funding from an early career faculty grant procured by a committee member of this dissertation and the principal investigator. The funding was used to hire a research assistant to work part time on the project as well as to provide a 15 dollar gift card to participants who participated in initial data collection, the one month follow-up in this study, and the six month follow-up conducted in the larger study. Additionally, participants were recruited from a second site, a Southwestern level 1 trauma center. Of the total sample enrolled at the second site ( $n = 19$ ) 15 completed the study.

### **Measures**

**Predictive screening tool for depression and PTSD after injury (Richmond et al. measure).** This measure is referred to in this study as the Richmond et al. measure. This measure was created for and normed on a U.S. sample in an urban emergency department (ED) demographically similar to the expected sample in this study (Male = 52%, Female = 48%;

Black =55%, White = 34%, Asian = 3%, and Hispanic = 3%) (Richmond et al., 2011). It consists of eight questions and utilizes a yes/no item response format developed to measure risk for PTSD and depression concurrently (Appendices B & C). All-subsets multiple logistic regression analyses were performed to establish the strongest items to predict depression and PTSD. ROC curve analysis was used to determine the optimal cut point offering the best balance for sensitivity (PTSD = 1.00) and specificity (.66). The positive predictive value for PTSD was .07 and negative predictive value was 1.00.

**PTSD Checklist-5.** The PTSD checklist 5 (PCL-5) was released for use in 2013. It consists of 20 items worded to avoid any linkage to a specific traumatic event and it takes 5-10 minutes to administer. Participants are instructed to answer the items based on their experience of the symptoms in the last month. Each item corresponds to a symptom in the *DSM-5* (figure 1); the first five items correspond to the re-experiencing/intrusive symptom cluster (items 1–5); the next three to the avoidance/numbing cluster (items 7-9); the next six to the negative alterations in cognition and mood cluster (items 9-14); and the final six to the increased arousal cluster (items 15-20) . Items are scored on a Likert scale from 0-4 and scores on the measure can range from 0-80. Given how new the PCL5 is, psychometric properties for the previous version of the measure are presented here.

The previous version of this questionnaire, the PCL – Civilian (PCL-C) version consists of 17 items. On this measure each item corresponds to a symptom in the *DSM-IV-TR*; the first five items correspond to the re-experiencing cluster, the next seven to the avoidance/numbing cluster, and the final five to the increased arousal cluster. Items are scored on a Likert scale from 1-5 and scores on the measure can range from 17-85. The cut point is dependent on the population and use of the measure. Consistent and strong reliability and validity of the PCL-C

have been demonstrated in many trauma-exposed populations (McDonald & Calhoun, 2010; Norris & Hamblen, 2004; Orsillo, 2001; Wilkins, Lang, & Norman, 2011).

With regard to reliability and validity among non-clinical civilian samples the PCL-C has demonstrated strong internal consistency ( $\alpha = .94$ ); good retest reliability ( $r = .66$  to  $.68$  at two weeks); and good convergent and divergent validity across many measures (Conybeare, Behar, Solomon, Newman, & Borkovec, 2012; Ruggiero, Del Ben, Scotti, & Rabalais, 2003). In a study of motor vehicle accident survivors and sexual assault survivors, using the recommended cutoff score of 50, sensitivity was .778 and specificity was .864 (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). These researchers recommended a cutoff score of 44 as this improved their sensitivity to .944 and specificity to .864. Their internal consistency for the whole measure was .939 and the overall correlation with the Clinician Administered PTSD Scale was .929.

**Clinician Administered PTSD Scale-5.** The CAPS-5 is a clinician-administered structured diagnostic interview originally created by Blake and colleagues (Blake et al., 1990; Blake et al., 1995). The administration of this test takes between 45 minutes to one hour. In the previous version, in order to establish that criterion A of the DSM diagnosis is met, up to three potentially traumatizing events are chosen via the empirically validated life events checklist (Gray, Litz, Hsu, & Lombardo, 2004) and the subsequent questions regarding the symptoms clusters are answered regarding these events (Orsillo, 2001). In the CAPS-5 participants identify a single index trauma on which to base their answers. There is a corresponding test item for each PTSD criterion and follow up questions regarding frequency and intensity. Further questions assess the onset, duration, and level of distress and impairment caused by the symptoms.

Scoring can produce dimensional (symptom severity) or categorical (yes/no) results (Weathers, Ruscio, & Keane, 1999).

In a review conducted by Weathers, Keane, and Davidson (2001) of 29 studies using the previous version of the CAPS, including 15 with at least partial civilian samples, the authors conclude that there is “considerable validity evidence that supports the use of the CAPS as a measure of PTSD diagnostic status and symptom severity” (p. 153). The CAPS has been studied primarily in veteran samples and in one large study ( $n = 838$ ) the CAPS yielded intraclass correlations for the symptom clusters from .86 - .87 for frequency (total frequency = .93,  $\alpha = .93$ ), .86 - .92 for intensity (total intensity = .95,  $\alpha = .94$ ), and .88 - .91 for severity (total severity = .95,  $\alpha = .94$ ) (Weathers et al., 1999). In a study of survivors of MVA Blanchard et al. (1995) found evidence for interrater reliability ranging from .82 - .99 with a kappa of .81 for PTSD diagnosis.

### **Description of Variables and Research Design**

The independent variables were participant responses to a set of 47 binary yes/no questions based on the risk factors presented in the literature review. These questions were developed based on risk factor data for acutely injured single-incident trauma survivors where the data were available. In some cases data from studies examining Veteran populations were used to extrapolate or bolster risk factor areas not well explored within the target population. Eight of the 47 questions came from a previous study examining a similar population of adults who were screened in an emergency department. The data were collected while participants were admitted to the trauma and critical care service at two level 1 trauma centers in metropolitan settings.



The design for the study was multivariate as it involved the analysis of 47 possible predictor variables on the dichotomous outcome variable of PTSD diagnosis. Data were collected prospectively as the possible participants were approached once hospitalized for injury and follow-up was conducted at one month. This type of data collection falls into the category of a descriptive field study which typically has high external validity due to the variables being collected directly from the target population; however, these designs often have low internal validity due to a lack of manipulation of the independent variables and the non-random design (Heppner, Wampold, & Kivlighan, 2008). Also, while binary data are categorical (coded as 0's and 1's) they exist on a nominal scale. Nominal data is the most basic level of data collection and it does not allow for orders of magnitude to be considered. As such it does not allow for researchers to examine cause and effect; therefore, no such conclusions can be drawn from this study. The dependent variable for this study was binary and was whether or not a participant met criteria for a PTSD diagnosis during follow-up interview at one month post injury. During this follow-up participants were given two psychometrically valid and reliable diagnostic tools; (1) the clinician administered PTSD scale 5 (CAPS), a diagnostic interview; and (2) the PTSD checklist 5 (PCL5), a self-report measure with a Likert scale.

### **Statistical Analyses**

**Comparison of the ITSS and Richmond et al. measure.** Since there was a single categorical dependent variable, logistic regression was used to compare the two measures on the dichotomous PTSD variable and to assess H1, which was assessed using Minitab®17 statistical software. Logistic regression analysis is used when one has multiple independent variables presented concurrently to predict one of two outcomes in a dependent variable (Azen & Walker, 2011). Logistic regression provides data related to probabilities (odds ratios) and the strength of

relationships between the IVs and DV. It is different from linear regression in that studies using dichotomous dependent variables have “non-normal error terms”, the “homoscedasticity of variance assumption is violated”, and “the relationship between the predictors and dependent variable is an ‘S’ shaped nonlinear function” (Sapp, 2006, p. 203).

***Assumptions of Logistic Regression.*** Regression analysis involves fitting data to a model with the objective of predicting values of the outcome variable based on the independent variables. In simple linear regression data are fit to a line mathematically via the method of least squares, known as ordinary least squares regression (Cohen, Cohen, West, & Aiken, 2003). This is achieved by calculating the deviation of each data point from a line (residuals) and the method of least squares essentially finds the line that minimizes the sum of squared error, finding the best fit for the data (Azen & Walker, 2011). Multiple regression builds on simple regression by utilizing this principle in research designs with multiple dependent and/or independent variables. In this study both the independent and dependent variables are bivariate, meaning they can only have one of two outcomes which require that the data be analyzed via logistic regression.

There are several unique differences that arise in logistic regression due to the nature of bivariate data analysis. The various types of linear regression utilize assumptions that enhance their mathematical utility (Cohen, Cohen, West, & Aiken, 2003) and logistic regression is often described in terms of its violation of these since it is based on many of the principles that underlie linear regression. These include that logistic regression violates the assumption of homoscedasticity of variance, that the error terms are nonnormal, and that there are constraints on the response function (Sapp, 2006; Stevens, 2009). These problems arise because the relationship between the independent and dependent variables are nonlinear and the values in the regression equation depend on the predicted value of the dependent variable (Cohen, Cohen,

West, & Aiken, 2003). These problems are addressed under a general statistical model known as a generalized linear model which compensates for the fact that the data are not normally distributed (Cohen, Cohen, West, & Aiken, 2003).

In order to address this nonlinearity and the associated violations of assumptions in linear regression, the logistic regression equation is modified to reflect the fact that the “the conditional mean of the regression equation be bounded between zero and one...”, and “the binomial, not the normal distribution describes the distribution of the errors” (Hosmer, Lemeshow & Sturtevant, 2013, p. 8). Additionally, unlike linear regression which uses the method of least squares, the coefficients of the logistic regression equation are derived using maximum likelihood estimation (Hosmer, Lemeshow & Sturtevant, 2013; Stevens, 2009). Maximum likelihood estimation is a procedure for obtaining the parameters of a model that are derived from a dataset, which is theoretically based on the likelihood that the data are representative of the population (Azen & Walker, 2011).

While the value of the dependent variables are predicted based on a given value of the independent variable in linear regression, logistic regression predicts *probabilities* of the outcome occurring given the value of the independent variable. The binomial distribution or probability distribution used in logistic regression is utilized because it allows for the probability for each participant to be calculated against the whole sample (Azen & Walker, 2011). In order to do this the probability ( $\beta$ ) of X is determined via the maximum likelihood estimate (Azen & Walker, 2011). The log odds transformation (or link function) is then used to allow the data to be modeled based on the expected values; Azen and Walker (2011) provide the following equation:

$$\text{logit}(\pi) = \ln\left(\frac{\pi}{1 - \pi}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p$$

Where  $\ln$  equals the natural logarithm,  $\pi$  equals the probability of the event (PTSD diagnosis),  $\alpha$  equals the intercept parameter, and  $\beta_p X_p$  represent the coefficients associated with each predictor (response to ITSS items). Therefore, the assumptions of logistic regression include that the data have a binary dependent variable, that the variable be dummy coded with 1 representing the occurrence of the event of interest, that the data be correctly fitted, that the observations are independent, and that the sample be large enough to yield valid results.

**Entry Method.** Stepwise entry was used in this study for several reasons including: (1) this study was primarily exploratory in nature; (2) the relationships between the outcome variable and predictors is not well established; and (3) in these cases in which many predictors are being tested for their association with the outcome, stepwise entry is a suitable and parsimonious option (Hosmer, Lemeshow & Sturtevant, 2013). Stepwise entry is an entry method for variables in which dependent variables are selected based entirely on statistical criteria and it involves retention of items with the highest semipartial correlation with the outcome variable, and subsequent removal of those items with the lowest (Hosmer, Lemeshow & Sturtevant, 2013; Sapp, 2006).

The primary limitation of stepwise entry is that the items included in the model are not derived by theory but by statistical software; however, this procedure does allow for the statistical investigation of an assortment of possible models that may not have been examined otherwise (Hosmer, Lemeshow & Sturtevant, 2013; Sapp, 2006). Hosmer, Lemeshow, and Sturtevant (2013) suggest that univariate analysis should be carried out first to allow researchers to decrease the impact of statistical software packages on retention of potentially important predictors. However, these authors stipulate that in cases in which the relationships between the outcome variable and predictors is less well established, and thus many predictors are being

tested for their association with the outcome, stepwise entry is an appropriate and effective option.

Given the exploratory nature of this study and the relationship between the many risk factors presented and PTSD, the stepwise method was selected to provide the most parsimonious model. This can in turn lead to overfitting of the data; that is, even if item retention and exclusion is based on sound statistical criteria ( $p < .05$ ) the findings may not hold up in a new sample or in cross validation. Sapp (2006) recommends simple cross validation of the data as a way to test for this problem in any given dataset. He adds that cross validation is not likely in many regression designs and particularly in studies with a large number of predictors and smaller sample sizes.

### **Predictive Accuracy of the Measures in the Sample**

H2 was assessed via Receiver Operating Characteristics (ROC) curve analysis using MedCalc® statistical software. ROC curve analysis was conducted to determine the cutoff point for the measure that provides the highest sensitivity and specificity:

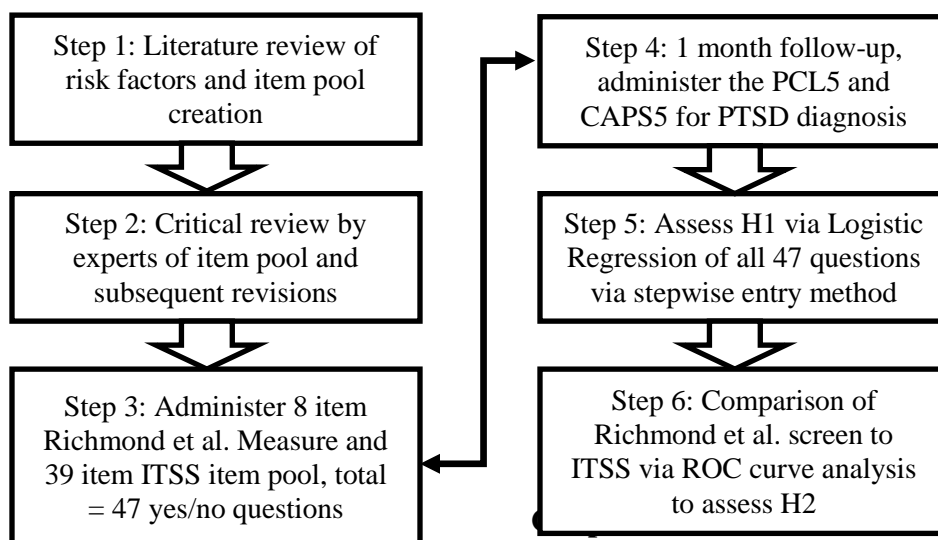
This curve, originating from signal detection theory, shows how the receiver detects the existence of signal in the presence of noise. It plots the probability of detecting true signal (sensitivity) and false signal (1–specificity) for an entire range of possible cutpoints. This measure has now become the standard for evaluating a fitted model's ability to assign, in general, higher probabilities of the outcome to the subgroup who develop the outcome ( $y = 1$ ) than it does to the subgroup who do not develop the outcome ( $y = 0$ ) (Hosmer Lemeshow & Sturtevant, 2013, p.173).

The ROC curve analysis is a graph that plots various thresholds of discrimination. As described by Hosmer Lemeshow & Sturtevant (2013) the plot consists of the true positive rate

(TPR, Sensitivity) and the false positive rate (1- specificity) plotted in various threshold settings. The sensitivity (number of true positives/number of positives) is a measure of how likely a test is to detect the presence of a characteristic in someone with that characteristic. The specificity (number of true negatives/number of negatives) is a measure of how likely a test is to detect the absence of a characteristic in someone who does not have that characteristic. The negative predictive value ( $NPV = \text{true negatives} / (\text{true negatives} + \text{false positives})$ ) is the likelihood that a person with a negative test result does not have the characteristic and the positive predictive value ( $PPV = \text{true positives} / (\text{true positives} + \text{false negatives})$ ) is the likelihood that a person with a positive test result has the characteristic.

Figure 2

*Study Flowchart*



## **Chapter 4**

### **Results**

The objective of this study was to create a screen consisting of the best predictors of PTSD among acutely injured survivors of single-incident traumatic events. The hypotheses were created based on a review of research examining the risk factors for the development of PTSD, as well as previous research on screen development for the acutely injured population. This review yielded the following risk factors (predictors): (1) Psychosocial pretrauma variables: previous trauma, pre-existing psychopathology, personality traits (i.e., neuroticism, introversion), life stress prior to injury, and substance abuse; (2) Peritraumatic variables: perceived life threat, intentional injury, peritraumatic emotionality, and peritraumatic dissociation (3) Posttraumatic variables: memory of the event, posttraumatic cognition (i.e., trait worry) and emotion (i.e., initial anger), symptoms of ASD, PTSD, depression and anxiety, poor social support, and posttraumatic life stress. A final list of 39 unique questions was generated via a critical review of the literature and consensus among several experts in the area of PTSD within the acute injury setting. An additional 8 questions from the Richmond et al. screen (Appendix A) were tested as well for a total of 47 items (Appendix B).

#### **Agreement and Reliability**

At the Midwestern site, the CAPS were administered and scored by two trained doctoral level students, and at the Southwestern site by one doctoral student. The Midwestern team along with one of the previously mentioned experts scored 5 assessments independently and achieved 100% accuracy with regard to PTSD diagnosis. Inter-rater reliability was assessed by audio recording a subsample of approximately 10% of CAPS (1 from the Southwestern site  $n = 15$ , and 9 from the Midwestern site  $n = 88$ ) administrations and having those measures scored by a team

member other than the one that conducted the initial interview. Inter-rater agreement was then calculated via a Kappa statistic, which produced a substantial Kappa of 1.00 at the level of diagnosis.

Given that there is little data on the psychometric properties of the CAPS-5 and PCL-5 a test of alternate forms reliability was used as an additional assessment of the reliability for diagnosis in this study. The first step in this process was comparing scores on the PCL-5 with diagnosis on the CAPS-5 via ROC curve analysis. This produced a Youden's  $J$  of 21 on the PCL-5 for PTSD diagnosis. The usefulness of this output is two-fold: (1) it provides a possible cut score for diagnosis of PTSD using the PCL-5 among the injured trauma population; and (2) this allowed for the calculation of Kappa at the level of diagnosis between these two measures which was found to be good, or moderate, for this sample at .76.

### **Hypothesis Testing**

**Hypothesis One.** Based on the review of the literature it was hypothesized that a subset of unique items created for the production of the Injured Trauma Survivor Screen (ITSS) would account for a larger percentage of variance than the Richmond et al. measure in a sample of acutely injured single-incident trauma survivors admitted to the hospital for their injuries. A stepwise logistic regression was used to explore the relationship between the 47 dichotomous predictor variables at hospitalization and the dichotomous outcome variable (PTSD/no PTSD) at one month posttrauma.

The stepwise logistic regression of all 47 items resulted in a model (step seven) in which five covariates (Table 2) were retained. These covariates had a statistically significant relationship with a positive PTSD diagnosis at the  $\alpha = .05$  significance level. As anticipated the coefficient estimates ( $\beta$  Coefficients) for the dependent variables have positive values with the



exception of the model constant. This value is negative due to the relationship between the model at its most basic level and the coding of PTSD; that is, the model will predict that all participants belong to the most frequently observed case (i.e., no PTSD).

All of the values fall within their corresponding confidence intervals indicating that one can be fairly certain that the population value of the coefficients lie within the corresponding estimated ranges. The z-statistic is the ratio of the  $\beta$  coefficient to its standard error and is used to determine whether the coefficient is significantly different from zero. The z-statistics and their associated  $p$  values are given for each predictor retained in the model in Table 2, and in this study answering in the affirmative (yes vs. no) to any given number of the five items retained in the model, increased the likelihood of having been diagnosed with PTSD at the one month follow-up.

Table 2

*Results of the Regression Analysis*

	$\beta$ Coefficients	SE	95% CI	Z-statistic	$p$	VIF
Constant	-6.43	1.49	-9.35, -3.51	-4.32	.000	
Item 8	1.989	.829	.363, 3.614	2.40	.016	1.05
Item 9	3.20	1.07	1.10, 5.30	2.99	.003	1.70
Item 28	2.445	.887	.708, 4.183	2.76	.006	1.18
Item 38	2.92	1.04	.88, 4.96	2.80	.005	1.62
Item 40	2.111	.836	.473, 3.749	2.53	.012	1.06

Note: SE = Standard Error, CI = Confidence Interval, VIF = Variance Inflation Factor

**Multicollinearity.** Multicollinearity (independence of observations) was assessed via the variance inflation factor (VIF; Table 2). Values of the VIF greater than 10 are usually taken as an indication that the parameters of the equation may be inflated due to multicollinearity (Kutner, Nachtsheim, & Neter, 2004). Multicollinearity is observed in data sets in which there are large correlations among individual independent variables reducing the interpretability of individual contributions of those variables to the outcome variable (Cohen, Cohen, West, &

Aiken, 2003). In this case none of the values for the VIF approached a value of 10, with the largest value being 1.70. Standard errors with values less than 2 can also be an indicator that there is not a great deal of multicollinearity between the items that were retained in the model (Azen & Walker, 2011; Fields, 2009). None of the standard errors for the predictor terms exceeded a value of 2. The assumption of independence was met as each value for the dependent variable came from a distinct participant.

***Model fit for ITSS items and Richmond et al. measure in the sample.*** Bearing in mind the previously stated differences regarding linear and logistic regression, there are several versions of an analog  $R^2$  statistic for non-linear regression models known as the pseudo- $R^2$ , and used for this study was the deviance  $R^2$ . It is generally recommended that this statistic be used cautiously as an indicator of fit given that the principles that underlie it were originally derived for linear models. Despite this Hosmer, Lemeshow and Sturtevant (2013) suggest that it is useful in cases in which one is comparing model fit within the same data set, adding the caveat that  $R^2$  values in logistic regression tend to be lower than those for linear regression.

Table 3

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*Injured Trauma Survivor Screen (ITSS)*

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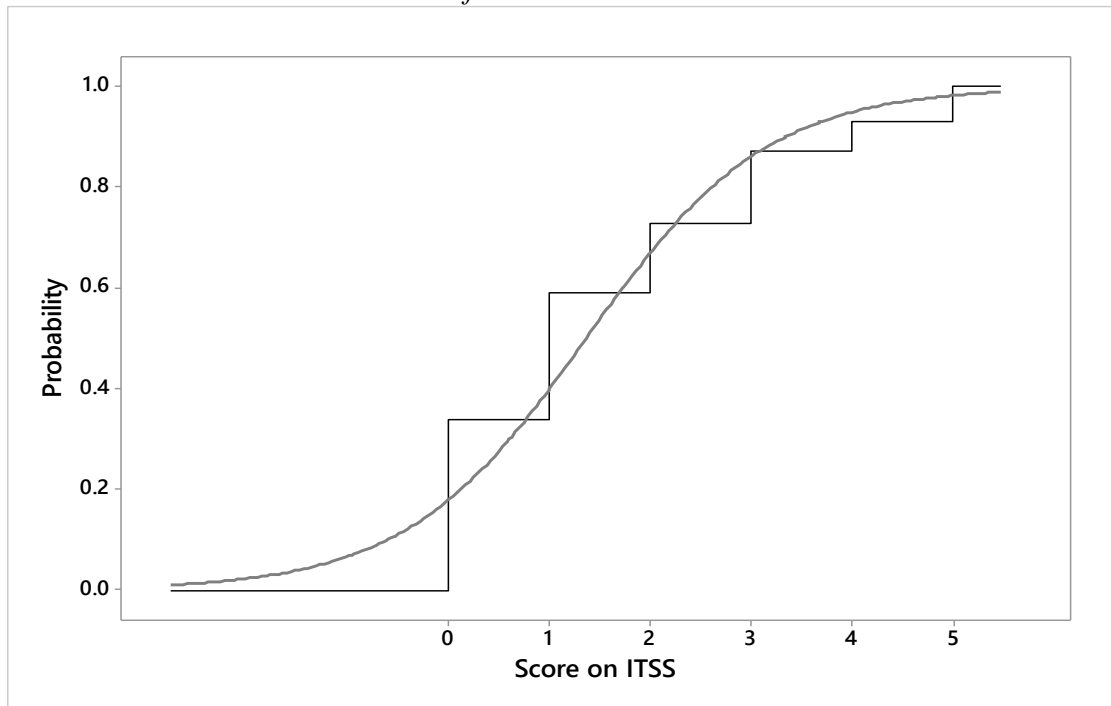
- 8. Has there ever been a time in your life you have been bothered by feeling down or hopeless or lost all interest in things you usually enjoyed for more than 2 weeks?
  - 9. Did you think you were going to die?
  - 28. Do you find yourself crying and are unsure why?
  - 38. Have you found yourself unable to stop worrying?
  - 40. Do you find yourself thinking that the world is unsafe and that people are not to be trusted?
- 

The  $R^2$  of the stepwise logistic regression model from the 5 items that were retained in the current study (ITSS, Table 3) was 66.78 with an adjusted value of 62.63. One item from the Richmond et al. study (Item 8 of the new measure, Table 3) was retained in the new model, the

other four items came from the item pool. Figure 3 is a graphical representation of the probability of a PTSD diagnosis as it related to scores on the retained variables for the model, as well as a demonstration of the sigmodal curve in which the data are fitted to in logistic regression.

Figure 3

*Cumulative Distribution Function of the ITSS*



The  $R^2$  of the 5 items from the Richmond et al. measure retained in their sample to predict PTSD specifically (i.e., the non-depression portion of their screen; Appendix A) was 33.51 with an adjusted value of 29.36 in this sample. Given that one of the items retained in the ITSS was an item associated with depression from the Richmond et al. (2011), an additional analysis was run on all 8 items from the Richmond et al. measure (i.e. both the items associated with PTSD and depression). The  $R^2$  of the full Richmond et al. measure within this sample was 51.54 with an adjusted value of 44.90. The results of these three analyses indicate that the items

retained in the ITSS were a better fit for the data overall via the stepwise regression when compared to either variation of the Richmond et al. measure.

Table 4

<i>Goodness-of-fit tests</i>			
Test	DF	$X^2$	$p$
Deviance	97	40.04	1.00
Pearson	97	39.34	1.00
Hosmer-Lemeshow	8	7.49	0.485

*Note:* DF = Degrees of Freedom

**Goodness-of-fit.** First, the concordance rate was examined which is the rate at which the model accurately predicts the outcome variable. In this sample those who were diagnosed to have PTSD at one month follow-up had a higher predicted odds of being accurately diagnosed at a rate of 96.8%. Goodness-of-fit tests assess how well the logistic regression model fits the data, or how well the outcomes predicted by the model relate to the actual data (Field, 2009). Specific fit statistics were calculated including the Deviance, Pearson chi-square, and Hosmer-Lemeshow tests of fit (Table 4). In all cases a significant  $p$ -value ( $<.05$ ) would indicate a failure to reject the null hypothesis that the binary distribution does not correctly predict the deviation of the predicted probabilities from the observed probabilities. However, given that the sample in this study was small compared to the number of predictors, all of these fit statistics must be interpreted cautiously.

**Odds ratios.** Table 5 presents the odds ratios for the various covariates retained in the model along with the 95% confidence interval for each. The odds ratio is essentially an effect size measure for categorical data and is the alternative to the correlation coefficient used with continuous variables (Azen & Walker, 2011; Field, 2009). Traditionally, in order to produce the odds ratio the probability of both outcome variables (i.e., yes PTSD vs. no PTSD) for each dependent variable (i.e., responses to ITSS items) is calculated. The probability of the event

occurring (yes PTSD) is then divided by the probability of the event not occurring (no PTSD) giving you the odds of the event. Odds ratios are in danger of becoming over inflated when the denominator term (no PTSD) occurs at a low rate (Ferguson, 2009). Given that the majority of this sample was not diagnosed with PTSD this likely did not impact the odds ratios in this study.

In logistic regression the odds ratios are calculated by exponentiating the  $\beta$  coefficients because these coefficients have been transformed by the natural log function (Azen & Walker, 2011). In this case the values for the odds ratio ranged from 7.3049 (CI = 1.4379, 37.1112) for item 8 which questioned participants about premorbid depression to 24.5909 (CI = 3.0150, 200.5661) which asked participants about whether or not they thought they were going to die. In the case of perceived threat to life for example, the odds ratio of a participant within this sample being diagnosed with PTSD if they answered yes to this question is approximately 24 times higher than if they answered no. These ratios should be interpreted cautiously as they may be biased given the small sample size of this study along with the lack of randomization (Ferguson, 2009).

Table 5

*Odds Ratios for Individual ITSS items*

	Odds Ratio	95% CI
Item 8	7.3049	1.4379, 37.1112
Item 9	24.5909	3.0150, 200.5661
Item 28	11.5348	2.0293, 65.5645
Item 38	18.5325	2.4071, 142.6843
Item 40	8.2576	1.6052, 42.4795

*Note:* CI = Confidence Interval

**Cross Validation.** The sample was randomly split into two groups ( $n = 51$ ,  $n = 52$ ) and the same regression analysis was run on each. Given the small sample size and large number of predictors these findings did not hold up in this simple-cross validation due to quasi-complete separation. This is a common problem when fitting too many variables to too few cases since

logistic regression calculates probabilities and essentially the probability curve (example, figure 3) cannot be determined with any certainty. Cross validation efforts illustrate the importance of replication studies when utilizing any form of regression analysis since regression output tends to be effected by chance relationships in individual data sets (Cohen, Cohen, West, & Aiken, 2003).

**Hypothesis Two.** The second hypothesis stated that the ITSS would more accurately predict the incidence of PTSD in the sample at one month than the Richmond et al. measure. This was tested via the Receiver Operating Characteristic (ROC) curve analysis. The ROC curve analysis is a type of fit statistic that plots various thresholds of discrimination allowing for the comparison of multiple tests with regard to their diagnostic accuracy (DeLong, DeLong, & Clarke-Pearson, 1988; Hosmer, Lemeshow, & Sturtevant, 2013). This accuracy is determined by plotting the true positive rate (TPR, Sensitivity) and the false positive rate (FPR, 1- specificity) in various threshold settings (Zweig & Campbell, 1993) on a graph.

Figure 4

*ROC curve analysis*

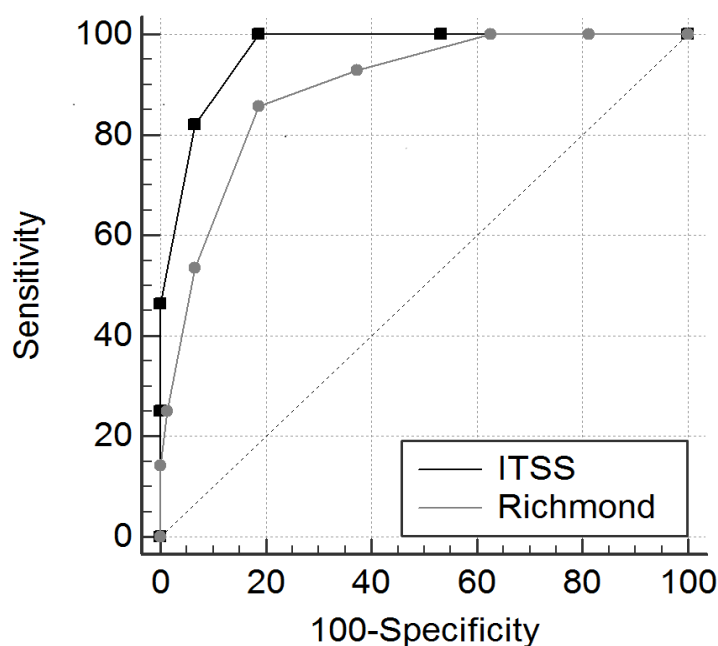


Figure 4 is the ROC curve analysis for the ITSS and the Richmond et al. measure. ROC curve analysis plots probabilities at various thresholds of discrimination. The plot consists of the true positive rate and the false positive rate based on a range of possible cut points (Hosmer, Lemeshow & Sturtevant, 2013). This allows for the calculation of the area under the curve (AUC) which has a range from 0.5 – 1. An AUC of 0.5 would mean that a test was as effective as a coin toss, and a test that reached the theoretical maximum of 1 would essentially be a perfect test. Hosmer, Lemeshow and Sturtevant (2013) recommend a rule of thumb for fit of the AUC where 0.5 is highly indiscriminate, 0.5 - 0.7 is poor, 0.7 – 0.8 is acceptable, 0.8 – 0.9 is excellent, and > 0.9 as outstanding discrimination.

Table 6

<i>Comparison of Area Under the Curve and Cutoff Scores</i>		
	ITSS	Richmond et al.
Area Under the Curve	0.965	0.891
Standard Error	0.0137	0.0323
95% Confidence Interval	0.910, 0.991	0.815, 0.944
z statistic	33.912	12.104
p value	<0.0001	<0.0001

Given that the full Richmond et al. measure performed better in this study than just their items retained to predict PTSD in their sample, ROC curve analysis was carried out on the full eight item version of their measure against the ITSS. With an AUC of .965(table 6) the discrimination for the fitted model using the ITSS predictors is outstanding and with an AUC of .891 the discrimination for the fitted model using the Richmond et al. predictors is excellent. Although both measures performed well the pairwise comparison of the ROC curves indicates a statistically significant difference between the areas ( $p$  value = .0167) (Table 7).

Table 7

<i>Pairwise comparison of ROC curves</i>	
Difference between areas	0.0740
Standard Error	0.0309
95% Confidence Interval	0.0134, 0.135
z statistic	2.394
p value	0.0167

The Youden index ( $J$ ; Table 8) is a summary statistic for identifying the optimal cut point for a test using the sensitivity and specificity (Youden, 1950). It has a value between 0 and 1 with values near 0 indicating an ineffective test and 1 indicating an effective test. Cut points for both tests were determined via the Youden index. The cut point for the ITSS is a score greater than or equal to 1 ( $J = 0.8133$ ) and for the Richmond et al. study is any score greater than or equal to 3 ( $J = .6705$ ), the same cutoff identified in their sample.

Table 8

<i>Youden's J index, Optimal Cutoff Scores, Sensitivity, Specificity, NPV and PPV</i>	ITSS	Richmond et al.
Youden's J index	0.8133	0.6705
Associated criterion	>1	>3
Sensitivity	100.00	85.71
Specificity	81.33	81.33
Negative predictive value	100.00	93.8
Positive predictive value	66.7	63.2

***Sensitivity and specificity.*** The sensitivity (number of true positives/number of positives) is a measure of how likely a test is to detect the presence of a characteristic in someone with that characteristic. The sensitivity of the ITSS was 100% with a score greater than or equal to one on the five item measure. The sensitivity of the Richmond et al. measure in their original study was



100% and was 85.71% in this sample. The specificity (number of true negatives/number of negatives) is a measure of how likely a test is to detect the absence of a characteristic in someone who does not have that characteristic. The specificity of the ITSS was 81.33% with a score of one on the five item measure. The specificity of the Richmond et al. measure in their original study was 66% in their sample and was also 81.33% in this sample.

**NPV and PPV.** Given the variability in previous research indicating a prevalence range of about 10% to 42% of single-incident trauma survivors developing PTSD, the 27.18% prevalence rate from this sample was used to calculate the negative predictive value and positive predictive values as it fell in the middle of this prevalence range (Blanchard, Hickling, Taylor, & Loos, 1996; Holbrook, Anderson, Sieber, Browner, & Hoyt, 1999; Michaels et al., 1999a; Ursano et al., 1999; Zatzick et al., 2002; Zatzick et al., 2007). The negative predictive value ( $NPV = \text{true negatives} / (\text{true negatives} + \text{false positives})$ ) is the likelihood that a person with a negative test result does not have the characteristic. The NPV for the ITSS was 100%. For the Richmond et al. measure it was 100% in their sample and 93.8% in this sample. The positive predictive value ( $PPV = \text{true positives} / (\text{true positives} + \text{false negatives})$ ) is the likelihood that a person with a positive test result has the characteristic. The PPV for the ITSS was 66.7%. For the Richmond et al. measure it was 7% in their sample and 63.2% in this sample.

## **Chapter 5**

### **Discussion**

In this section the unique findings of this study are contextualized with previous research and are presented in light of this studies limitations. The rationale, hypotheses, and results are reviewed. Corresponding results and clinical implications are discussed.

#### **Rationale**

The objective of this study was to create a brief screening tool capable of predicting which individuals are most at risk for the development of PTSD among single-incident trauma survivors hospitalized due to an acute injury. This project was undertaken for several reasons including: (1) the relatively high rates of PTSD found across studies examining this unique population (10 - 42%; Blanchard, Hickling, Taylor, & Loos, 1996; Holbrook, Anderson, Sieber, Browner, & Hoyt, 1999; Michaels et al., 1999a; Ursano et al., 1999; Zatzick et al., 2002; Zatzick et al., 2007); (2) the current impetus to empirically validate the usefulness of secondary/early intervention (O'Donnell et al, 2012; Zatzick et al., 2004); (3) the difficulty in predicting who is at risk for PTSD given the different symptom trajectories (deRoos-Cassini et al., 2010) and the lack of a measure designed to do so; and (4) the current recommendation from the American College Surgeons to screen for PTSD in all trauma centers (ACS, 2014).

A quickly and easily administered screen for those at risk could provide a pragmatic solution to address these issues, and most importantly it will help in directing and connecting patients to secondary prevention resources as needed. Risk factor research has assessed myriad possible pretrauma, peritrauma, and posttrauma risk factors that put individuals at risk for the later development of PTSD. Based on the findings from the current study five items were

retained in stepwise logistic regression analyses, and constitute an easily administered screening tool for hospitalized trauma survivors.

### **Hypothesis one**

It was hypothesized that the unique items created for this study would add to the predictive power of the regression equation and that these items would account for a percentage of the variance above those which were demonstrated in the study conducted by Richmond et al. (2011). Support for this hypothesis was found via stepwise binary logistic regression that included the 39 newly derived items given to participants in addition to the 8 items of the Richmond et al. measure. In the final model, one item was retained from the Richmond et al. measure along with four of the newly derived items. When the Richmond et al. measure (adjusted  $R^2 = 44.90$ ) was then compared to the new measure in this sample it was found that the new measure (ITSS; adjusted  $R^2 = 62.63$ ) accounted for more variability in this sample.

### **Injured Trauma Survivor Screen (ITSS)**

Based on the results of this study, the injured trauma survivor screen (ITSS) is made up of five items representing the most parsimonious fit for the data. The following is a discussion of each item, the rationale for its development, and a review of the associated literature.

**Premorbid psychopathology.** Item 8 was the only item retained from the Richmond et al. measure and it asked “Has there ever been a time in your life you have been bothered by feeling down or hopeless or lost all interest in things you usually enjoyed for more than 2 weeks?” In their sample it was retained as a predictor of depression following traumatic injury, not a predictor of PTSD. In this study, the odds of being diagnosed with PTSD were 7.3 times higher for participants who answered yes to this question. The item was designed to assess for a previous history of depression and was a less directive way of asking participants about having a

history of depression than the other question Richmond et al. (2011) developed which was “Have you ever sought treatment for feeling down or depressed (or thought you should have)?” Item 8 is also less specific than a similar question added to the item pool for the ITSS which asked “Have you ever taken medication for, or been given a mental health diagnosis?”

Pre-existing psychopathology, including mood disorders, was included as it is a pretrauma risk factor that has been shown to increase risk for PTSD following traumatic injury across injury types and populations. In a study of MVA survivors, having a previous history of a PTSD diagnosis, a major anxiety disorder, or a personality disorder were all associated with greater risk of PTSD following an acute injury (Ursano et al., 1999). In a study of patients with facial injuries, having a previous “mental health need” based on a screen that assesses previous mental health service use was found to have a relationship with PTSD diagnosis 1 year post-injury (Glynn et al., 2007, p.414). Assault survivors with pre-existing depression or anxiety were also at increased risk for PTSD in a study conducted in a hospital emergency department (Kleim, Ehlers, & Gluckman, 2007).

In a large retrospective study that included all types of trauma exposures (i.e., rape, abuse, physical threat, natural catastrophe, witnessing an event, and combat) including having been in a “serious accident,” pretrauma anxiety and/or somatoform disorders were found to be predictive of PTSD as well (Hapke, Schumann, Rumpf, John, & Meyer, 2006). Similar findings were evident in the meta-analysis of all types of trauma exposures conducted by Ozer et al (2008). Although retained in the Richmond et al. measure as a predictor of depression, their study excluded those with a current diagnosis of depression or previous diagnosis of any type of psychotic disorder (Richmond et al., 2011). Given the consistency of the finding that having a premorbid mental health concern increases risk, it is not surprising that a measure of previous

depression demonstrated a strong relationship with the later development of PTSD in this study. Depression has been proven to be highly comorbid with many mental health disorders in epidemiological studies in the U.S. (Kessler, Chiu, Demler, & Walters, 2005) making it an important factor to assess given its relationship with premorbid psychopathology in general.

**Perceived threat to life.** Item 9 asked “Did you think you were going to die?” The odds of a participant being diagnosed with PTSD were 24.6 times higher for those who said yes to this item. This item was based on research examining peritraumatic risk factors and was designed to assess perceived threat to life. The key element appears to be the subjective belief that one is going to die which does not necessarily hinge on the objective facts of the traumatic event or the individuals injury severity (Brasel, deRoos-Cassini, & Bradley, 2010). Although not necessarily an exact analog, injury severity, often referred to as trauma severity, tends only to be predictive when you are measuring an individual’s perceptions of the injury (Delahanty et al., 2003; Holbrook et al., 2001; Michaels et al., 199b). As evidenced by the large odds ratio present in this study, an individual’s perception of an event as life threatening, whether this is based on the nature of the event or their injuries, appears to be strongly associated with the later development of PTSD.

The disorienting effect of having one’s subjective experience of being alive called into question is perhaps best understood through a phenomenological-contextualist perspective:

When a person says to a friend, “I’ll see you later” or a parent says to a child at bedtime, “I’ll see you in the morning,” these are statements whose validity is not open for discussion. Such absolutisms are the basis for a kind of naïve realism and optimism that allow one to function in the world, experienced as stable and predictable. It is in the essence of emotional trauma that it shatters these absolutisms, a catastrophic loss of

innocence that permanently alters one's sense of being-in-the-world. Massive deconstruction of the absolutisms of everyday life exposes the inescapable contingency of existence on a universe that is random and unpredictable and in which no safety or continuity of being can be assured. Trauma thereby exposes "the unbearable embeddedness of Being" . . . . As a result, the traumatized person cannot help but perceive aspects of existence that lie well outside the absolutized horizons of normal everydayness. It is in this sense that the worlds of traumatized persons are fundamentally incommensurable with those of others, the deep chasm in which an anguished sense of estrangement and solitude takes form (Stolorow, 2007, p. 16).

This peritraumatic risk factor was included because it has been shown to be predictive of PTSD across study designs and across populations. In a prospective epidemiological study conducted within the San Diego Regionalized Trauma System participants were asked "Did you feel during this event that your life was in danger?" (Holbrook et al., 2001., p. 288). Those who answered in the affirmative were found to be at greater risk for later PTSD diagnosis. In a study examining PTSD in Israelis exposed to terrorist attacks, perceived threat to physical or emotional well-being was measured on a Likert scale and was found to be significantly associated with PTSD (Gil & Caspi, 2006). Evidence for this risk factor was also presented in the Ozer et al. (2008) meta-analysis that examined this risk factor utilizing data from many populations, including but not limited to those who had been in an MVA.

Although not always included in risk factor studies, it is clear that this is an extremely important component of the later development of PTSD among those who have suffered an acute injury. In fact, this is often the key component in the fear conditioning that is theorized to take place during a traumatic event. Based on classical conditioning theory, it is hypothesized that

previously neutral stimuli (i.e., driving) become associated with the traumatic event and the individual then generalizes this experience to neutral experiences of everyday life, triggering acute anxious symptoms misinterpreted by the sufferer as cues for real threat. Underlying this misinterpretation are “pathological fear structures in memory” which become easily triggered over time, and evoke the flight or fight response quickly and excessively (Cahill & Foa, 2007, p. 62). This fear conditioning and the associated fear structure greatly exacerbate posttraumatic emotional responses as the intrusive and re-experiencing symptoms of PTSD are thought to be a part of normal recovery from PTSD (Cahill & Foa, 2007). Although theoretical, evidence would suggest that this process can be set in motion when one experiences the extreme and destabilizing stress of thinking one is going to die.

**Posttraumatic negative alteration in mood.** Item 28 asked “Do you find yourself crying and are unsure why?” The odds of being diagnosed with PTSD were 11.5 times higher for participants who answered yes to this question. This question was designed to assess current mood and/or depression and was intended to get at the isolation of affect that often accompanies emotionally painful experiences. It is conceivable that the retained items 8, 28, and 38 are all related to this phenomena to some degree. Many psychological theories of psychopathology posit that it is the active avoidance of painful affects that underlie the range of psychological disorders, and this avoidance is pathogenic if not brought to light and the painful emotion then integrated into one’s personal narrative in a less distressing or personally meaningful way (Greenberg, 2002; McWilliams, 2011; Summers & Barber, 2012).

This is encapsulated in the DSM-5 PTSD criteria under the avoidance symptoms which involve “avoidance of or efforts to avoid distressing memories, thoughts, or feelings about or closely associated with the traumatic events” and “avoidance of or efforts to avoid external

reminders (people, places, conversations, activities, objects, situations) that arouse distressing memories, thoughts, or feelings about or closely associated with the traumatic events” (APA, 2012, p. 271). The aforementioned theories that best describe this emotional avoidance also suggest that anger and other distressing emotions are often the end result of efforts to ignore or repress distressing memories or other feelings that may make one feel more vulnerable; this is encapsulated in the “negative alterations in mood” symptoms described in the DSM-5. This includes a person who presents with or describes experiencing a “persistent negative emotional state (e.g., fear, horror, anger, guilt, or shame)...markedly diminished interest or participation in significant activities...feelings of detachment or estrangement from others” and perhaps most relevantly, a “persistent inability to experience positive emotions (e.g., inability to experience happiness, satisfaction, or loving feelings)” (APA, 2013, p. 271).

Addressing this alteration in mood following a traumatic event is also one key component of emotional processing theory, on which prolonged exposure therapy was developed (PE). PE is a widely accepted evidence based approach to psychotherapy for PTSD (Foa & Kozak, 1986). In prolonged exposure therapy it is theorized that a person finds relief from the traumatic memories of the event through the physiological activation of the old emotions (elicitation of fear structure) associated with the traumatic event. This helps with the natural habituation to the memory of the traumatic event and facilitates the healthy processing of associated emotions and cognitions so the individual can organize the memory in a way that reduces their need to avoid trauma reminders which can negatively reinforce the fear structure (Cahill & Foa, 2007; Foa & Kozak, 1986).

Evidence has been found for posttraumatic alterations in mood within the acute injury population in the form of specific acute stress symptoms as well as increases in anger,



depression, and anxiety. Posttraumatic anger, and early symptoms of PTSD and/or acute stress have all been found to be predictive of PTSD among MVA survivors (Blanchard et al., 1996; Ehlers et al., 1998; Koren, Arnon, & Klein, 1999; Zatzick et al., 2002). Additionally, the findings that depression, anxiety, anger, and acute stress following a traumatic event can be predictive of PTSD across various injury types has held up in emergency department and trauma center populations (deRoon-Cassini et al., 2010; Holbrook et al., 2001; Mason et al., 2006). Taken in conjunction with the findings of this study, negative alterations in mood soon after traumatic injury appear to have a strong association with the later development of PTSD.

**Posttraumatic rumination and trait worry.** Item 38 asked “Have you found yourself unable to stop worrying?” The odds ratio associated with this item was 18.5. This item was designed to assess trait worry, and given that it is often considered both a pretrauma and posttrauma risk factor, it is a measure of posttraumatic feelings of anxiety and worry as well. Similar to the item asking about depression without labeling it as such, this is a less directive way to assess rumination, anxiety, and general nervousness following a traumatic event. A question designed to ask more directly about general feelings of anxiety or nervousness was not retained: “Have you felt more nervous or anxious than usual?” Participants were also asked about the physiological symptoms of anxiety, panic and autonomic nervous system arousal: “Have you had unusual experiences unrelated to your injury like your heart pounding, sweating, numbness or tingling, or feeling lightheaded?”

Evidence for trait worry and rumination has been found in studies examining PTSD in MVA survivors and in assault survivors that were treated in an emergency department (Ehlers et al., 1998; Kleim et al., 2007). Similar to item 40, rumination can be thought of as involving negative cognitive appraisals of a traumatic event. In a study examining PTSD in burn

survivors, there was evidence for a relationship between higher scores on the neuroticism subscale of the NEO-PI and PTSD as well (Fauerbach et al., 2000). Although too extrapolatory for a study of this nature, it is possible that such a predisposition towards anxious or depressed states may be a contributing factor for many of the items retained in this study. Alternatively, the possibility that this item was a better measure of generalized anxiety following a traumatic event (Mason et al., 2006) or negative alterations in cognitions related to the event (Ehlers et al., 1998; Kleim et al., 2007) remains possible given their relationship with PTSD in previous research.

Similar to the item retained in this study to assess depression (item 8) this item assesses anxiety by asking about posttraumatic worry and/or rumination. It has been theorized that worry is an ineffective means of trying to gain control (attentional control) over reminders (potential threats) and memories related to a traumatic experience (Wells & Matthews, 1996). By worrying about an event one has the false sense that they are taking control of their reactions to trauma reminders by being on the ready while subsequently actively avoiding the reminders. This can temporarily reduce autonomic responses to stressful stimuli which has the effect of negatively reinforcing worry as a coping strategy and preventing emotional processing (Borkovec & Hu, 1990). It is clear that in this sample, an inability to mitigate worry and/or a reliance on it as a coping strategy was strongly related to the later development of PTSD.

**Posttraumatic negative alterations in cognition.** Item 40 asked “Do you find yourself thinking that the world is unsafe and that people are not to be trusted?” The odds of being diagnosed with PTSD were 8.3 times higher for participants who answered yes to this question. The relationship between beliefs about safety, trust, and powerlessness following trauma is well documented across theoretical orientations in the literature, and these are often one of the

emphases of treatment for many types of trauma (Summers & Barber, 2012). Cognitive theories and treatments that focus primarily on the cognitive sequela of traumatic events emphasize the specific changes that can occur to beliefs in an individual with PTSD.

For example, treatment might involve identifying how a trauma survivor may try to *assimilate* the traumatic event with their previous beliefs (the world is safe most of the time) by altering their beliefs to make sense of the event in a way that is harmful to them (I cannot trust myself to make good decisions in an world that can be unsafe); and/or they may *over-accommodate* their pre-existing belief (most people are not trustworthy) following a traumatic event (no one can be trusted under any circumstance) (Resick, Monson, & Chard, 2010). Evidence for this posttraumatic risk factor has been found in the injured trauma population in studies utilizing Ehlers & Clark's cognitive model of PTSD (2000). This model has at its core the cognitive theoretical tenet that it is one's appraisal of an event and the associated consequences of the event that creates the current sense of threat seen in those with PTSD.

Evidence has been found in a study focused on assault survivors in a metropolitan emergency department which found that mental defeat was associated with the later development of PTSD (Kleim et al., 2007). In a study examining MVA survivors, those that negatively interpreted their intrusive recollections were at greater risk for PTSD as well (Ehlers et al., 1998). In a review of research concerning DSM criteria, Friedman et al. (2010) concluded that the evidence for "catastrophic" or "maladaptive" alterations in cognitions among those with PTSD are "overwhelming" (p. 9). The relationship between unhelpful or inaccurate cognitions and negative affective states is theorized to be a reciprocal one, and it is easy to conceptualize how this relationship can sustain and prevent recovery in the affected individual. Well attuned clinicians balance the need for the elicitation and processing of the natural emotions associated

with accurate appraisals of a terrifying event, while paying close attention for possible misperceptions or pathogenic beliefs about the world or oneself following a trauma.

### **Risk Factors Not Included in the Model**

Despite the overall better performance of the ITSS in this sample there are countless variables that contribute to the later development of PTSD. This is not uncommon when studying complex psychological phenomena such as PTSD which undoubtedly has multiple causal pathways related to sociocultural and biological factors. The biopsychosocial model offers an integrative and holistic framework for investigations of the innumerable influences on human behavior and individual psychology. Since the ITSS is a self-report measure focused on subjective psychological factors, the following section touches on biological, sociocultural, and well-being factors that could add to the risk model for PTSD.

**Biological risk factors.** There has been a tremendous amount of research done on the biological components of PTSD; what follows is a focus on several key areas that have the most promise for predicting risk. Researchers in this area examine and measure specific biomarkers as a way to diagnose and potentially predict who might be at risk for PTSD following a traumatic event. In medicine, a biomarker is any measurable biological substance that is indicative of a disease state. Currently, given the complex nature of PTSD, it does not seem likely that any one biomarker will be identified as indicative of risk or diagnosis (Michopoulos, Norrholm, & Jovanovic, 2015).

A common research technique used to measure potential biological contributions to mental health disorders is the twin study which is used to estimate the heritability of phenotypes (Kremen, Koenen, Afari, & Lyons, 2012). Authors of a recent review of the literature in this area concluded that although the data available are severely limited by the samples upon which

most of the data come from, the potential neurodevelopmental risk factors for PTSD from these studies include: (1) having an abnormally large cavum septum pellucidum (tissue between first and second ventricle); (2) having a smaller hippocampal volume; (3) having neurological soft signs such as a lack of inhibitory emotional control; (4) and certain aspects of premorbid general cognitive ability as evidenced by specific neurocognitive functions (Kremen, Koenen, Afari, & Lyons, 2012). In one twin study, it was found that genetics may account for up to 30% of the variance in PTSD (True et al., 1993) indicating that genetics play an important role in the development of PTSD that it is not clearly understood.

Another area of biomedical research has focused on the interaction of biology and psychology via epigenetics, which is the study of how environmental factors influence gene expression, also called the gene x environment interaction (Roth, 2014). PTSD as a mental health construct might represent the ideal area of study for this given the fact that PTSD is currently the only disorder agreed upon by professionals to have any type of specific etiological requirement (i.e., that it be triggered by the occurrence of a potentially traumatic event). There has been a steady increase in evidence that genes appear to be especially sensitive when environmental stressors occur early in life (Zovkic, Meadows, Kaas, & Sweatt, 2013). The degree to which findings from these studies are describing consequences of trauma versus risk factors for PTSD will require close inspection.

In another summary article reviewing biomarker research for PTSD across many biomedical domains, the authors conclude that current research in this area suggests that a diagnostic model for PTSD might be attainable, but that this will likely be based on “alterations and differences in monoaminergic systems, neuroendocrinology, inflammation, genomics, psychophysiology, and neuroanatomy” (Michopoulos, Norrholm, & Jovanovic, 2015, p.6). An

example of a potential neuroanatomical/neuroactivational biomarker for the development of PTSD is the decreased regulation of the amygdala by the medial prefrontal cortex; this is measured in functional magnetic resonance imaging studies in participants with a PTSD diagnosis, so its relationship to risk is as of yet unknown (Michopoulos, Norrholm, & Jovanovic, 2015). Given the complex nature of psychological phenomena such as PTSD, an understanding of the intersection of biology with environmental, psychological, and sociocultural factors will continue to enhance a risk factor model for PTSD.

**Sociocultural risk factors.** In an effort to bridge the gap between biological and sociocultural factors researchers have developed theories that focus on the integration of these components; one such theory is the Conservation of Resources (COR theory). COR theory is an integrative approach that suggests that understanding an individual's stress response is best done via the interrelationship of the individual to contextual, sociocultural, environmental, psychological, and biological factors (Hobfoll, 2001). In this theory, resources range from fundamental needs such as food and clothing, through to higher order needs such as support and affection from valued others. While Western appraisal based theories of stress have implied that humans utilize internal idiographic interpretations of external stressors, COR posits that these appraisals are also the result of ongoing learning that takes place via sociocultural processes in addition to one's perceived and objective resource loss. The biological, cultural, and psychological reactions of an individual to a loss of resources is theorized to be a developmentally adaptive evolutionary response to resource loss, given the historical impact that such losses have had on the survival of individuals and groups.

While examining between group differences in this study among completers and non-completers, race and/or ethnicity approached significance,  $LR(5, N = 179) = 10.899, p = 0.053$ .

Speculatively, this may be due to the higher overall retention rates among racial minority participants. Retention was 67% among those who identified as African American or black (n = 42), 68% among those who identified as Hispanic/Latino (n = 11), 100% among those identifying as American Indian (n = 2), and was exactly 50% among white participants (n = 47). Of those with PTSD 25 of the 28 who were eventually diagnosed with PTSD at one month follow-up are currently considered to belong to U.S. ethnic/racial minority groups (Table 9).

Table 9

*PTSD diagnosis by sex and race*

Sex		PTSD criteria met?		Percentage
		No	Yes	
Female	Black/AA	6	6	50%
	American Indian	0	1	100%
	Hispanic/Latino	2	1	33%
	White/Caucasian	10	1	10%
Male	Black/AA	15	15	50%
	American Indian	1	0	0
	Hispanic/Latino	6	2	25%
	White/Caucasian	34	2	5.6%
	Other	1	0	0

*Note:* AA = African American

The higher rate of PTSD itself may have been a contributing factor in the retention rate, for example it may have factored into one's decision to partake in the study given the lack of information available regarding treatment options once someone has been discharged from the hospital. Additionally, the financial incentive offered in this study may have impacted retention rates as many U.S. cities are segregated and stratified along racial and socioeconomic lines. It should be noted that any participant presenting with increased levels of distress was offered intervention at the study site or was assisted in finding additional resources if amenable to the individual.

Although this study assessed variables that can be conceived of as potentially socioculturally relevant such as perceived social support, pre and posttraumatic life stress, and

concern for having the necessary resources during recovery, it is clear that many variables outside of those addressed directly in this study contributed to the incidence rate of PTSD. The risk factors developed for the item pool were derived from a largely mainstream research perspective and when demographic variables are collected but not considered fully or appropriately it is detrimental to the ecocultural validity and applicability of a study (Chao & Otsuki-Clutter, 2011; McLoyd, Kaplan, Hardaway & Wood, 2007). When psychological researchers ignore the impact of contextual variables, they ignore within-group heterogeneity and are unable to identify sociocultural/contextual explanations for the variability in their model (Chao & Otsuki-Clutter, 2011; McLoyd et al., 2007).

The findings presented in table 9 are informative but must be interpreted in light of research that takes a more socioculturally and contextually relevant approach, which takes into account additional sociocultural variables when examining the rates of mental health diagnoses among different populations. Using a critical perspective approach to health psychology research, Mezuk et al. (2010) explored the phenomena that blacks of lower socioeconomic status typically have lower overall rates of depression when compared to their white counterparts but higher overall rates of physical health ailments. These researchers found that poor health behaviors (PHB) that increase risk for physical health problems serve a protective function against mental illness among blacks of low socioeconomic status. By calling into question the status quo with regard to the causal explanation of the particular mental and physical health disparities (i.e., heart disease risk as strictly genetic) between whites and blacks, these researchers demonstrated a more nuanced examination of this demographic factor.

These results draw attention to the impact of differential access to various resources, and different means of coping based on environmental and cultural differences, rather than on race



alone. This finding may not hold up with regard to PTSD in the acutely injured population as those PHBs may be less effective in the face of an acute trauma with an associated physical injury that serves as a reminder of the traumatic event and alters access to resources. While this supposition goes well beyond the scope of this project, this type of sociocultural phenomena illustrates the importance of not drawing conclusions or creating additional hypotheses without first considering the complex relationships between variables such as biology, SES, culture, and ethnicity, as they relate to mental and physical health.

An example of a factor that might differ based on cultural or socioeconomic status is proximity to the environment in which the event took place. For example, a person who has the resources to avoid a place where they were assaulted might be less likely to be routinely re-exposed to specific reminders of the traumatic event in the acute aftermath. That is, people with more resources can take time to heal and revisit those places when they feel ready, in a way that is therapeutic, or even avoid them outright until such an option is available. This supposition is based on the theories underlying PTSD and is transtheoretical since all extant theories and/or treatments of PTSD require that effective intervention involve the evocation of the thoughts and feelings associated with the trauma whether it be by one's own memory of the event or exposure to feared stimuli. However, without the most integral component, which is that these exposures be followed by processing the potentially pathogenic thoughts, feelings, behaviors, and psychophysiological symptoms as they relate to the event, these reminders may simply be re-traumatizing. This processing is necessary due to the active avoidance that is seen in those with PTSD, which is thought to be pathogenic in itself. Without the second component of healthy processing of the associated (healthy/accurate or unhealthy/inaccurate) thoughts, feelings, behaviors and psychophysiological symptoms in-vivo, the pathological responses to the

traumatic event remain in place and are experienced by the survivor in a way that may reify and solidify their symptoms, prolonging and exacerbating their posttraumatic reaction.

With regard to injury type, cases of PTSD were split evenly in this sample with 14 traumas that were more indicative of traumatic events typically considered interpersonal in nature (GSW and stabbing,  $n = 14$ ; MVC, MCC, Pedestrian,  $n = 14$ ). While participants were asked “Do you think this was done to you intentionally?” this was not retained in the final model. Given that this setting sees more men on average and given that suffers of sexual trauma are typically not admitted to surgery services, it is not unusual that the majority of those diagnosed with PTSD in this sample were male ( $n = 19$ ). This provides evidence for the supposition that contextualized gender-interactional (Kimerling, Ouimette, & Weitlauf, 2007) explanations for trauma rates will provide more robust and useful risk factor data where additional factors such as sociocultural variables act as moderators. This type of exploration seems warranted given the overall rate of PTSD among ethnic/racial minorities in this sample.

***Resilience and meaning making.*** Sociocultural forces likely contribute strongly to the meaning one gives to an event, which may impact one’s recovery and set in motion the different trajectories seen in the research. In brief review, the aforementioned symptom trajectories of PTSD described by Bonanno, Westfall and Mancini (2011) include a resilient trajectory, a recovery trajectory, a chronic trajectory, and a delayed trajectory. Findings for these trajectories among the injured trauma survivor population are congruent with the findings among other populations that most individuals will fall in the resilient trajectory (deRoos-Cassinin et al., 2010). Resilience is the norm for the majority of individuals that experience a traumatic event, even when that event is accompanied by a traumatic injury. It is clear that individuals differ in the way they respond to a potentially traumatic event.

Research that takes into account protective and meaning making factors may aid in identifying those who present with normative distress following a trauma but who may be on a recovering or resilient trajectory. Although some protective factors may intuitively be the inverse of some risk factors (i.e. social support) (Bonanno, 2008) research and theory in this area has been explicit that resilience is not simply the absence of pathology (Almedom & Glandon, 2007). Therefore, additional research designed to measure protective factors might contribute to more robust measures and a clearer understanding of posttraumatic resilience. In one review of the literature several key factors were described including: personality, proximal and distal exposure, social and economic resources, past and current stress, worldviews, and positive emotions (Bonanno et al., 2011).

Nuanced explorations of psychological well-being as it relates to the perception of the traumatic event, and specifically the traumatic injury, are necessary to better understand what factors contribute to a healthy course following trauma. An example of this is research that examined Veterans with a spinal cord injury. In this study, medical injury severity was not related to psychological well-being, but resource loss (i.e., perceived loss of physical function) was associated with a decrease in psychological well-being (deRoos-Cassini, de St. Aubin, Valvano, Hastings, & Horn, 2009). However, when global meaning making (i.e., “an individual’s perspective of seeking purpose and finding meaning in his or her existence”) was considered in their model, the perceived loss of physical resources was no longer significantly related to psychological well-being (p. 309). The authors suggest that this may be due to a possible mediation effect of an individual’s perceptions as they relate to subjective states of meaning making and purpose in life.

## Hypothesis Two

It was hypothesized that the revised screen would more accurately predict the incidence of PTSD in the sample at one month than the previous measure normed on an emergency room sample. Support for this hypothesis was found via ROC curve analysis of the ITSS in comparison to the Richmond et al. measure. Although both measures performed well in the sample the ITSS performed better than the previous screen in several ways.

**Comparing the ITSS and the Richmond et al. measure.** The incidence rate of PTSD in this sample was 27%, falling into the middle of the range shown in previous studies within the single-incident injured trauma survivor population of 10-42% (Blanchard, Hickling, Taylor, & Loos, 1996; Holbrook, Anderson, Sieber, Browner, & Hoyt, 1999; Michaels et al., 1999a; Ursano et al., 1999; Zatzick et al., 2002; Zatzick et al., 2007). Richmond et al. examined PTSD at six months in a sample consisting of randomly selected individuals passing through an emergency department whether they were admitted or not, rather than exclusively examining individuals admitted to the trauma service. Follow-up was conducted within two weeks after injury. This yielded a PTSD incidence rate of 2.4% in their sample (Richmond et al., 2011). They suggested that this may have impacted the PPV and NPV in their study and suggested that future research be conducted on individuals who may have been involved in incidents and with injuries that were perceived to be life threatening.

Evidence for this supposition was observed in this study as the perceived threat to life risk factor was retained as a significant predictor with a large odds ratio ( $OR = 24.6$ ). Their measure did not produce as strong of a sensitivity (85.71%) in this sample as it did in their sample (100%) but had a greater specificity (81.33%) than in their sample (66%). The NPV for their measure remained quite robust in this sample (93.8%) even when compared to that attained

in their sample (100%). The largest difference was observed in their PPV which was quite low in their sample (7%) and as they had speculated was significantly higher in a sample of patients admitted for their injuries (63.2%).

By comparison, the ITSS outperformed the Richmond et al. measure within this sample in ROC curve analysis. Answering yes to any of the five items (score  $\geq 1$ ) retained in the measure was associated with a sensitivity (true positive rate) of 100% which essentially means that it is less likely that someone at risk for the later development of PTSD will answer no to all of these questions. The specificity of the ITSS was 81.33% (true negative rate) meaning that the majority of cases in which someone is not at risk for PTSD will be identified as such. Conversely this also means that there will be occasions in which someone might endorse one or more of these items and will not go on to develop PTSD.

This finding holds up when considering a possible prevalence rate of 27.18% among this population which yielded a PPV of 66.7% and NPV of 100%. The higher the PPV the less false positives and the higher the NPV the less false negatives. Essentially the benefits of giving the screen would significantly outweigh the brief time commitment required to administer it. Considering the routine finding that resilience is the norm following the experience of a PTE it is not surprising that there are some individuals that will endorse an item on the ITSS and will not go on to develop PTSD. Furthermore, endorsement of one or more of these items would warrant a follow-up by a mental health professional who could prioritize early treatment interventions for those presenting as more at risk during a secondary clinical evaluation.

In summary, given that objective injury severity is not in itself predictive of the later development of PTSD it is not entirely clear what additional factors lead to PTSD in the injured trauma survivor population, but these findings shed light on the risk factors that might place one

at the most risk. Based on these findings it is also likely that different screens are necessary for those who are admitted to the trauma service and those who might be passing through an emergency department. Regardless, these findings need to be considered in relation to factors not included in this study such as biological predisposition, sociocultural factors, psychological well-being, and resilience following traumatic injury. With those limitations in mind the primary strength of the ITSS is that it is the first screen of its type created and normed on individuals who suffered a traumatic injury resulting in hospitalization in a level 1 trauma center in the U.S. The findings of this study provide evidence for the predictive validity of the measure with regard to later assessment of PTSD at one month follow-up.

### **Limitations**

There were several limitations associated with this research project. First, the retention rate for this study was 55.7% which is slightly lower than that evidenced in risk factor research within the injured trauma population in several other studies (~ 60%; Ehlers et al. 1998; Mason et al. 2006; Mellman et al. 2001). This limitation is compounded by the fact that recruitment for this study was based on self-selection for participation which can lead to sampling bias and limits the generalizability of the findings. Additionally, offering reimbursement or incentives for participation upon completion of follow-up can bias one's sample given that economic motivation can be greater for those of lower socioeconomic status.

Together these limitations draw into question whether or not it is those who are experiencing the most distress that are agreeing to participate and are being retained in the study. However, given the incidence rate of PTSD in the sample (27.18%) and given that this rate falls towards the middle of the range seen across studies (10-42%), it is possible that this is not the case and/or that the PTSD rate was only marginally inflated (Blanchard, Hickling, Taylor, &

Loos, 1996; Holbrook, Anderson, Sieber, Browner, & Hoyt, 1999; Michaels et al., 1999a; Ursano et al., 1999; Zatzick et al., 2002; Zatzick et al., 2007). Also, two large scale studies examining PTSD rates within the injured trauma survivor population in the U.S. found rates similar to that in this study. One with a sample size of 3,047 found a rate of 21.8% (Zatzick et al., 2010) and the other with a sample size of 2,931 found a rate of approximately 23% (Zatzick et al., 2007).

The major limitation of this study was that the sample size was small given the large number of predictors which precluded a simple cross-validation of the findings; however, this study was embedded within a larger study and data acquisition is ongoing. A larger sample size is required in order to extrapolate findings from the study that are either valid or reliable. While there is debate about a heuristic for sample size that is ideal for logistic regression, a larger sample than that attained in this study is needed and these results should be interpreted cautiously in light of this limitation (Vittinghoff & McCulloch, 2006). Cross-validation within the development sample once a larger dataset has been accumulated should be carried out in addition to replication studies, which collectively would add to the predictive validity of the model and would make potential problems with overfitting of the data evident (Sapp, 2006).

Also, the design for this study was simple and it relied on categorical data which precludes making causal inferences as bivariate logistic regression does not allow for causal relationships to be examined, although useful for a diagnostic screen. Additionally, given that the stepwise data entry method was used due to the exploratory nature of this study, the final items included in the model were not derived by a specific theoretical position but by the software used to analyze the data (Sapp, 2006). Finally, since the data presented here are correlational in nature one can only infer that there is a relationship between the predictor items

and PTSD, limiting the applicability of these findings beyond the sample on which they were normed.

### **Future Directions**

Given the performance of the Richmond et al. measure in this sample and the failure of the ITSS to cross-validate it is conceivable that the ITSS might perform quite differently in another sample. The psychometric properties of the ITSS presented here are based on the sample in which it was developed which significantly limits the generalizability or interpretability of the output. Therefore, cross validation within a larger developmental sample as well as replication studies are needed to increase confidence in the findings and in order to provide evidence for the predictive validity of the measure. A theory based data entry method would yield more reliable results, and a larger randomized sample would address many of the limitations present in this study. Future research should also extend beyond the one month time period given the evidence for differential trajectories of recovery or delayed stress responses. Research looking beyond this one month post injury time period could also have a significant impact on what risk factors remain statistically significant.

Future researchers developing items examining risk factors for PTSD among this population might ask about certain personality traits or pre-existing mood disorders in a way more in line with the Richmond et al. measure item that was retained in this study (item 8) as well as the item retained to assess worry (item 38). Rather than asking directly about a mental health diagnosis or history, questions designed to ask more generally about the subjective symptoms of psychological distress might be more easily understood and more accurately answered by participants. An examination of the sociocultural factors that may put an individual at greater risk for PTSD following a potentially traumatic event with an acute injury is warranted



given the disparity found in this study in rates of PTSD among racial/ethnic minorities. This implies that research examining PTSD risk factors might yield more robust findings if developed from within specific ecocultural frameworks. Investigations that attempt to remain acultural will likely be missing important contributing factors to distress within any one specific cultural or ethnic group. Future biomarker research may address these limitations while bolstering understanding of how cultural and biological variables interact to increase or reduce risk for the development of PTSD.

## **Conclusion**

Identifying those at risk for the development of PTSD among single-incident trauma survivors is becoming a priority for mental health treatment providers in medical settings and physicians alike. The organization responsible for setting and verifying the standards of care for trauma centers, the American College of Surgeons (2014), has recommended that medical centers evaluate and treat those who could potentially suffer from posttraumatic psychological distress; often a first step in an eventual mandate. The evidence presented in this study adds to the nascent but promising body of research examining the relationship between PTSD risk factors and the later development of PTSD among the injured trauma survivor population. Specifically, given further validation, the Injured Trauma Survivor Screen (ITSS) is a tool that could be easily integrated into current screening procedures while trauma survivors are in hospital, thereby streamlining efforts to identify and prioritize mental health intervention for those with the most acute need.

## References

- Almedom, A. M., & Glandon, D. (2007). Resilience is not the absence of PTSD any more than health is the absence of disease. *Journal Of Loss And Trauma*, 12(2), 127-143.
- American College of Surgeons (2014). *Resources for optimal care of the injured patient*. Retrieved from <https://www.facs.org/quality%20programs/trauma/vrc/resources>
- American Psychiatric Association. (1952). *Diagnostic and Statistical Manual of Mental Disorders* (1<sup>st</sup> ed.). Washington, DC: Author.
- American Psychiatric Association. (1968). *Diagnostic and Statistical Manual of Mental Disorders* (2<sup>nd</sup> ed.). Washington, DC: Author.
- American Psychiatric Association. (1980). *Diagnostic and Statistical Manual of Mental Disorders* (3<sup>rd</sup> ed.). Washington, DC: Author.
- American Psychiatric Association. (1987). *Diagnostic and Statistical Manual of Mental Disorders* (3<sup>rd</sup> ed., text rev.). Washington, DC: Author.
- American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders* (4<sup>th</sup> ed., text rev.). Washington, DC: Author.
- American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5<sup>th</sup> ed.). Washington, DC: Author.
- American Psychiatric Association. (2013). Cultural concepts in DSM-5. Retrieved from [www.psychiatry.org/.../DSM/DSM-5/Cultural-Concepts-in-DSM-5.pdf](http://www.psychiatry.org/.../DSM/DSM-5/Cultural-Concepts-in-DSM-5.pdf)
- Andreasen, N. C. (2010). Posttraumatic stress disorder: A history and a critique. *Annals of the New York Academy Of Sciences*, 1208(1), 67-71.
- Australian Government Centrelink. (2009). *Disability and career payment rates July-September 2009*. Retrieved from <http://www.centrelink.gov.au/internet/internet.nsf/publications>

/co031.htm

- Azen, R. & Walker, C.M. (2011). *Categorical data analysis for the behavioral and social sciences*. New York, NY: Taylor and Francis Group, LLC.
- Batten, S.V., Aslan, M., Maciejewski, P.K., & Mazure, C.M. (2004). Childhood maltreatment as a risk factor for adult cardiovascular disease and depression. *The Journal Of Clinical Psychiatry*, 65(2), 249-254.
- Bjelland, I., Dahl, A. A., Haug, T.T., & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale: An updated literature review. *Journal of Psychosomatic Research*, 52(2), 69.
- Blake, D.D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Charney, D. S., & Keane, T. M. (1990). *The clinician-administered PTSD scale-IV*. Boston: National Center for PTSD, Behavioral Sciences Division.
- Blake, D.D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Gusman, F. D., Charney, D. S., & Keane, T. M. (1995). The development of a Clinician-Administered PTSD Scale. *Journal Of Traumatic Stress*, 8(1), 75-90.
- Blanchard, E. B., Hickling, E. J., Barton, K. A., Taylor, A. E., Loos, W.R., & Jones-Alexander, J. (1996). One-year prospective follow-up of motor vehicle accident victims. *Behaviour Research and Therapy*, 34(10), 775-786.
- Blanchard, E. B., Jones-Alexander, J., Buckley, T.C., & Forneris, C.A. (1996). Psychometric properties of the PTSD checklist (PCL). *Behaviour Research and Therapy*, 34(8), 669-673.
- Bonanno, G.A. (2004). Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events? *American Psychologist*, 59(1), 20–28.

- Bonanno, G. A. (2012). Uses and abuses of the resilience construct: Loss, trauma, and health-related adversities. *Social Science & Medicine*, 74(5), 753-756.
- Bonanno, G.A., Ho, S.M., Chan, J.C., Kwong, R.S., Cheung, C.K., Wong, C.P., & Wong, V.C. (2008). Psychological resilience and dysfunction among hospitalized survivors of the SARS epidemic in Hong Kong: A latent class approach. *Health Psychology*, 27(5), 659-667.
- Bonano, G. A., Rennie, C., & Dekel, S. (2005). Self-enhancement among high-exposure survivors of the september 11th terrorist attack: Resilience or social maladjustment?. *Journal Of Personality and Social Psychology*, 88(6), 984-998.
- Bonanno, G. A., Westphal, M., & Mancini, A. D. (2011). Resilience to loss and potential trauma. *Annual Review of Clinical Psychology*, 7, 511-535.
- Bonnie, R.J., Fulco, C.E., & Liverman, C.T. (1999). *Reducing the burden of injury: Advancing prevention and treatment*. Washington, D.C.: National Academies Press.
- Borkovec, T. D., & Hu, S. (1990). The effect of worry on cardiovascular response to phobic imagery. *Behaviour Research and Therapy*, 28(1), 69-73.
- Boscarino, J.A. (2004). Posttraumatic stress disorder and physical illness: Results from clinical and epidemiologic studies. *Annals of the New York Academy Of Sciences*, 1032(1), 141-153.
- Bramsen, I., Dirkzwager, A.J., & Van der Ploeg, H.M. (2000). Predeployment personality traits and exposure to trauma as predictors of posttraumatic stress symptoms: A prospective study of former peacekeepers. *The American Journal of Psychiatry*, 157(7), 1115-1119.

- Brasel, K.J., deRoos-Cassini, T., & Bradley, C.T. (2010). Injury severity and quality of life: Whose perspective is important? *Journal of Trauma and Acute Care Surgery*, 68(2), 263-268.
- Breslau, N. (2002). Epidemiologic studies of trauma, posttraumatic stress disorder, and other psychiatric disorders. *Canadian Journal of Psychiatry*, 47(10), 923.
- Breslau, N. (2009). The epidemiology of trauma, PTSD, and other posttrauma disorders. *Trauma, Violence, & Abuse*, 10(3), 198-210.
- Breslau, N., Kessler, R.C., Chilcoat, H.D., Schultz, L.R., Davis, G.C., & Andreski, P. (1998). Trauma and posttraumatic stress disorder in the community: The 1996 Detroit area survey of trauma. *Archives of General Psychiatry*, 55(7), 626-632.
- Breuer, J., & Freud, S. (1895). *Studies on hysteria*. Vienna: Franz Deuticke.
- Brewin, C. R. (2005). Systematic review of screening instruments for adults at risk of PTSD. *Journal of Traumatic Stress*, 18(1), 53-62.
- Brewin, C. R., Andrews, B., & Rose, S. (2000). Fear, helplessness, and horror in posttraumatic stress disorder: Investigating DSM-IV criterion A2 in victims of violent crime. *Journal of Traumatic Stress*, 13(3), 499-509.
- Brewin, C. R., Andrews, B., & Valentine, J. D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology*, 68(5), 748-766.
- Bromet, E., Sonnega, A., & Kessler, R. (1998). Risk factors for DSM-III-R posttraumatic stress disorder: Findings from the National Comorbidity Survey. *American Journal of Epidemiology*, 147(4), 353-361.

- Bryant, R., O'Donnell, M., Creamer, M., McFarlane, A., Clark, C., & Silove, D. (2010). The psychiatric sequelae of traumatic injury. *The American Journal of Psychiatry*, 167(3), 312-320.
- Cahill, S.P., & Foa, E.B. (2007). Psychological theories of PTSD. In M.J. Friedman, T.M. Keane & P.A. Resick (Eds.), *Handbook of PTSD: Science and Practice* (pp. 55-77). New York: KluwerAcademic/Plenum.
- Center for Disease Control and Prevention (2011). *National hospital ambulatory medical care survey: 2009 emergency department summary tables*. Retrieved from [http://www.cdc.gov/nchs/ahcd/web\\_tables.htm](http://www.cdc.gov/nchs/ahcd/web_tables.htm)
- Chao, R.K., & Otsuki-Clutter, M. (2011). Racial and ethnic differences: Sociocultural and contextual explanations. *Journal of Research on Adolescence*, 21(1), 47-60.
- Cohen, J., Cohen, P., West, S., & Aiken, L. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences*. (3<sup>rd</sup> ed.). New York, NY: Taylor & Francis Group, LLC.
- Conybeare, D., Behar, E., Solomon, A., Newman, M. G., & Borkovec, T. D. (2012). The PTSD Checklist-Civilian Version: reliability, validity, and factor structure in a nonclinical sample. *Journal of Clinical Psychology*, 68(6), 699-713.
- Corneil, W., Beaton, R., Murphy, S., Johnson, C., & Pike, K. (1999). Exposure to traumatic incidents and prevalence of posttraumatic stress symptomatology in urban firefighters in two countries. *Journal of Occupational Health Psychology*, 4(2), 131-141.
- Courtois, C. A. (2008). Complex trauma, complex reactions: Assessment and treatment. *Psychological Trauma: Theory, Research, Practice, and Policy*, 5(1), 86-100.
- Crossley, M.L. (2000). *Rethinking health psychology*. Philadelphia, PA., Open University Press.

- Delahanty, D. L., Raimonde, A.J., & Spoonster, E. (2000). Initial posttraumatic urinary cortisol levels predict subsequent PTSD symptoms in motor vehicle accident victims. *Biological Psychiatry*, 48(9), 940-947.
- Delahanty, D. L., Raimonde, A.J., Spoonster, E., & Cullado, M. (2003). Injury severity, prior trauma history, urinary cortisol levels, and acute PTSD in motor vehicle accident victims. *Journal of Anxiety Disorders*, 17(2), 149-164.
- DeLong, E. R., DeLong, D. M., & Clarke-Pearson, D. L. (1988). Comparing the areas under two or more correlated receiver operating characteristic curves: A nonparametric approach. *Biometrics*, 837-845.
- deRoos-Cassini, T. A., de St Aubin, E., Valvano, A., Hastings, J., & Horn, P. (2009). Psychological well-being after spinal cord injury: perception of loss and meaning making. *Rehabilitation psychology*, 54(3), 306-314.
- deRoos-Cassini, T.A., Mancini, A.D., Rusch, M.D., & Bonanno, G.A. (2010). Psychopathology and resilience following traumatic injury: A latent growth mixture model analysis. *Rehabilitation Psychology*, 55(1), 1-11.
- DeVellis, R.F. (2012). *Scale development: Theory and application* (3rd ed.). Thousand Oaks, CA., Sage Publications, Inc.
- Dougall, A., Ursano, R. J., Posluszny, D. M., Fullerton, C. S., & Baum, A. (2001). Predictors of posttraumatic stress among victims of motor vehicle accidents. *Psychosomatic Medicine*, 63(3), 402-411.
- Dunn, C., Zatzick, D., Russo, J., Rivara, F., Roy-Byrne, P., Ries, R., & ... Gentilello, L. (2003). Hazardous drinking by trauma patients during the year after injury. *The Journal of Trauma*, 54(4), 707-712.

- Ehlers, A., & Clark, D.M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy*, 38(4), 319-345.
- Ehlers, A., Mayou, R. A., & Bryant, B. (1998). Psychological predictors of chronic posttraumatic stress disorder after motor vehicle accidents. *Journal of Abnormal Psychology*, 107(3), 508-519.
- Fauerbach, J. A., Lawrence, J. W., Schmidt Jr, C.W., Munster, A. M., & Costa Jr, P. t. (2000). Personality predictors of injury-related posttraumatic stress disorder. *Journal of Nervous and Mental Disease*, 188(8), 510-517.
- Ferguson, C. J. (2009). An effect size primer: A guide for clinicians and researchers. *Professional Psychology: Research and Practice*, 40(5), 532.
- Field, A. (2009). *Discovering statistics using SPSS*. (3<sup>rd</sup> ed.). Thousand Oaks, CA: SAGE publications Inc.
- Flett, R. A., Kazantzis, N., Long, N. R., MacDonald, C., & Millar, M. (2002). Traumatic events and physical health in a New Zealand community sample. *Journal of Traumatic Stress*, 15(4), 303-312.
- Foa, E.B., Hambree, E.A., & Rothbaum, B.O. (2007). *Prolonged exposure therapy for PTSD: Emotional processing of traumatic experiences*. New York, NY: Oxford University Press, Inc.
- Foa, E. B., Hearst-Ikeda, D., & Perry, K. J. (1995). Evaluation of a brief cognitive-behavioral program for the prevention of chronic PTSD in recent assault victims. *Journal of Consulting and Clinical Psychology*, 63(6), 948-955.
- Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: exposure to corrective information. *Psychological Bulletin*, 99(1), 20-35.



- Foa, E. B., Rothbaum, R.O., Riggs, D.S., & Murdock, T.B. (1991). Treatment of posttraumatic stress disorder in rape victims: A comparison between cognitive-behavioral procedures and counseling. *Journal of Consulting and Clinical Psychology*, 59(5), 715-723.
- Friedman, M.J., Keane, M.T., & Resick, P.A. (2007). *Handbook of PTSD: Science and practice*. New York, NY: Guilford Press.
- Friedman, M. J., Resick, P. A., Bryant, R. A., & Brewin, C. R. (2010). Considering PTSD for DSM-5. *Depression and Anxiety*, 28(9), 750-769.
- Friedman, M. J., Resick, P. A., Bryant, R. A., Strain, J., Horowitz, M., & Spiegel, D. (2011). Classification of trauma and stressor-related disorders in DSM-5. *Depression and Anxiety*, 28(9), 737-749.
- Froedtert and the Medical College of Wisconsin (2014). *Adult level I trauma center annual report*. Retrieved from <http://www.froedtert.com/upload/docs/services/trauma/trauma-annual-report.pdf>
- Fuglsang, A., Moergeli, H., & Schnyder, U. (2004). Does acute stress disorder predict post-traumatic stress disorder in traffic accident victims? Analysis of a self-report inventory. *Nordic Journal of Psychiatry*, 58(3), 223-229.
- Fullerton, C. S., Ursano, R. J., & Wang, L. (2004). Acute stress disorder, posttraumatic stress disorder, and depression in disaster or rescue workers. *The American Journal of Psychiatry*, 161(8), 1370-1376.
- Gil, S., & Caspi, Y. (2006). Personality traits, coping style, and perceived threat as predictors of posttraumatic stress disorder after exposure to a terrorist attack: A prospective study. *Psychosomatic Medicine*, 68(6), 904-909.

- Gil, S., Caspi, Y., Ben-Ari, I., Koren, D., & Klein, E. (2005). Does memory of a traumatic event increase the risk for posttraumatic stress disorder in patients with traumatic brain injury? A prospective study. *The American Journal of Psychiatry*, 162(5), 963-969.
- Glynn, S.M., Shetty, V., Elliot-Brown, K., Leathers, R., Belin, T.R., & Wang, J. (2007). Chronic posttraumatic stress disorder after facial injury: a 1-year prospective cohort study. *Journal of Trauma-Injury Infection and Critical Care*, 62(2), 410-418.
- Gradus, J. L., Ping, Q., Lincoln, A. K., Miller, M., Lawler, E., Sørensen, H.T., & Lash, T. L. (2010). Posttraumatic Stress Disorder and Completed Suicide. *American Journal of Epidemiology*, 171(6), 721-727.
- Gray, M.J., Litz, B.T., Hsu, J.L., & Lombardo, T.W. (2004). Psychometric properties of the Life Events Checklist. *Assessment*, 11(4), 330-341.
- Greenberg, L.S. (2002). *Emotion-focused therapy: Coaching clients to work through their feelings*. American Psychological Association.
- Greenberg, P.E., Sisitsky, T., Kessler, R.C., Finkelstein, S.N., Berndt, E.R., Davidson, J.R., ... & Fyer, A.J. (1999). The economic burden of anxiety disorders in the 1990s. *The Journal of Clinical Psychiatry*, 60(7), 427-435.
- Hapke, U., Schumann, A., Rumpf, H.J., John, U., & Meyer, C. (2006). Post-traumatic stress disorder: The role of trauma, pre-existing psychiatric disorders, and gender. *European Archives of Psychiatry and Clinical Neuroscience*, 256(5), 299-306.
- Heinrichs, M., Wagner, D., Schoch, W., Soravia, L.M., Hellhammer, D.H., & Ehlert, U. (2005). Predicting posttraumatic stress symptoms from pretraumatic risk factors: A 2-year prospective follow-up study in firefighters. *The American Journal of Psychiatry*, 162(12), 2276-2286.

- Heppner, P.P., Wampold, B.E., & Kivlighan, D.M. (2008). *Research design in counseling* (3rd ed.). Belmont, CA.: Thomson Brooks/Cole.
- Hinton, D.E., & Lewis-Fernández, R. (2010). Idioms of distress among trauma survivors: Subtypes and clinical utility. *Culture, Medicine, and Psychiatry*, 34(2), 209-218.
- Hinton, D.E., & Lewis-Fernández, R. (2011). The cross-cultural validity of posttraumatic stress disorder: implications for DSM-5. *Depression and Anxiety*, 28(9), 783-801.
- Hobfoll, S. E. (2001). The influence of culture, community, and the nested-self in the stress process: advancing conservation of resources theory. *Applied Psychology*, 50(3), 337-421.
- Hodgins, G.A., Creamer, M., & Bell, R. (2001). Risk factors for posttrauma reactions in police officers: A longitudinal study. *The Journal of Nervous and Mental Disease*, 189(8), 541-547.
- Holbrook, T.L., Anderson, J.P., Sieber, W.J., Browner, D., & Hoyt, D.B. (1999). Outcome after major trauma: 12-month and 18-month follow-up results from the Trauma Recovery Project. *The Journal Of Trauma-Injury Infection and Critical Care*, 46(5), 765-773.
- Holbrook, T., Hoyt, D., Stein, M., & Sieber, W. (2001). Perceived threat to life predicts posttraumatic stress disorder after major trauma: risk factors and functional outcome. *The Journal Of Trauma*, 51(2), 287-292.
- Holbrook, T., Hoyt, D., Stein, M., & Sieber, W. (2002). Gender differences in long-term posttraumatic stress disorder outcomes after major trauma: women are at higher risk of adverse outcomes than men. *The Journal Of Trauma-Injury Infection and Critical Care*, 53(5), 882-888.

Hosmer Jr, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression* (3<sup>rd</sup> ed.). John Wiley & Sons.

Institute of Medicine Committee on Treatment of Posttraumatic Stress Disorder.

(2008). *Treatment of posttraumatic stress disorder: An assessment of the evidence*. National Academies Press.

Joy, D., Probert, R., Bisson, J.I., & Shepherd, J.P. (2000). Posttraumatic stress reactions after injury. *The Journal of Trauma and Acute Care Surgery*, 48(3), 490-494.

Jung, T., & Wickrama, K. A. S. (2008). An introduction to latent class growth analysis and growth mixture modeling. *Social and Personality Psychology Compass*, 2(1), 302-317.

Keane, T.M., Brief, D.J., Pratt, E.M., & Miller, M.W. (2007). Assessment of PTSD and its comorbidities in adults. In M.J. Friedman, T.M. Keane & P.A. Resick (Eds.), *Handbook of PTSD: Science and practice* (pp. 279-305). New York: Kluwer Academic/Plenum.

Kearns, M.C., Ressler, K.J., Zatzick, D., & Rothbaum, B.O. (2012). Early interventions for PTSD: A review. *Depression and Anxiety*, 29(10), 833-842.

Kessler, R. C. (2000). Posttraumatic stress disorder: The burden to the individual and to society. *Journal of Clinical Psychiatry*, 61(Suppl 5), 4-14.

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, 62(6), 593-602.

Kessler, R.C., Chiu, W.T., Demler, O., & Walters, E.E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, 62(6), 617-627.

- Kessler, R. C., Sonnega, A., Bromet, E., Hughes, M., & Nelson, C. B. (1995). Posttraumatic stress disorder in the National Comorbidity Survey. *Archives of General Psychiatry*, 52(12), 1048-1060.
- Kimerling, R., Ouimette, P., & Weitlauf, J.C. (2007). Gender Issues in PTSD. In M.J. Friedman, T.M. Keane & P.A. Resick (Eds.), *Handbook of PTSD: Science and practice* (pp. 279-305). New York: Kluwer Academic/Plenum.
- King, D. W., King, L. A., Foy, D. W., Keane, T. M., & Fairbank, J. A. (1999). Posttraumatic stress disorder in a national sample of female and male Vietnam veterans: Risk factors, war-zone stressors, and resilience-recovery variables. *Journal Of Abnormal Psychology*, 108(1), 164-170.
- King, L.A, King, D.W., Bolton, E.E., Knight, J.A., & Vogt, D.S. (2008). Risk factors for mental, physical, and functional health in Gulf War veterans. *Journal of Rehabilitation Research and Development*, 45(3), 395-407.
- Klein, E., Caspi, Y., & Gil, S. (2003). The relation between memory of the traumatic event and PTSD: Evidence from studies of traumatic brain injury. *Canadian Journal of Psychiatry*, 48(1), 28-33.
- Kleim, B., Ehlers, A., & Glucksman, E. (2007). Early predictors of chronic post-traumatic stress disorder in assault survivors. *Psychological Medicine*, 37(10), 1457-1467.
- Koenen, K. C., Harley, R., Lyons, M. J., Wolfe, J., Simpson, J. C., Goldberg, J., & ... Tsuang, M. (2002). A twin registry study of familial and individual risk factors for trauma exposure and posttraumatic stress disorder. *Journal of Nervous and Mental Disease*, 190(4), 209-218.

- Koren, D., Arnon, I., & Klein, E. (1999). Acute stress response and posttraumatic stress disorder in traffic accident victims: a one-year prospective, follow-up study. *The American Journal of Psychiatry*, 156(3), 367-373.
- Kremen, W.S., Koenen, K.C., Afari, N., & Lyons, M.J. (2012). Twin studies of posttraumatic stress disorder: differentiating vulnerability factors from sequelae. *Neuropharmacology*, 62(2), 647-653.
- Kutner, M. H., Nachtsheim, C., & Neter, J. (2004). *Applied linear regression models*. McGraw-Hill/Irwin.
- Lanius, R. A., Brand, B., Vermetten, E., Frewen, P. A., & Spiegel, D. (2012). The dissociative subtype of posttraumatic stress disorder: Rationale, clinical and neurobiological evidence, and implications. *Depression And Anxiety*, 29(8), 701-708.
- Lanius, R.A., Vermetten, E., Loewenstein, R.J., Brand, B., Schmahl, C., Bremner, J.D., & Spiegel, D. (2010). Emotion modulation in PTSD: Clinical and neurobiological evidence for a dissociative subtype. *The American Journal of Psychiatry*, 167(6), 640-647.
- Litz, B.T. & Maguen, S. (2007). Early intervention for trauma. In M.J. Friedman, T.M. Keane & P.A. Resick (Eds.), *Handbook of PTSD: Science and practice* (pp. 279-305). New York: Kluwer Academic/Plenum.
- Malta, L.S., Blanchard, E.B., Taylor, A.E., Hickling, E.J., & Freidenberg, B.M. (2002). Personality disorders and posttraumatic stress disorder in motor vehicle accident survivors. *Journal of Nervous and Mental Disease*, 190(11), 767-774.
- Marbley, A.F., & Rouson, L. (2011). Indigenous Systems within the African-American Community. *Multicultural Education*, 18(4), 2-9.

- Marmar, C.R., McCaslin, S.E., Metzler, T.J., Best, S., Weiss, D.S., Fagan, J., & ... Neylan, T. (2006). Predictors of posttraumatic stress in police and other first responders. *Annals of the New York Academy Of Sciences*, 1071(1), 1-18.
- Mason, S., Turpin, G., Woods, D., Wardrope, J., & Rowlands, A. (2006). Risk factors for psychological distress following injury. *British Journal of Clinical Psychology*, 45(2), 217-230.
- McDonald, S. D., & Calhoun, P. S. (2010). The diagnostic accuracy of the PTSD Checklist: A critical review. *Clinical Psychology Review*, 30(8), 976-987.
- McLoyd, V. C., Kaplan, R., Hardaway, C. R., & Wood, D. (2007). Does endorsement of physical punishment matter? Assessing moderating influences on the maternal and child psychological correlates of physical discipline in African American families. *Journal of Family Psychology*, 21(2) 165-174.
- McWilliams, N. (2011). *Psychoanalytic diagnosis: Understanding personality structure in the clinical process*. Guilford Press.
- Mellman, T.A., David, D., Bustamante, V., Fins, A.I., & Esposito, K. (2001). Predictors of post-traumatic stress disorder following severe injury. *Depression & Anxiety*, 14(4), 226-231.
- Mezuk, B., Rafferty, J.A., Kershaw, K.N., Hudson, D., Abdou, C.M., Lee, H., & ... Jackson, J.S. (2010). Reconsidering the role of social disadvantage in physical and mental health: Stressful life events, health behaviors, race, and depression. *American Journal of Epidemiology*, 172(11), 1238-1249.
- Michaels, A.J., Michaels, C.E., Moon, C.H., Smith, J.S., Zimmerman, M.A., Taheri, P.A., & Peterson, C. (1999a). Posttraumatic stress disorder after injury: Impact on general health outcome and early risk assessment. *The Journal of Trauma*, 47(3), 460-467.

- Michaels, A.J., Michaels, C.E., Zimmerman, M.A., Smith, J.S., Moon, C.H., & Peterson, C. (1999b). Posttraumatic stress disorder in injured adults: etiology by path analysis. *The Journal of Trauma and Acute Care Surgery*, 47(5), 867-873.
- Michopoulos, V., Norrholm, S.D., & Jovanovic, T. (2015). Diagnostic Biomarkers for posttraumatic stress disorder: Promising horizons from translational neuroscience research. *Biological Psychiatry*. Advance online publication. doi:10.1016 /j.biopsych.2015.01.005
- Miller, M.W., Wolf, E.J., Kilpatrick, D., Resnick, H., Marx, B.P., Holowka, D.W., & ... Friedman, M.J. (2013). The prevalence and latent structure of proposed DSM-5 posttraumatic stress disorder symptoms in U.S. national and veteran samples. *Psychological Trauma: Theory, Research, Practice, and Policy*, 5(6), 501-512.
- National Institute of Health (2013). *Burns and traumatic injury*. Retrieved from <http://report.nih.gov/NIHfactsheets/ViewFactSheet.aspx?csid=33>
- Norris, Fran H. & Hamblen, Jessica L. (2004). Standardized self-report measures of civilian trauma and PTSD. In J.P. Wilson, T.M. Keane & T. Martin (Eds.), *Assessing psychological trauma and PTSD* (pp. 63-102). New York: Guilford Press.
- O'Donnell, M.L., Creamer, M.C., Parslow, R., Elliott, P., Holmes, A.C., Ellen, S., & ... Bryant, R.A. (2008). A predictive screening index for posttraumatic stress disorder and depression following traumatic injury. *Journal of Consulting and Clinical Psychology*, 76(6), 923-932.
- O'Donnell, M.L., Creamer, M.C., & Pattison, P. (2004). Posttraumatic stress disorder and depression following trauma: Understanding comorbidity. *The American Journal of Psychiatry*, 161(8), 1390-1396.



- O'Donnell, M.L., Creamer, M.C., Pattison, P., & Atkin, C. (2004). Psychiatric morbidity following injury. *The American Journal of Psychiatry*, 161(3), 507-514.
- O'Donnell, M.L., Lau, W., Tipping, S., Holmes, A.N., Ellen, S., Judson, R., & ... Forbes, D. (2012). Stepped early psychological intervention for posttraumatic stress disorder, other anxiety disorders, and depression following serious injury. *Journal of Traumatic Stress*, 25(2), 125-133.
- Orsillo, S.M. (2001). Measures for acute stress disorder and posttraumatic stress disorder. In M.M. Antony & S.M. Orsillo (Eds.), *Practitioner's guide to empirically based measures of anxiety* (pp. 255-307). New York: KluwerAcademic/Plenum.
- Ozer, E.J., Best, S.R., Lipsey, T.L., & Weiss, D.S. (2008). Predictors of posttraumatic stress disorder and symptoms in adults: A meta-analysis. *Psychological Trauma: Theory, Research, Practice, and Policy*, 5(1), 3-36.
- Pacella, M.L., Hruska, B., & Delahanty, D.L. (2013). The physical health consequences of PTSD and PTSD symptoms: A meta-analytic review. *Journal of Anxiety Disorders*, 27(1), 33-46.
- Perkonig, A.A., Kessler, R.C., Storz, S.S., & Wittchen, H.U. (2000). Traumatic events and post-traumatic stress disorder in the community: Prevalence, risk factors and comorbidity. *Acta Psychiatrica Scandinavica*, 101(1), 46-59.
- Rauch, S.A.M., Foa E.B. (2003) *Post-traumatic stress disorder*. In D. Nutt & J. Ballenger (Eds.), *Anxiety Disorders* (pp. 65-81). Osney Mead, Oxford: Blackwell Science Ltd.
- Resick, P.A., Monson, C.M., & Chard, K.M. (2010). *Cognitive processing therapy: Veteran/military version*. Washington, DC: Department of Veterans' Affairs.

- Richmond, T.S., Ruzek, J., Ackerson, T., Wiebe, D.J., Winston, F., & Kassam-Adams, N. (2011). Predicting the future development of depression or PTSD after injury. *General Hospital Psychiatry, 33*(4), 327-335.
- Roberts, N.P., Kitchiner, N.J., Kenardy, J., & Bisson, J.I. (2009). Systematic review and meta-analysis of multiple-session early interventions following traumatic events. *American Journal of Psychiatry, 166*(3), 293-301.
- Roth, T.L. (2014). How traumatic experiences leave their signature on the genome: An overview of epigenetic pathways in PTSD. *Frontiers in Psychiatry, 5*(93), 1-2.
- Ruggiero, K.J., Del Ben, K., Scotti, J.R., & Rabalais, A.E. (2003). Psychometric properties of the PTSD Checklist—Civilian Version. *Journal of Traumatic Stress, 16*(5), 495-502.
- Sapp, M. (2006). *Basic psychological measurement, research, designs, and statistics without math*. Springfield, IL: Charles C. Thomas Publisher LTD.
- Shalev, A.Y., Freedman, S., Peri, T., Brandes, D., Sahar, T., Orr, S.P., & Pitman, R.K. (1998). Prospective study of posttraumatic stress disorder and depression following trauma. *The American Journal of Psychiatry, 155*(5), 630-637.
- Shalev, A.Y., Peri, T., Canetti, L., & Schreiber, S. (1996). Predictors of PTSD in injured trauma survivors: a prospective study. *The American Journal of Psychiatry, 153*(2), 219-225.
- Steuwe, C., Lanius, R.A., & Frewen, P.A. (2012). Evidence for a dissociative subtype of PTSD by latent profile and confirmatory factor analyses in a civilian sample. *Depression & Anxiety, 29*(8), 689-700.
- Stevens, J.P. (2009). *Applied multivariate statistics for the social sciences* (5th ed.). New York, NY, Taylor & Francis Group.

- Stolorow, R. D. (2007). *Trauma and human existence: Autobiographical, psychoanalytic, and philosophical reflections*. New York, NY: Routledge.
- Sue, D.W. & Sue, D. (2013). *Counseling the culturally diverse: Theory and practice*. Hoboken, NJ: John Wiley & Sons, Inc.
- Summers, R. F., & Barber, J. P. (2012). *Psychodynamic therapy: A guide to evidence-based practice*. Guilford Press.
- Terr, L.C. (1991). Childhood traumas: An outline and overview. *The American Journal of Psychiatry*, 148(1), 10-20.
- Tolin, D.F., & Foa, E.B. (2006). Sex differences in trauma and posttraumatic stress disorder: A quantitative review of 25 years of research. *Psychological Bulletin*, 132(6), 959-992.
- True, W.R., Rice, J., Eisen, S.A., Heath, A.C., Goldberg, J., Lyons, M.J., & Nowak, J. (1993). A twin study of genetic and environmental contributions to liability for posttraumatic stress symptoms. *Archives of general psychiatry*, 50(4), 257-264.
- Ursano, R.J., Fullerton, C.S., Epstein, R.S., Crowley, B., Kao, T.C., Vance, K., ... & Baum, A. (1999). Acute and chronic posttraumatic stress disorder in motor vehicle accident victims. *The American Journal of Psychiatry*, 156(4), 589-595.
- van der Kolk, B. (2009). Developmental trauma disorder: towards a rational diagnosis for chronically traumatized children. *Praxis Der Kinderpsychologie Und Kinderpsychiatrie*, 58(8), 572-586.
- van der Kolk, B.A., & Courtois, C.A. (2005). Editorial comments: Complex developmental trauma. *Journal of Traumatic Stress*, 18(5), 385-388.
- Verger, P., Dab, W., Lamping, D. L., Loze, J.Y., Deschaseaux-Voinet, C., Abenhaim, L., & Rouillon, F. (2004). The psychological impact of terrorism: An epidemiologic study of

- posttraumatic stress disorder and associated factors in victims of the 1995-1996 bombings in France. *The American Journal of Psychiatry*, 161(8), 1384-1389.
- Vittinghoff, E., & McCulloch, C. E. (2006). Relaxing the rule of ten events per variable in logistic and Cox regression. *American Journal of Epidemiology*, 165(6), 710-718.
- Vogt, D.S., King, D.W., & King, L.A. (2007). Risk pathways for PTSD. In M.J. Friedman, T.M. Keane & P.A. Resick (Eds.), *Handbook of PTSD: Science and practice* (pp. 99-113). New York: Kluwer Academic/Plenum.
- Weathers, F. W., Litz, B. T., Herman, D. S., Huska, J. A., & Keane, T. M. (1993). *The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility*. Paper presented at the 9th Annual Conference of the ISTSS, San Antonio, TX.
- Weathers, F.W., Keane, T.M., & Davidson, J.T. (2001). Clinician-Administered PTSD Scale: A review of the first ten years of research. *Depression and Anxiety*, 13(3), 132-156.
- Wells, A., & Matthews, G. (1996). Modelling cognition in emotional disorder: The S-REF model. *Behaviour Research and Therapy*, 34(11), 881-888.
- Wilcox, H.C., Storr, C.L., & Breslau, N. (2009). Posttraumatic stress disorder and suicide attempts in a community sample of urban American young adults. *Archives of General Psychiatry*, 66(3), 305-311.
- Wohlfarth, T., Winkel, F., & Van Den Brink, W. (2002). Identifying crime victims who are at high risk for post traumatic stress disorder: developing a practical referral instrument. *Acta Psychiatrica Scandinavica*, 105(6), 451-460.
- Youden, W. J. (1950). Index for rating diagnostic tests. *Cancer*, 3(1), 32-35.

- Zatzick, D.F., Jurkovich, G.J., Rivara, F.P., Russo, J., Wagner, A., Wang, J., & ... Katon, W. (2013). A randomized stepped care intervention trial targeting posttraumatic stress disorder for surgically hospitalized injury survivors. *Annals of Surgery*, 257(3), 390-399.
- Zatzick, D.F., Jurkovich, G.J., Rivara, F.P., Wang, J., Fan, M.Y., Joesch, J., & Mackenzie, E. (2008). A national U.S. study of posttraumatic stress disorder, depression, and work and functional outcomes after hospitalization for traumatic injury. *Annals of Surgery*, 248, 429-437.
- Zatzick, D.F., Kang, S.M., Müller, H.G., Russo, J.E., Rivara, F.P., Katon, W., & ... Roy-Byrne, P. (2002). Predicting posttraumatic distress in hospitalized trauma survivors with acute injuries. *The American Journal of Psychiatry*, 159(6), 941-946.
- Zatzick, D.F., Rivara, F.P., Jurkovich, G.J., Hoge, C.W., Wang, J., Fan, M. Y., ... & Mackenzie, E.J. (2010). Multisite investigation of traumatic brain injuries, posttraumatic stress disorder, and self-reported health and cognitive impairments. *Archives of General Psychiatry*, 67(12), 1291-1300.
- Zatzick, D.F., Rivara, F.P., Nathens, A.B., Jurkovich, G.J., Wang, J., Fan, M.Y., & ... Mackenzie, E.J. (2007). A nationwide US study of post-traumatic stress after hospitalization for physical injury. *Psychological Medicine*, 37(10), 1469-1480.
- Zatzick, D.F., Roy-Byrne, P., Russo, J.E., Rivara, F.P., Driesch, R., Wagner, A., & ... Katon, W. (2004). A randomized effectiveness trial of stepped collaborative care for acutely injured trauma survivors. *Archives of General Psychiatry*, 61(5), 498-506.
- Zovkic, I.B., Meadows, J.P., Kaas, G.A., & Sweatt, J.D. (2013). Interindividual variability in stress susceptibility: a role for epigenetic mechanisms in PTSD. *Frontiers in Psychiatry*, 4(60), 1-22.

Zweig, M.H., & Campbell, G. (1993). Receiver-operating characteristic (ROC) plots: A fundamental evaluation tool in clinical medicine. *Clinical Chemistry*, 39(4), 561-577.

## Appendix A

## Predictive Screening Tool for Depression and PTSD after Injury

<b>BEFORE THIS INJURY:</b>	<b>Yes</b>	<b>No</b>	<b>Depressi</b>	<b>PTSD</b>
Has there ever been a time in your life you have been bothered by feeling down or hopeless, or lost all interest in things you usually enjoyed for more than 2 weeks?	1	0		
<b>WHEN YOU WERE INJURED OR RIGHT AFTERWARDS:</b>				
Did you feel really helpless?	1	0		
Did it seem unreal or like it was happening in a dream or slow motion?	1	0		
<b>SINCE YOUR INJURY</b>				
Have you wanted to (or tried hard to) stay away from things that remind you of what happened?	1	0		
Have you been staying away from people, even people you are usually close to?	1	0		
Are you worried about money because of what happened?	1	0		
Since you were hurt, have you been worried because you had trouble keeping your mind on things?	1	0		
Is there someone who has responded badly when you told them about what happened?	1	0		
<b>Total (Sum the number in each column)</b>				
<b>Scoring Metric</b>			≥2 is positive for	≥3 is positive for

## Appendix B

## ITSS Items Administered to Participants

<b>BEFORE THIS INJURY:</b>	Yes	No
1. Have ever experienced mental or emotional distress following a violent or terrifying event? (emotional distress related to a PTE)	1	0
2. Have you ever taken medication for, or been given a mental health diagnosis? (pre-existing psychopathology)	1	0
3. Would you say that you prefer to be alone? (personality/introversion)	1	0
4. Has the last year or so been full of stressful events that were tough to deal with? (life stress prior to event/past year/objective)	1	0
5. In general do you find that there is so much stress in your life that you find yourself unable to handle it? (life stress prior to event/perception of)	1	0
6. Do you regularly use alcohol...any other drugs? (history of substance abuse)	1	0
7. Would you say that you have strong support from friends and family? (lack of social support prior to event)	0	1
8. Has there ever been a time in your life you have been bothered by feeling down or hopeless or lost all interest in things you usually enjoyed for more than 2 weeks?	1	0
<b>WHEN YOU WERE INJURED OR RIGHT AFTERWARDS:</b>		
9. Did you think you were going to die? (perceived life threat)	1	0
10. Do you think this was done to you intentionally? (intentional injury)	1	0
11. Did you feel terrified or horrified? (peritraumatic emotionality)	1	0
12. Do you remember what happened to you? (memory for/conscious for event)	1	0
13. Were you injured so severely that you are confident that your life will never be the same? (cognition)	1	0
14. Did you feel really helpless?	1	0
15. Did it seem unreal or like it was happening in a dream or slow motion?	1	0
<b>SINCE YOUR INJURY:</b>		
16. Have you worried that you won't have everything you need to cope with what has happened to you? (social support/worry)	1	0
17. Have you worried that you will not be able to deal with your future? (cognition/worded to reflect a potential reality/coping)	1	0
18. Will you have the financial resources you need to recover? (posttraumatic life stress)	0	1
19. Have you had disturbing thoughts or images run through your mind? (Re-experiencing)	1	0
20. Have you been having nightmares that began following the event? (Re-experiencing)	1	0
21. Have you felt less hopeful about your future? (cognition/mood)	1	0
22. Have you felt as if you deserved this? (cognition/mood)	1	0
23. Have you felt emotionally detached from your loved ones? (cognition/mood)	1	0
24. Have you felt worthless? (cognition/mood/depression)	1	0



25. Have you felt hopeless? (cognition/mood/depression)	1	0
26. Have you wished that you were dead? (cognition/mood/depression)	1	0
27. Have you felt as if you just want to be alone? (mood/depression)	1	0
28. Do you find yourself crying and are unsure why? (mood/depression)	1	0
29. Have you found yourself unmotivated to engage in treatments in the hospital? (cognition/mood/depression)	1	0
30. Have you felt more nervous or anxious than usual? (anxiety)	1	0
31. Have you had thoughts or feelings that terrible things are about to happen? (cognition/mood/anxiety)	1	0
32. Have you had unusual experiences unrelated to your injury like your heart pounding, sweating, numbness or tingling, or feeling lightheaded? (arousal/anxiety)	1	0
33. Have you felt more restless, tense or jumpy than usual? (arousal)	1	0
34. Have you been avoiding thinking or talking about the event? (avoidance)	1	0
35. When you are given a chance to sleep in the hospital, are you still unable to fall asleep? (arousal)	1	0
36. Have you felt angry or full of rage? (initial emotion/anger)	1	0
37. Have you felt shameful or guilty? (initial emotion/guilt/shame)	1	0
38. Have you found yourself unable to stop worrying? (trait worry)	1	0
39. Are there parts of the event that you don't remember that you were awake for and that you think you should remember? (dissociative amnesia)	1	0
40. Do you find yourself thinking that the world is unsafe and that people are not to be trusted? (Cognition)	1	0
41. Have you been really irritable? (arousal)	1	0
42. Have you felt detached from your body or have you felt detached from your surroundings, as if in a dream? (dissociation)	1	0
43. Have you wanted to (or tried hard to) stay away from things that remind you of what happened?	1	0
44. Have you been staying away from people, even people you are usually close to?	1	0
45. Are you worried about money because of what happened?	1	0
46. Since you were hurt, have you been worried because you had trouble keeping your mind on things?	1	0
47. Is there someone who has responded badly when you told them about what happened?	1	0

## Appendix C

## Demographic Questions Asked of Participants

Age \_\_\_\_\_

Sex: M F T

Race/ethnicity \_\_\_\_\_

Year in school/occupation \_\_\_\_\_

Veteran Y/N

Era \_\_\_\_\_

Branch \_\_\_\_\_

Injury Type \_\_\_\_\_

Injury date \_\_\_\_\_

Phone numbers at which participant can be contacted for follow-up

1 \_\_\_\_\_

2 \_\_\_\_\_

3 \_\_\_\_\_

## Josh Hunt

### EDUCATION

<b>Postdoctoral Fellowship</b> Sep. 2015-‘17	Department of Surgery, Division of Trauma and Critical Care. Froedtert & the Medical College of Wisconsin
<b>Ph.D.</b> May 2015	Counseling Psychology University of Wisconsin – Milwaukee (APA accredited) Dissertation: <i>Predicting PTSD in single-incident trauma survivors with an acute injury.</i>
<b>Predoctoral Internship</b> Aug. 2014-‘15	Clinical Psychology with emphasis on trauma, health, and assessment. Milwaukee Veterans Affairs Medical Center (APA accredited)
<b>M.A.</b> Dec. 2009	Community Counseling Concordia University of Chicago (CACREP accredited) Thesis: <i>Mental illness stigma: A measure within the nursing home setting.</i>
<b>B.A.</b> Dec. 2004	Psychology Southern Illinois University - Carbondale

### LICENSURE and CERTIFICATION

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National Certified Counselor

### PREDOCTORAL CLINICAL TRAINING

<b>Milwaukee VA Medical Center</b> <b>APA accredited predoctoral internship</b> Completing yearlong rotation in post-deployment outpatient mental health, providing outpatient psychotherapy and group to Veterans of all eras. Yearlong combined rotation in the neuropsychology clinic with rotations in the polytrauma support clinic, and neurology clinic. Conducting neuropsychological interviews, testing, report writing, and feedback. <i>Primary Supervisors:</i> Thomas Hammeke, Ph.D. & Shauna Fuller, Ph.D.	<b>Mental Health Division</b> <b>Aug. 2014 - Current</b>
<b>Froedtert Hospital and MCW</b> <b>Doctoral trauma psychology practicum</b> Conducted PTSD screens on patients admitted to the trauma surgery service via the Level I Trauma Center. Provided outpatient psychotherapy to patients diagnosed with PTSD and other clinical disorders. Offered psychological consultation to patients with elevated levels of acute distress. Provided brief in-hospital interventions to patients and their families on various services and ICUs. <i>Supervisor:</i> Terri deRoos-Cassini, Ph.D.	<b>Department of Surgery, Division of Trauma &amp; Critical Care</b> <b>June 2012- Aug. 2014</b>
<b>Milwaukee VA Medical Center</b> <b>Doctoral geropsychology practicum</b> Provided Inpatient and outpatient psychotherapy to elderly Veterans with various psychological disorders and presenting problems. Assessed cognitive functioning and decisional capacity. Led weekly reminiscence group and collaborated with interdisciplinary treatment team at care plan meetings held in the community living center. <i>Supervisors:</i> Heather M. Smith, Ph.D. & Irene Kostiwa, Ph.D.	<b>Mental Health Division</b> <b>Sep. 2013- May 2014</b>

**Froedtert Hospital and the Medical College of Wisconsin**  
**Doctoral transplant psychology practicum**

**Department of Transplant Surgery**  
**June 2012- May 2013**

Conducted pre-transplant evaluations and wrote integrative reports with recommendations to enhance surgery outcomes and maximize post-operative success. Provided psychotherapeutic services to transplant candidates and recipients. Conducted psychological consultations with inpatients as requested by the patient or by the multidisciplinary treatment team. *Supervisor:* Rebecca Anderson, Ph.D.

**Froedtert Hospital and the Medical College of Wisconsin**  
**Doctoral bariatric/general psychotherapy practicum**

**Department of Plastic Surgery**  
**June 2012- May 2013**

Delivered long-term and short-term individual therapy to a diverse clientele with various clinical disorders. Conducted bariatric evaluations and wrote comprehensive reports with recommendations to enhance surgery outcomes and maximize long-term post-operative dietary compliance. Provided psychotherapeutic services to patients diagnosed with eating disorder NOS and concurrent disorders. *Supervisor:* Mark Rusch, Ph.D.

**Froedtert Hospital and MCW**  
**Doctoral assessment practicum**

**Department of Neurology, Neuropsychology Clinic**  
**May 2011- June 2012**

Administered comprehensive psychometric batteries assessing patients' neurological and/or psychiatric functioning. Utilized measures evaluating a multitude of cognitive functions including intellectual ability, memory, executive functioning, attention/concentration, and visuospatial deficits. Trained in fundamentals of assessment interpretation and neuropsychological report writing. *Supervisors:* David Sabsevit, Ph.D. & Jennifer Geiger, Ph.D.

**Tosa Behavioral Health Center – MCW**  
**Doctoral psychotherapy practicum**

**Center for Consultative Academic Psychiatry Services**  
**Sep. 2010 - May 2011**

Delivered long-term and short-term individual psychotherapy. Completed necessary documentation, treatment planning, individual and group notes, and case management. Worked in tandem with psychiatry and nursing staff to provide integrated and comprehensive psychosocial rehabilitation. Observed and co-facilitated group psychotherapy sessions with males ages 8-12 presenting with autism spectrum disorders and social skills difficulties. *Supervisor:* George Jacobson, Ph.D.

**Alexian Brothers Center for Mental Health**  
**Master's internship**

**Partial Hospitalization Program**  
**Feb. 2009 - Sep. 2009**

Day program group psychotherapy for patients with chronic and acute disorders, recently discharged from the hospital or working to prevent hospitalization. Applied crisis intervention training and skills to intercede in suicidal and psychotic episodes. Collaborated with supervisor to create psychosocial curriculum and tailor group material to patient needs. Conducted intake assessments, discharge planning, and case management. *Supervisors:* Katherine Connolly, M.A., LCPC & Rick Germann, M.A., LCPC

**Concordia University Chicago Counseling Clinic**  
**Master's practicum**

**Jan. 2009 – Mar. 2009**

Provided psychotherapy to diverse clientele under the supervision of the university seminar leader. Trained in an integrative approach in both group and individual psychotherapy. *Supervisors:* Daniel Bishop, Psy.D. & Brenda Becker, M.A.

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## MENTAL HEALTH EMPLOYMENT

### **Manor Care Nursing and Rehabilitation**

#### **Social Services Coordinator**

**Mar. 2009 - Mar. 2010**

Conferred with consulting psychologist as primary contact for mental health issues and stability of residents with mental health diagnoses. Oversaw long-term care unit of 55 residents presenting with a range of health issues. Provided mental health interventions; completed social service assessments; coordinated hospice services; communicated with families; completed MDS assessments and quarterly/annual reviews; conducted care plan meetings. *Supervisor: Amy Depotty, M.S.W., LCSW*

### **Niles Nursing and Rehabilitation**

#### **Psychiatric Rehabilitation Services Coordinator**

**Sept. 2008 - Mar. 2009**

Collaborated with a comprehensive social service team providing services to residents 20 years of age and older. Provided one to one consultation, counseling, case management and crisis intervention/involuntary hospitalization to a caseload of 35 clients with chronic and acute mental illness. Also worked with elderly residents with various health concerns and neurological disorders. Completed intakes, care plans, psychosocial evaluations, MDS assessments and quarterly reviews. *Supervisor: Erin Kelly, M.A., LCPC*

### **Alden of Long Grove**

#### **Psychiatric Rehabilitation Services Coordinator**

**Mar. 2007 - Sept. 2008**

Worked with psychiatrists and nursing team to provide case management and counseling services to a clientele aged 20 and up with chronic and acute mental illness. Administered therapeutic rehabilitation services to patients with problems ranging from psychosis to chronic suicidal ideation and self-injury. Provided weekly counseling to a caseload of 17 residents; facilitated daily psychoeducational groups; activities; crisis intervention/hospitalization; and charting. Completed intakes, psychosocial evaluations, MDS assessments, quarterly reviews, and assisted in discharge planning. *Supervisor: Cathy Pappagorgio, M.A., LCPC*

### **Boys Hope Girls Hope**

#### **Residential Counselor - Lead House Parent**

**May 2006- Jan. 2007**

Lead a staff of four live-in residential counselors in daily routine to ensure optimal house function and psychological health and well-being of group of diverse resident scholars. Assisted in academic growth and success of adolescents via daily study; counseling; crisis intervention; appropriate discipline; and communication with teachers, parents and staff. Completed weekly and monthly administrative responsibilities. *Supervisor: Julie Grey, M.S.W., LCSW*

### **Alternative Behavior Treatment Center**

#### **Residential Counselor**

**Sept. 2005- May 2006**

Performed a wide variety of client care activities to diverse clientele as directed by the Unit Leader such as daily living skills, teaching appropriate behaviors and ensuring resident safety from self and others. Participated on a multidisciplinary team to provide direct patient care, crisis intervention, treatment planning, groups, and discharge plans. *Supervisor: Dawn Lavorsi, M.A., LCPC*

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## TEACHING EXPERIENCE

### University of Wisconsin Milwaukee

#### Instructor

**Sep. 2010 – May 2013**

Taught three sections of an undergraduate vocational planning course. Lectured and facilitated discussion to assist students in determining academic major and vocational match in addition to fostering academic and professional development. Partnered with UWM Career Development Center staff to enhance course effectiveness and bolster course material. *Supervisor:* Lauren Lessac, M.S.

### University of Wisconsin Milwaukee

#### Co-Instructor

**Jan. 2013- May 2013**

Assisted in facilitating online trauma counseling course for students in counseling, nursing, and occupational therapy. Made revisions and edits to course materials as requested by the instructor. Assisted in facilitating online conversations and ensuring appropriate student participation. *Supervisor:* Leah Arndt, Ph.D.

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## RESEARCH GRANT

Title: Initial Development of Trauma Screen  
 Source: Research Affairs Committee (MCW), New Faculty Grant (deRoos-Cassini PI)  
 Role: Co-Investigator  
 Dates: July, 2014 – June, 2015  
 Direct Funds: \$25,000

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## RESEARCH EXPERIENCE

### MCW Trauma and Quality of Life research team

**Medical College of Wisconsin**

#### Research Assistant/Principal Investigator

**June 2012- Present**

Designed, proposed and have begun dissertation to create a predictive screen for PTSD. Received MCW, IRB and OCCRIC approval to conduct research at Froedtert Hospital. Made significant contributions to grant writing and submitted three grant applications. *Research Advisor:* Terri deRoos-Cassini, Ph.D.

### Hypnosis and Health Psych Lab

**University of Wisconsin, Milwaukee**

#### Research Assistant/Principal Investigator

**Sep. 2011 - Present**

Ongoing collaboration with integrative research teams on a range of projects including: mental illness stigma among service providers; creating an early screening measure for injured trauma survivors; hypnosis with inpatient adolescents; indigenizing psycho-oncology with American Indians. *Supervisor:* Marty Sapp, Ed.D.

### Meta-Analytic Research Team

**University of Wisconsin, Milwaukee**

#### Lead Research Assistant

**Sep. 2010 - Present**

Completed meta-analytic review of empirical literature evaluating the efficacy of psychological interventions among patients suffering from chronic pain. Organized the research team, database search procedures, team coding effort, data entry and interpretation of output. *PI:* Thomas Baskin, Ph.D.

### Concordia University Chicago

#### Master's Thesis

**Jan. 2009 - Nov. 2009**

Proposed and conducted a research study examining attitudes towards patients diagnosed with a mental illness in a nursing home setting. Distributed questionnaires to targeted population, collected, analyzed and interpreted data. *Research Advisors:* Daniel Bishop, Psy.D. & Karin Anderson, Ph.D.

**Integrative Neuroscience Laboratory****Southern Illinois University of Carbondale****Principal Investigator****Jan. 2004 - Dec. 2004**

Wrote and submitted a grant for the 2004 Undergraduate Creative Research Award. Received and allocated funds for research purposes; developed study design; wrote protocols necessary to execute study; collected, analyzed, and interpreted data. Presented preliminary findings at the Undergraduate Creative Research Forum. Trained additional research assistants to competently resume data acquisition for the remainder of the study. *Research Advisor*: David Gilbert, Ph.D.

**Integrative Neuroscience Laboratory****Southern Illinois University of Carbondale****Research Assistant****Jan. 2003 - Dec. 2004**

Facilitated comfort and familiarity of research participants with research requirements; acquisition of electroencephalography (EEG) and eye tracking data; monitored data collection during experimental sessions; data entry and processing; revised and implemented protocols; trained lab members; and attended weekly lab meetings. Lead eye tracking data acquisition in pilot study, paid undergraduate research assistant position. *PI*: David Gilbert, Ph.D.

**MANUSCRIPTS and BOOK CHAPTERS**

**Hunt, J.**, Alomá, A., Lira, E., Wohlers, H., Lopez, M., & Sapp, M. (Fall, 2013) Attitudes towards patients with a mental illness: A comparative analysis of counseling students and nursing home care providers. *Wisconsin Counseling Journal*.

Rouse, L., Davis, A., & **Hunt, J.** (Under review). It moves like a spider: Indigenizing psycho-oncology with American Indians/Alaska Natives. *Journal of American Indian and Alaska Native Mental Health Research*.

Baskin, T., **Hunt, J.**, Kim, S., Lambrou, K., & Ghosh, A. (Manuscript in preparation) Efficacy of psychological intervention in the treatment of persistent pain: Meta-analysis of treatment outcome studies.

deRoos-Cassini, T.A., & **Hunt, J.** (Manuscript in preparation) Trauma and Related Disorders. In Nietzel, M.T., Bernstein, D.A., McCauley, E.A., & Speltz, M.L. (2<sup>nd</sup> ed) *Abnormal Psychology*.

deRoos-Cassini, T.A., & **Hunt, J.** (Manuscript in preparation) Schizophrenia. In Nietzel, M.T., Bernstein, D.A., McCauley, E.A., & Speltz, M.L. (2<sup>nd</sup> ed) *Abnormal Psychology*.

**POSTERS and PRESENTATIONS**

**Hunt, J.**, Simiola, V., & deRoos-Cassini, T. (2015). *Development of a brief screen to predict PTSD among adults admitted to a level 1 trauma center*. Paper presented at the 23<sup>rd</sup> Annual Emergency Medicine Research Forum, Milwaukee, WI.

**Hunt, J.**, deRoos-Cassini, T., & Sapp, M. (2013) *Predicting posttraumatic stress disorder in single incident trauma survivors with an acute injury*. Poster presented at International Society for Traumatic Stress Studies 29<sup>th</sup> Annual Meeting, Philadelphia, PA.

**Hunt, J.**, Alomá, A., Lira, E., DePratt, T., Quant, M., Del Ponte, M. & Sapp, M. (2013) *Integrating hypnosis into early intervention and screening of injured trauma survivors*. Paper presented at 121<sup>st</sup> Annual Convention of the American Psychological Association, Honolulu, Hawaii.

**Hunt, J.**, Kim, S., Lambrou, K., Ghosh, A., & Baskin, T. (2013) *Efficacy of psychological intervention in the treatment of persistent pain: Meta-analysis of treatment outcome studies*. Poster presented at

the division 17 social hour at the 121<sup>st</sup> Annual Convention of the American Psychological Association, Honolulu, Hawaii.

**Hunt, J.,** Alomá, A., Lira, E., Wohlers, H., Lopez, M., & Sapp, M. (2013) *Attitudes towards patients with a mental illness: A comparative analysis of counseling students and nursing home care providers*. Poster presented at the 2013 Wisconsin Psychological Association Annual Conference, Madison, WI.

Alomá, A., **Hunt, J.,** Lira, E., DePratt, T., Quant, M., Del Ponte, M. & Sapp, M. (2013) *Medical providers' perceptions of hypnosis for Latinos with type 2 diabetes: Findings and implications*. Paper presented at 121<sup>st</sup> Annual Convention of the American Psychological Association, Honolulu, Hawaii.

Quant, M., Alomá, A., DePratt, T., Lira, E., **Hunt, J.,** Del Ponte, M. & Sapp, M. (2013) *Hypnotic susceptibility of diverse inpatient adolescents*. Paper presented at 121<sup>st</sup> annual convention of the American Psychological Association, Honolulu, Hawaii.

Wester, S.R., Danforth, L., Arndt, L., **Hunt, J.,** & Davis, A. (2011). *Male veterans of military service, stigma, and attitudes toward counseling: The role of expectations and gender role conflict*. Poster presented at the 119<sup>th</sup> Annual Convention of the American Psychological Association, Washington, DC.

**Hunt, J.,** Gilbert, D. (2004) *The effects of nicotine and anxiety on attentional bias and mood interpretation*. Poster presented at Annual Undergraduate Creative Research Forum, Southern Illinois University Carbondale.

#### PROFESSIONAL MEMBERSHIPS

Psi Chi, Southern Illinois University  
American Psychological Association  
Wisconsin Psychological Association

APA Division 17: Society of Counseling Psychology  
APA Division 38: Health Psychology  
APA Division 56: Trauma Psychology