

POST-TRAUMATIC STRESS DISORDER (PTSD) SYMPTOMS AS PREDICTORS
OF SUICIDE BEHAVIOR AMONG VETERANS WITH AND WITHOUT A
HISTORY OF TRAUMATIC BRAIN INJURY (TBI)

A Dissertation

by

EDGAR JAVIER VILLARREAL

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2012

Major Subject: Counseling Psychology

Post-Traumatic Stress Disorder (PTSD) Symptoms as Predictors of Suicide Behavior
among Veterans with and without a History of Traumatic Brain Injury (TBI)

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ABSTRACT

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Among Veterans with and without a History of Traumatic Brain Injury (TBI).

(August 2012)

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Co-Chairs of Advisory Committee: Dr. Timothy Elliott
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Prior research has established that a history of post-traumatic stress disorder (PTSD) and/or traumatic brain injury (TBI) increases the risk of suicide behavior. Few studies have examined the role of specific PTSD symptom clusters and suicide attempts. The current study is among a handful of studies that have examined the association between the presence of PTSD symptom clusters and suicide attempts among Veterans with PTSD and/or TBI. The study utilized archival data from a sample of 137 Veterans receiving mental health treatment at the Denver Veteran Affairs Medical Center. Results from logistic regression analyses indicated that PTSD symptom clusters were not associated with an increased risk for suicide behavior among individuals with and without a history of TBI. Findings suggest that looking at the presence of PTSD symptoms is not sufficient to fully account for the risk of suicide behavior. Clinical and research implications on the need to examine the role of PTSD symptom severity and suicide behavior are discussed.

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NOMENCLATURE

ACS- Acquired Capability for Suicide

APA- American Psychological Association

CAPS- Clinician Administered PTSD Scale

CDC-Centers for Disease Control

EMR- Electronic Medical Record

IOM- Institute of Medicine

IPTS-Inter-Personal Theory of Suicide

LOC- Loss of Consciousness

MIRECC- Mental Illness Research, Education & Clinical Center

OEF- Operation Enduring Freedom

OIF- Operation Iraqi Freedom

OR- Odds Ratio

PCL- Post Traumatic Stress Disorder Check List

PTSD- Post Traumatic Stress Disorder

SAH- Suicide Attempt History

SAS- Statistical Analyses Software

SCID- Structure Clinical Interview for DSM

TBI- Traumatic Brain Injury

VA- Veterans Affairs

WHO- World Health Organization

CHAPTER I

INTRODUCTION

Suicide and suicide behavior have become major public health concerns in the United States and around the world (Department of Health and Human Services, 1999; World Health Organization, 2011). In the U.S. alone, suicide ranks among the top eight leading causes of death with over 32,000 people ending their lives each year (Centers for Disease Control, 2009). This rate represents 101 suicides per day, approximately one every 15 minutes or 10.8 suicides per 100,000 populations (CDC, 2009). Globally, an estimated one million people die by suicide each year, more than are lost to homicide or to war combined (WHO, 2011). It has also been reported that suicide has increased by 60% worldwide over the last 45 years and is one of the top three leading causes of death among individuals ages 15-44 (WHO, 2011). Furthermore, these statistics are believed to be higher than what has been reported as suicides are frequently underreported (Satcher, 2000).

Yet as startling as these statistics are, the prevalence of the occurrence of suicide behavior, both attempts and completions, cannot accurately be ascertained as most epidemiological studies often only examine deaths by suicides and fail to account for the full spectrum of suicide behavior that includes suicide attempts (McKeon, 2009). In 2008, according to an estimate by the American Association of Suicidology (AAS), the number of suicide attempts outnumbered suicide completions 25 to 1; underscoring the importance of research examining suicide attempts. Suicide attempt data continues to be

This dissertation follows the style of *Suicide and Life-Threatening Behavior*.

the most reliable predictor of suicide completions as 30-40% of suicide deaths are preceded by a suicide attempt. In fact, of those who died by suicide and had made a prior attempt, 70% had made one prior attempt, approximately 14% had made two previous attempts, and the rest had made three or more attempts (Maris, 1992).

One population at increased risk for suicide is military Veterans¹ (Kaplan et al., 2007). Findings by Kaplan and colleagues (2007) suggest that a range of factors increase the likelihood that those who have served in the military will die by intentional self-inflicted injury. Furthermore, they found that Veterans were twice as likely to die by suicide as members of the general population (Kaplan et al., 2007). Studies have focused on the relationship between psychiatric illness, including depression and substance abuse, and Veteran suicide (Zivin et al, 2007). Moreover, among Vietnam Veterans, those with Post-Traumatic Stress Disorder (PTSD) were more likely to die by suicide than those without PTSD (Bullman & Kang, 1994). Signature wounds of the current conflicts in Iraq and Afghanistan include PTSD and traumatic brain injury (TBI) (Hoge et al, 2007). In turn, research efforts have begun to focus on identifying mental and physical health outcomes associated with these conditions. However, previous work regarding suicide in Veterans with both of these conditions has been limited (Brenner, Vanderploeg, Terrio, 2009; Corrigan & Bognar, 2007).

Identification and mitigation of suicide risk factors is vital to suicide preventing strategies (Mann, 2005). The importance of suicide research was underscored in 2001 when the Department of Health and Human Services(DHHS) established the National

¹ The word “Veteran” is capitalized throughout this entire document in accordance to VA documentation standards.

Strategy for Suicide Prevention which established suicide as a preventable phenomenon and set critical goals of increasing suicide prevention, awareness, and research. In 2002, The Institute of Medicine (IOM) released a report, *Reducing Suicide: A National Imperative*, which reviewed the status of our scientific understanding of the causes and prevention of suicide. The report concluded that as a field we continue to lack the ability to integrate how suicide risk and protective factors elicit suicidal behavior (Goldsmith, Pellmar, Kleinman, & Bunney, 2002, p.3). The central objective of this dissertation is to answer this call for research by furthering the existing body of literature on suicide risk as it relates to PTSD symptomatology and TBI. The current study is among a limited body of literature examining suicide risk as it pertains to specific PTSD symptoms. The present study will examine the following questions concerning PTSD, TBI and suicide behavior:

- Q-1) What are the relative contributions of specific PTSD symptom clusters to the prediction of suicide attempt(s)?
- Q-2) What are the relative contributions of the specific PTSD symptom clusters in the prediction of Veteran suicide attempt(s), taking into account the presence of TBI?

The research hypotheses for the current study are:

- (a) Re-experiencing symptoms will more closely associate with an increase in suicide among Veterans with both PTSD and or TBI.
- (b) Hyperarousal symptoms will more closely associate with an increase in suicide among Veterans with both PTSD and or TBI.

(d) Individuals with PTSD and TBI will closely associate with an increased risk of suicide, even more than that of individuals with only PTSD or TBI alone.

CHAPTER II

REVIEW OF LITERATURE

A review of the literature was conducted in order to gain an increased understanding of the relationship between suicidality, PTSD and TBI. A search of the databases: Psych Info, Psych Articles, Pilots, Academic Search Elite, Pub Med, Medline, and Google Scholar was conducted to locate empirical studies with the following keyword search parameters: combat trauma; military Veterans; Posttraumatic stress disorder; PTSD; PTSD SYMPTOMS; suicide; Traumatic Brain Injury and TBI.

2.1 General Information about Suicide

Suicidality is the current term used to encompass suicidal thoughts, gestures or behaviors and attempts. *Suicide* is defined as an act of voluntarily and intentionally taking one's own life completed by a person in extreme distress who seeks to escape intolerable psychic pain (Schneidman, 1996). *Suicide attempt* is the deliberate act of self-harm with at least some intent to die that *does not* result in death (Soubrier, 1993). Suicidality can be understood as a form of coping for individuals who feel overwhelmed and use suicide as a way of escaping strong negative emotions. The question as to why exactly it is that people turn to suicide as a way of coping has no clear answer yet several psychological theories have made contributions to our understanding of suicide. Among the most popular is that of Edwin Schneidman's theory which conceptualized suicide behavior as an attempt to escape from unendurable psychological pain (Schneidman, 1996). Aaron Beck's theory on suicide emphasized the significant role of hopelessness

and cognitive sensitization of suicidal thoughts and behaviors (Beck, 1996; Beck, Steer, Kovaks, & Garrison, 1985). Linehan (1993) examined the role of emotional dysregulation and suicide behavior. According to this theory, suicidal individuals frequently experience strong emotions which they have difficulty tolerating without resorting to behaviors that help them escape or moderate these intense and painful emotions. Increasing in popularity is Joiner's theory of suicide. Joiner (2005) hypothesizes that individuals are not born with the capacity for lethal self-injury. He adds that people obtain the desire to die by losing their innate fear of death through the process of habituation as they are repeatedly desensitized by thoughts of suicide and past suicide attempts. According to Joiner, in order to die by suicide people must want to kill themselves and must possess the capacity through which to carry that action (Joiner, 2005).

Most recently, Seguin et al. (2007) proposed an interesting approach to the study of suicide using the life-course method. This approach allows one to identify distinctive pathways of suicide by assessing the accumulation of burden over time brought on by psychosocial factors. The life calendar approach (Caspi et al. 1996; Ensel et al. 1996) allows for the identification and quantification of burden of adverse life events throughout the course of an individual's life. Seguin's adaptation of the life calendar approach to suicide research adds the identification of negative life events previously associated with suicide (e.g. sexual or physical abuse, childhood separation, spousal separation). This all-encompassing approach examines the accumulation of psychophysiological wear and tear that results from ongoing adaptive efforts to maintain

stability in response to psychosocial stressors. Recently, as will later be discussed, Brenner et al. (2009b) readapted Seguin's approach to better conceptualize the cumulative effects of PTSD and TBI among individuals at risk for suicide.

2.2 Suicide & Military Personnel

Among those most at risk for suicide are military servicemen. Suicide is the second leading cause of death in the U.S military (Mahon, Tobin, Cusak, Kelleher, & Malone, 2005). The wars in Iraq have reported higher percentages of suicides than previous wars. Between the years 2003-2007, suicide rates among Army personnel deployed in Operation Iraqi Freedom were between 10.5 and 24 per 100,000. These suicide rates are considered to be higher than the comparable civilian population (Office of the Surgeon Multi-National Force-Iraq, Office of the Command Surgeon, & Office of the Surgeon General United States Army Medical Command, 2008). This figure only pertains to active duty personnel and does not account for the number of discharged military Veterans that engage in suicide behavior.

Several risk factors have been identified related to suicide (Lambert & Fowler, 1997). Marris, Berman, and Silverman (2000) identified social isolation, physical illness, chronic pain, traumatic exposure, perceived loneliness, perceived burdensomeness, substance use, previous suicide attempts, having access to weapons, being male, being older, current mental disorders such as depression, bipolar disorder and schizophrenia as risk factors related to suicide. Given these risk factors, the psychosocial and demographic profile of most military Veterans (e.g older, white males, poor health, diminished psychosocial support, high frequency of depression and substance abuse

problems) statistically puts this population at higher risk for suicide in comparison to the general population (Lambert & Fowler, 1997). As previously mentioned, the presence of mental disorders has been identified as a significant risk factor for suicidal behavior (Harris & Battaclough, 1997). Psychiatric disorders have been found to increase the risk for suicide behaviors with 33% to 98% of individuals who attempted suicide having received a diagnosis of psychiatric illness (Gupta & Trzepacz, 1997; Haw, Hawton, Houston et al., 2001; Schmidtke, Bille-Brahe, DeLeo et al., 2004; Suominen, Henriksson, Suokas et al., 1996). Similarly, mental illness has been found to be the strongest factor associated with attempted suicide with nearly 87-90% of individuals who committed suicide as having had indicated a diagnosis of mental illness (Arsenault-Lapierre, Kim, & Turccki, 2004; Cavanaugh et al., 2003). The relationship between suicide risk and the presence of psychiatric illness is significant as Veterans with PTSD are more likely to die by suicide than those without PTSD (Bullman & Kang, 1994).

2.3 Post-Traumatic Stress Disorder (PTSD)

Post-Traumatic Stress Disorder (PTSD) is an abnormal response to an event outside the scope of a person's normal process of comprehension. The PTSD diagnosis was originally developed to characterize the psychological reactions of combat Veterans after many of them returned home from war (Foy, 1984). The etiology of PTSD symptoms remains unclear. Over the years, several conceptual models of PTSD have on the impact of the traumatic event itself to account for symptom development; however, despite a wealth of research in this area, there is still no unified position (King & King,

1991). Kaylor, King and King (1987) conducted a meta-analysis of 67 studies on Vietnam Veterans in the literature and were unable to clearly define the complex array of factors contributing to PTSD symptoms among Veterans.

The American Psychological Association (APA) diagnosis of PTSD is defined as a distinct pattern of 17 possible symptoms arising in reaction to a traumatic event in which the person either witnessed death or experienced severe injury and responded to the event with intense fear, helplessness or horror (APA, 2000). To receive a diagnosis of PTSD, a person must present with a total of at least six of the 17 symptoms within the three symptom clusters or criteria that comprise the diagnosis. This pattern of symptoms can develop either immediately following the distressing event or several months later (APA, 2000). This maladaptive reaction to traumatic event(s) is distinguished by the following set of symptoms: 1) Increased arousal: difficulty sleeping, hyper-vigilance, and startled-response; 2) Re-experiencing: recurrent and/or intrusive recollections of the event, flashbacks, recurrent distressing dreams or nightmares, or intense psychological or physiological reactions to events that resemble some portion of the original trauma(s); 3) Avoidance: of stimuli associated with the trauma or numbing of general responsiveness to protect the individual from becoming emotionally overwhelmed. A growing body of literature highlights an ongoing debate among researchers that considers PTSD to be defined by 4 symptoms clusters, including numbing, instead of three. (Elhai, 2011; King, 1998)

Epidemiological studies indicate that the prevalence of exposure to traumatic event(s) is common yet only a small percentage of individuals fail to recover from

traumatic events and develop PTSD. It has been estimated by some studies that nearly 50-90% of the general population has experienced at least one traumatic event throughout the course of their lives (Breslau et al., 1998; Bromet, Sonnega, & Kessler, 1998; Norris, 1992; Resnick, Kilpatrick, Dansky, & Best, 1993). Although these studies indicate that a large number of people experience traumatic events, prevalence of individuals who progress to develop PTSD has been reported that be less than ten percent (Norris, 1992). Research suggests that PTSD often has a chronic course as one-third of individuals with PTSD continue to endorse symptoms 10 years after their initial diagnosis (Kessler, 1995). Reviews of the literature have noted that PTSD is associated with an increased risk of suicide, comorbid medical conditions, impairments in work and school performance, social isolation, interpersonal problems, and lifetime comorbidity with other mental disorders of about 79-88% (Breslau, 2001; Davidson, 2000; Kessler et al., 1995). Similar to the challenges faced in the accurate reporting of suicide figures, PTSD prevalence rates are also believed to be under reported as many cases are undiagnosed due to a lack of inquiry into a patients' history of trauma (Cusack, Frueh, & Brady, 2004). In addition, the reporting of PTSD is an underestimate as those who struggle with PTSD find it difficult to seek treatment (Simon, 2007; Hoge et al., 2004; Mahon et al., 2005).

2.4 Prevalence of PTSD among Veterans

In 2007, the Department of Veteran Affairs Healthcare System reported an estimate of 400,000 service members with mental health issues (Simon, 2007). Since 1990, more than 200,000 Veterans have applied for disability benefits for mental illness

(Arbisi, Murdoch, Fortier, & McNulty, 2004). A recent study conducted by the VA reviewed the records of more than 100,000 service members who were discharged from duty between 2001 and 2005. The study found that 25 % of Veterans of OEF and OIF received at least one mental health diagnosis, among those being PTSD (Seal, Bertenthal, Miner, Sen, & Marmar, 2007).

PTSD is the most common condition that is reported in Veterans seeking benefits. Estimates of the prevalence of PTSD in combat Veterans vary yet research has shown that Veterans have a much higher incidence of PTSD when compared to the general population (Arbisi et al., 2004). 15 to 29% of Iraq war Veterans and 11-30% of Afghanistan war Veterans are estimated to suffer from PTSD (Hoge et al., 2004; Lapierre, Schwegler, & LaBauve, 2007; Milliken, Auchterlonie, & Hoge, 2007; Simmon, 2007). Between 2001 and 2004 approximately 45% of soldiers returning from Iraq were considered at risk for developing PTSD (Streisand, 2006). Overall, researchers estimate that over 500,000 Veterans suffer from PTSD (Arbisi et al., 2004). Moreover, the incidence of PTSD in returning soldiers is expected to increase dramatically 1 to 3 years after they return from combat duty (Friedman, 2004). This may be due to the fact that PTSD symptoms have an average delayed onset of 3 months after the traumatic event has been experienced (Cantrell & Dean, 2005; Hoge et al., 2004; Streisand, 2006).

2.5 PTSD & Suicide

A recent growing body of literature has concluded that there is a strong association between deployment to a war zone and an elevation of suicide risk (IOM, 2008). Such findings are significant since individuals with combat related PTSD

represent a group of patients that carry a lifetime risk for both suicide attempts and completions (Farberow et al., 1990; Freeman, Roca & Moore, 2000; Hendin & Haas, 1991; Kramer et al., 1994). Despite this established risk for suicide, PTSD is rarely mentioned as a risk factor for suicide in the suicide literature (Krysinska, Lester & Martin, 2009; Mehlum, 2005; Meichenbaum, 2005). An extensive 50 article meta-analysis that examined the association between PTSD and suicide ideation/behaviors found PTSD to be associated with an increased incidence of prior suicide attempts and current suicide ideation even after controlling for other psychiatric illnesses (Krysinska & Lester, 2010). These findings are congruent with similar studies that have also found PTSD to be associated with elevated suicide ideation and suicide attempts (Davidson, Hughes, Blazer, & George, 1991; Jakupcak et al., 2009; Marshall et al., 2001; Sareen et al., 2007). One reported that PTSD played a distinct role in explaining suicide ideation after controlling for depression and substance abuse (Waldrop, et al., 2007).

Identification of risk and protective factors in Veterans who have been diagnosed with PTSD is essential since research has shown those with PTSD are at great risk of suicide than those without the disorder (Amir, Kaplan, Efroni, & Kotler, 1999; Davidson, Hughes, Blazer, & George, 1991; Rudd, Dahm, & Rajab, 1993).

2.6 Specific PTSD Symptoms & Suicide Risk

A review of the PTSD and suicide literature shows a small body of research that has focused on what specific mechanisms of PTSD are associated with suicide attempt and completions. Although previous work has investigated differing patterns of suicidal behavior, limited research is available informing clinicians and researchers of which

PTSD symptoms or symptom clusters best predict suicide among Veterans with PTSD (Bell & Nye, 2007).

Recent research into persons exposed to highly traumatic events indicates that intrusion, and hyperarousal are the most commonly endorsed symptoms of PTSD. In contrast, avoidance and numbing symptoms are the least frequently symptoms yet are known to serve as possible markers for PTSD and other comorbid psychiatric illnesses (Breslau et al. 2004; Breslau et al. 2005; Breslau, Reboussin, Anthony, & Storr, 2005; McMillen, North, & Smith, 2000; North et al. 1999; North et al. 2002; North et al. 2005). In a study examining the relationship between PTSD and suicidal ideation among OEF/OIF Veterans, Guerra & Calhoun (2010) reported that the emotional numbing symptoms of PTSD were uniquely associated with suicidal ideation.

Although research into the pervasiveness and presentation of PTSD symptoms holds diagnostic value it has yet to inform clinicians about how such symptoms present themselves among suicidal individuals. Only a handful of studies have examined the relation of PTSD symptoms to suicidality, with mixed results. One study reported that the experience of guilt related to traumatic events contributed to the prediction of both suicidal ideation and suicide attempts in a sample Vietnam Veterans (Hendin and Haas, 1991). In a widely cited study by Bell and Nye (2007) found that re-experiencing symptoms were predictive of suicidal ideation in a sample of Vietnam Veterans. Others have reported evidence of a relation between re-experiencing, hyperarousal and suicidality (Tarrier and Gregg , 2004).

Finally, although research regarding specific PTSD symptoms has been promising yet inconsistent, there remains a need to investigate the extent to which suicide risk relates to specific PTSD symptoms among individuals with and without a history of traumatic brain injury (Asmundson, Stapleton, & Taylor, 2004; Zatzick et al., 2002).

2.7 Traumatic Brain Injury

Among wounded soldiers in Iraq, TBI appears to account for a larger portion of casualties than in any other war. Recently, it has been termed the signature injury of Iraq War Veterans (Department of Veterans Affairs (DOVA) & Department of Defense (DoD), 2005). The Brain Injury Association of America (2003) defines TBI as an insult to the brain caused by an external physical force that may produce a diminished or altered state of consciousness, which results in an impairment of cognitive abilities or physical functioning. It also can result in the disturbance of behavior or emotional functioning (Borgaro, Prigatano, Kwasnica, & Rexer, 2003). In addition, certain traumas may also impair the frontal lobes, resulting in changes in the ability to manage emotions and changes in coping abilities (Vanderploeg, Curtiss, Duchnick, & Luis, 2003; Vasterling et al., 2000). Traumatic brain injuries can result from being hit by shrapnel, a blow to the head, fall, motor vehicle accident, beatings, torture, or blast injury (Trudeau et al., 1998; Vasterling, Constans, & Hanna-Pladdy, 2000).

Blast injuries have recently received increased attention due to their preponderance in the current wars of Iraq and Afghanistan. Blast injuries take place when individuals are in the near proximity of a detonating device such as mortar, rocket,

grenade, mine, or munitions explosions (Trudeau et al., 1998). Blast related TBIs occur when the blast from an explosion suddenly creates a fluctuation in atmospheric air pressure commonly referred to as a 'blast wave.' These rapid changes can produce an injury to the brain resulting in concussion or contusion. Injuries associated with the blast from an improvised explosive device (IED) are believed to cause changes in attention and concentration abilities (Trudeau et al., 1998). In addition, waves from the blast can propel bodies, vehicles, or debris with incredible force, also creating the potential for head injury (Okie, 2006; Taber, Warden, & Hurley, 2006; Trudeau et al., 1998). TBIs are likewise caused when the head suddenly and violently hits an object, or when an object pierces the skull and enters the brain (Taber et al., 2006).

The vast majority of TBIs are caused by IEDs. Between January 2003 and February 2005, it is estimated that nearly 60% of patients seen at Walter Reed Army Medical Center were treated for blast injuries and/or TBI (Okie, 2006.) It is now estimated that 24% of Vietnam Veterans who were hospitalized due to psychiatric symptoms actually suffered from TBIs (Chentob, Muraoka, Wu-Holt, Fairbank, Hamed, & Keane, 1998; Vasterling et al., 2000).

2.8 PTSD, TBI & Suicide

The majority of studies have reported the presence of PTSD in patients who sustained a TBI. For example, in one study, subjects who suffered TBI, following a traumatic event, were found to have been diagnosed with PTSD as often as those without a history of TBI (Hickling et al., 1998). Others have reported that 42% of OEF/OIF Veterans with a history of mild TBI also reported symptoms of PTSD (Lew et al., 2008).

Vasterling et al. (2000) found that TBIs accounted for 20% of the variance in symptoms for depression and 9% of the symptom variance for PTSD. Additionally, those Veterans who reported a diagnosis of PTSD were also more likely than Veterans without a PTSD diagnosis to report history of a head injury or involvement in an explosion (Carson et al., 1998; Vasterling et al., 2000). This carries diagnostic implications as symptoms of TBI have been reported to mimic those of PTSD, making it difficult to determine the difference between the two (Brenner et al., 2009a). Symptoms can include headache, lightheadedness, blurred vision, confusion, dizziness, fatigue, behavior or changes in mood, sleeping difficulties, problems with memory, concentration, thinking or attention (Taber et al., 2006). Symptoms that TBI and PTSD have in common include insomnia, memory deficits, hyperarousal, fatigue, irritability, problems with concentration, sensitivity to noise and light, and anxiety (Bushnik, Englander, & Duong, 2004; Groswasser et al., 1998; Pegg et al, 2005).

In a recent study, examining the relationship between mild TBI and PTSD among military personnel 3-4 months post-deployment, found that 44% of those who reported a loss of consciousness also met the criteria for PTSD (Hoge et al., 2008). The authors of this study also found that all of the variance in the reported symptoms could be accounted for by the presence of PTSD and/or depression (Hoge et al., 2008). In 2008, Schneiderman, Braver, & Kang, conducted a similar study examining mild TBI and PTSD in a sample of 2,200 Veterans and reported that mild TBI doubled the risk for PTSD.

Although research examining the interplay of PTSD and TBI is still in its infancy, Brenner et al. (2009b) provide an interesting hypothesis that revisits literature that has adapted Merton's 1968 theory of "Cumulative Disadvantage". Brenner and colleagues further support the use of a cumulative model to explain the mutually exacerbating role that mild TBI and PTSD have on one another (King, 2008). Overall, it is theorized that post-concussive disorder and PTSD culminate a myriad physical, emotional, cognitive, psychosocial, vocational, financial and recreational stressors that exacerbate premorbid factors that may result in increased disability and increased the risk for poor long-term physical and health-related outcomes (Brenner et al., 2009b; Evered, Ruff, Baldo, & Isomura, 2003). This theory of cumulative effects seems to be consistent with recent studies that report an increased risk of suicide among individuals with PTSD and TBI. Simpson and Tate (2005) found that 70% of suicide attempts among individuals with TBI were 21 times more likely among individuals with a history of psychiatric and emotional disturbances post-injury.

Limited research has been conducted regarding suicide attempts among individuals with TBI and PTSD yet several studies suggest there is a link. One study found that individuals with comorbid psychiatric illness and TBIs were 21 times more likely to have made a suicide attempt than those without a TBI (Simpson & Tate, 2005). Depending on the severity of the brain injury sustained (mild, moderate, severe), suicide rates among individuals with a history of TBI have been estimated to be up to 4.0 times higher than the general population (Teasdale & Engberg, 2001). Others have reported

that patients with suicidal tendencies represent 33.3% of the total of TBI patients seeking neuropsychological care (Carrion et al., 2001).

It is unclear as to what puts individuals with TBI and PTSD at risk for suicide yet recent studies have begun to explore contributing factors. Among the factors taken into consideration is the role of executive function (Fann, Leonetti, Jaffe et al., 2002; Jollant, Bellivier, Leboyer et al., 2005). Depending on the type of injury and the location of the neurological damage, TBIs can affect the frontal lobes which are responsible for higher level functions such as emotional regulation, decision making, and problem solving. Dysfunction of the frontal lobes can also be associated with impulsivity which has been cited as a suicidal risk factor (Mann, Waternaux, Haas et al., 1999). This is consistent with findings from Carrion et al. (2001) which examined the neuro-behavioral and cognitive profiles of traumatic brain injury patients at risk for depression and suicide. Carrion et al. (2001) indicated:

The neuro-behavioral and cognitive profile of the TBI suicide-prone individual shows an emotional person with cognitive difficulties in how they interpret reality; the person tries to understand what is happening around them, but is unable to cope. They show concrete thoughts, although they have difficulties solving problems and have few intellectual resources to cope with their surroundings. They do not know how to distance themselves from the emotional aspect of situations (p. 175).

CHAPTER III

METHODOLOGY

3.1 Sample

Participants in this study were comprised of Veterans who were assessed on several dimensions and clinical outcomes as part of their routine mental health treatment. This information was stored in an archival clinical database at the Denver Colorado Veterans Affairs Medical Center (VAMC). One hundred and thirty-seven Veterans with a confirmed diagnosis of PTSD were identified between October 2004 and February 2006 from this mental health clinic database of 3,239 potential participants. Inclusion criteria for cases required that the participants had received Veterans Affairs (VA) health care services and an electronic medical record (EMR) note documenting a suicide attempt and diagnosis of PTSD. Fifty-nine cases were identified as having a history of suicide attempt and a diagnosis of PTSD. Fifty-three of the cases had a history of TBI.

Control participants were identified via a thorough review of their medical records to ensure the presence of PTSD in the absence of a history of suicide. Seventy-eight individuals with PTSD and without a history of suicide were identified to serve as control participants. Only individuals with suicide attempts were included in this study. Individuals who exhibited thoughts of suicide and those who died by suicide were excluded from this study.

3.2 Demographics

Table 1 contains detailed information about the demographic characteristics for each group. Demographic information used in this study includes Veterans' age and gender. Men composed 80% of the sample while there were only 40 women in the study. Ages ranged from 24 to 78 years of age. The average age of participants in the study was 48 for men and 46 for women ($SD = \pm 11$). In addition, the sample included a mixed cohort of Veterans from the combat theaters of Vietnam, Korea, OEF, and OIF.

3.3 Procedure

Participant information was made available by the U.S Department of Veterans Affairs Medical Center (VAMC) in Denver, Colorado. Electronic Medical Records (EMRs) for individuals in the VA system date back to at least 1998. Electronic Medical Records, which include patient notes, discharge summaries and imaging reports, were reviewed for all participants. A key-word search of all participants' EMRs was conducted to identify a history of PTSD, suicide, and/or TBI. Information regarding the process of identification for suicidality, PTSD and TBI are described below.

3.4 Data Search Strategy

Suicide. Key words used to identify potential suicidal behavior, attempts, in EMRs included "suic" and "suicide." Participants' medical records were reviewed for confirmation of at least one suicide attempt during the target period of October 2004 and February 2006. If multiple events occurred during that time frame, data was recorded on each separate event. Lifetime (pre- or post-target period) suicide attempts will be recorded using the same search strategy. Potential case participants with a history of

suicidal thoughts, non-suicidal self-directed violence, or death by suicide only were excluded.

The same key-word search was conducted for control participants who had no history of suicidal behavior. If a history of suicidal behavior (attempts or completions) was identified, the participant was excluded. Exclusionary criteria for control participants did not include suicidal ideation or non-suicidal self-directed violence.

Traumatic Brain Injury. For the purpose of identifying history of TBI, key-word searches were conducted using the following terms: “traumatic brain injury,” “TBI,” “head injury,” “head trauma,” “concussion,” “loss of consciousness,” “LOC,” “amnesia,” and “post-traumatic amnesia.” Imaging reports in the EMRs were also reviewed. After a possible history of TBI is identified, information including year of injury and temporal relationship to the target suicide event were collected. This information was used to confirm injury history and severity. In the event that insufficient information is available to classify injury severity, such cases will be classified as “undetermined level of injury.” Although the definition of TBI utilized for this study is consistent with that endorsed by the VA (2009), information recorded in the EMR often does not include specific data regarding the injury event and subsequent alteration in consciousness. Ultimately, individuals with a history of brain injury were put in dichotomized categories defined by the presence or absence of a TBI.

PTSD Diagnosis. For the purpose of identifying PTSD, key-word searches were conducted using “PTSD,” “Post Traumatic Stress Disorder, ” “Post Traumatic Stress Disorder Check List (PCL),” “PCL,” “Traumatic Event,” “Traumatic Experience,”

“Trauma,” and “posttraum.” The earliest date (year) of PTSD diagnosis was recorded, along with the temporal relationship of PTSD diagnosis to suicide target event (i.e. pre-suicide event, post-suicide event). In addition, EMR notes in close proximity, at least one year prior to the suicide event, were used to establish that PTSD was a chronic and ongoing issue for the Veteran at a time prior and near the suicide event. Furthermore, in order to be included in data analysis as having a positive history of PTSD, the participants had to have a documented diagnosis of PTSD by an individual from one of the following professional backgrounds: medical doctor, psychologist, licensed clinical social worker, clinical nurse specialist, nurse practitioner, or supervised psychology fellow or intern. Medical notes regarding PTSD without a formal diagnosis of PTSD were excluded from data collection.

PTSD Symptoms. For the purpose of identifying specific PTSD symptoms, key word searches were conducted using terminology derived from the Post-Traumatic Stress Disorder Checklist (PCL) and the Clinician-Administered PTSD Scale (CAPS). These measures were only used to provide the nomenclature for the keyword search queries and were not used as actual measurement tools during the study. The PCL and CAPS are empirically validated instruments for measuring PTSD symptomology and are among the most commonly used measures by the Department of Veteran Affairs. The Clinician-Administered PTSD Scale (CAPS) is a measure developed at the National Center for PTSD (Blake et al., 1995). The CAPS assesses the 17 symptoms of PTSD outlined in the DSM-III-R as well as eight associated symptoms. This measure was chosen for its sensitivity to the presence, absence and severity of symptomatology. It

measures frequency, intensity, and yields dichotomous and continuous data for individual symptoms for PTSD (Blake et al., 1990). In addition, the CAPS has been found to be highly correlated with other measures of PTSD such as the Mississippi Scale for Combat-related PTSD (Keane, Caddell, & Taylor, 1988). The PTSD Checklist (PCL; Weathers et al. 1993) is a self-report, measure that consists of 17 items (each rated on a 5-point Likert-type scale) that corresponds to the DSM-III-R symptoms of PTSD.

The following key words represent specific PTSD symptoms and are categorized within their respective diagnostic symptom clusters.

- *Re-experiencing Symptoms.* For the purpose of identifying specific re-experiencing symptoms, key-word searches were conducted using the terms: “re-experiencing,” “upsetting thoughts,” “upsetting memories,” “nightmares,” “flashback(s),” “reminder of the trauma,” and “physically response.”
- *Avoidance Symptoms.* For the purpose of identifying specific avoidance symptoms, key-word searches were conducted using the terms: “avoidance,” “avoids thoughts,” “avoids feelings,” “avoids conversations,” “avoids places,” “avoids people,” “loss of interest,” “avoids activities,” “distant from others,” “emotionally numb,” “hopeless about future,” “difficulty maintaining relationships.”
- *Hyperarousal Symptoms.* For the purpose of identifying specific hyperarousal symptoms, key-word searches were conducted using the terms: “difficulty sleeping,” “difficulty falling asleep,” “difficulty staying asleep,” “anger,”

“irritable,” “irritability,” “difficulty concentrating,” “jumpy,” “easily startled,” “on edge,” “easily frightened,” “hears things,” and “sees things.”

3.5 Statistical Analyses

Dichotomous variables, (Y/N), were created for participants with a documented history of suicide behavior (attempts) and those who had no such behavior. Similarly, dichotomous variables were created for participants who had a history of brain injury and those who did not. Participants’ endorsement of symptoms was also coded dichotomously to represent the presence or absence of specific PTSD symptoms. One-hundred and thirty-seven participants were selected based on the presence of a formal diagnosis of PTSD. Fifty-nine cases with suicide behavior were identified and seventy-eight controls were identified with no such behavior.

3.6 Descriptive Statistics

Descriptive statistics made comparisons between patients who showed suicide behavior and those who did not on all relevant variables. Between-groups differences of dichotomous variables were examined using chi-square tests. A chi square (χ^2) statistic was used to investigate whether distributions of dichotomous variables differed from one another. The χ^2 statistic compared the total endorsement of symptoms between the independent groups. All analyses were performed using the Statistical Analysis Software v9.2.

3.7 Preliminary Analysis

Prior to conducting the logistic regressions it is necessary to determine if age or gender was associated with suicidal behavior. Both characteristics are known to be

associated with suicidal attempts, generally. A χ^2 test was conducted to determine the rate of men in the group of participants with no history of suicidal behavior and in the group of those with a history of suicidal behavior. Similarly, a t-test was conducted to compare the average age of participants with and without a history of suicidal behavior.

3.8 Logistic Regressions

Three sets of logistic regressions were performed to investigate which of the hypothesized symptom clusters were significantly and independently associated with suicide attempts. All analyses assumed a two-sided test of each hypothesis, with a significance level of $p < .05$. These analyses were stratified by gender and age with subject status (case/control) as the dependent variable. Three sets of logistic regression models were used to address the questions proposed in the previous chapter. All logistic regression models yielded odds ratios (OR). The OR represents the odds that an outcome will occur in the presence of an exposure, compared to the odds of the outcome occurring in the absence of that exposure (Szumilas, 2010). In other words, the OR was used to examine the odds, or relative risk, of having a suicide attempt occur in the presence of specific PTSD symptom clusters. Within each model, odds ratios examined the relative risk of symptom clusters when compared individually (stepwise method) and when compared collectively (block method) to suicide attempt.

As previously noted, the first question to be addressed by this study is “*What are the relative contributions of specific PTSD symptom clusters to the prediction of suicide attempt(s)?*” To answer this question the first set of logistic regression models included all participants ($n = 137$). The first equation included all predictor variables individually

through the use of a randomized stepwise method for logistic regression analysis. The second equation entered the three symptom clusters as a block to predict suicide behavior.

The second question to be addressed is “*What are the relative contributions of the specific PTSD symptom clusters in the prediction of Veteran suicide attempt(s), taking into account the presence of TBI?*” This question was addressed with a series of logistic equations to predict suicide behavior (coded as yes or no). These analyses were designed to determine the degree to which TBI contributed to the prediction of suicide behavior. The first equation entered TBI in the first step of the equation and proceeded to enter the remainder of the symptom variables at random. The second equation entered TBI in the first step of the equation and proceeded to enter the remainder of the symptom variables as a block to predict suicide behavior. In order to further examine the possible contributing effects of TBI, a final set of logistic regression models were conducted to examine how PTSD symptoms clusters were associated with suicide behavior specifically among participants with TBI (n = 53). The first equation included all predictor variables individually through the use of a randomized stepwise method for logistic regression analysis. The second equation entered the three symptom clusters as a block to predict suicide behavior.

Overall, it was expected that re-experiencing symptoms would be significantly contribute to an increased occurrence of suicide behavior in all models regardless of the presence of TBI. Similarly, hyperarousal symptoms were expected to significantly contribute to an increased occurrence of suicide behavior in all models regardless of the

presence of TBI. Finally, it was hypothesized that the presence of TBI would significantly contribute to an increased occurrence of suicide behavior.

CHAPTER IV

RESULTS

4.1 Characteristics & Comparisons

Descriptive and comparative statistics for participant data used in the subsequent logistical models are presented in Table 1. Dichotomous variables were created of those participants who had experienced a suicide behavior (attempt) and those who had no such behavior. Similarly, dichotomous variables were created for the presence or absence for each of the PTSD symptom clusters. Comparisons were made between participants who showed suicide behavior and those who did not in the presence of PTSD symptoms. All tests were 2-tailed and the convention of $p = .05$ significance was observed.

As depicted in Table 1, there were no significant differences in symptom endorsement between the suicide behavior group and the non-suicide behavior group. In fact, symptom endorsement was nearly identical across both groups, and symptom endorsement appeared to lack significant variability. One-hundred and eight (79%) participants endorsed at least one or more re-experiencing symptoms, followed by Hyperarousal (76%), and then Avoidance (64%).

4.2 Preliminary Analysis

In determining if age or gender were associated with suicidal behavior a χ^2 test was conducted to determine the proportion of men in the group of participants with and without a history of suicidal behavior (see Table 1). A t-test was also conducted to

compare the average age of participants with and without a history of suicidal behavior. Neither age nor gender was found to significantly differ within groups. Therefore, these were not included in the subsequent analysis.

4.3 Logistic Regression Analyses

Logistic regressions were performed to investigate which PTSD symptom clusters were significantly and independently associated with suicide behavior. The first sets of logistic regression models, presented in Table 2, were used to answer the following question: “*What are the relative contributions of specific PTSD symptom clusters to the prediction of suicide attempt(s)?*” The first set of logistic regression models included all participants ($n = 137$). Suicide behavior was first modeled as a function of each symptom cluster entered separately as predictor variables. A second model was then conducted with the three symptom clusters entered simultaneously as a block to predict suicide behavior.

The first logistic model examined the degree to which the separate symptom clusters contributed to the prediction of suicide behavior. As depicted in Table 2, the separate symptom clusters did not significantly contribute to the prediction of suicide behavior. Similarly, the second logistic equation revealed that the three symptom clusters entered as a block did not significantly predict suicide behavior. In both models, then, symptom clusters were not significantly predictive of suicidal behavior. The logistic regression models did not identify any individual symptom clusters as predictors of the presence of suicidal behavior.

TABLE 1

Demographic and Descriptive Information of Participants with and without a History of Suicide Behavior.

	History of Suicide Behavior (<i>N</i> = 59)	No History of Suicide Behavior (<i>N</i> = 78)	Statistic	<i>p</i>
<i>Continuous Variables</i>				
Age	47.3	48.9	$t = 0.79$	0.43
<i>SD</i>	±10.9	±11.9		
<i>Dichotomous Variables</i>				
Gender (Male)	46	63	$\chi^2 = 0.16$	0.69
%	78%	81%		
History of TBI	36	48	$\chi^2 = 0.004$	0.95
%	61%	62%		
Re-experience	46	62	$\chi^2 = 0.05$	0.83
%	78%	79%		
Avoidance	36	52	$\chi^2 = 0.47$	0.49
%	61%	67%		
Hyperarousal	43	61	$\chi^2 = 0.52$	0.47
%	73%	78%		

Note. Test *p*-value is from independent-samples *t*-tests for continuous variables and chi-squared independence tests for categorical variables.

TABLE 2

Logistic Regression Analysis: Suicide Attempt as a Function of PTSD Symptom Clusters for All Participants (n = 137)

Univariate Comparison of Symptom Clusters	OR	95% CI	Wald χ^2	p
Re-experiencing	0.91	(0.40, 2.08)	$\chi^2 = 0.05$	0.83
Avoidance	0.78	(0.39, 1.58)	$\chi^2 = 0.47$	0.49
Hyperarousal	0.749	(0.34, 1.64)	$\chi^2 = 0.90$	0.34
Multivariate Comparison of Symptom Clusters				
Re-experiencing	1.04	(0.43, 2.52)	$\chi^2 = 0.003$	0.96
Avoidance	0.85	(0.37, 1.92)	$\chi^2 = 0.11$	0.74
Hyperarousal	0.81	(0.33, 1.99)	$\chi^2 = 0.47$	0.49

Logistic regressions were performed to investigate the degree to which TBI contributed to the prediction of suicide behavior. The second set of logistic regression models, presented in Table 3 and 4, were used to answer the following question: “*What are the relative contributions of specific PTSD symptom clusters to the prediction of suicide attempt(s)?*” The results from the second set of logistic regressions, controlling for history of TBI, are presented in Table 3. PTSD symptom clusters were not found to be significant predictors of the presence of suicide behavior when controlling for TBI (Table 3) and the point estimates were very similar to the models in Table 2. These data indicate that TBI was not predictive of suicide behavior, and adding it to the model had no effect on the relations between any of the three symptom clusters to suicide behavior.

Finally, the third set of logistic regressions was conducted with only participants with a history of TBI ($n = 53$). The results are presented in Table 4. Among participants with TBI, the PTSD symptom clusters were not significantly associated with suicide behavior ($p > 0.54$; see Table 4).

4.4 Summary

Overall, these results indicate that the odds of suicide behavior did not increase in the presence of any PTSD symptom cluster when compared univariately or multivariately. In addition, the presence of a TBI diagnosis did not have any additive effects to the occurrence of suicide behavior.

TABLE 3

Logistic Regression Analysis: Suicide Attempt as a Function of PTSD Symptom Clusters, Controlling for TBI (n = 137)

Univariate Comparison of Symptom Clusters	OR	95% CI	Wald χ^2	p
Re-experiencing	0.91	(0.40, 2.08)	$\chi^2 = 0.05$	0.83
Avoidance	0.78	(0.38, 1.58)	$\chi^2 = 0.48$	0.49
Hyperarousal	0.74	(0.34, 1.64)	$\chi^2 = 0.98$	0.32
Multivariate Comparison of Symptom Clusters				
Re-experiencing	1.04	(0.43, 2.53)	$\chi^2 = 0.004$	0.95
Avoidance	0.84	(0.37, 1.99)	$\chi^2 = 0.12$	0.72
Hyperarousal	0.80	(0.32, 2.17)	$\chi^2 = 0.53$	0.47

TABLE 4

Logistic Regression Analysis: Suicide Attempt as a Function of PTSD Symptom Clusters Among Individuals with TBI (n = 53)

Univariate Comparison of Symptom Clusters	OR	95% CI	Wald χ^2	<i>p</i>
Re-experiencing	1.45	(0.37, 5.69)	$\chi^2 = 0.80$	0.60
Avoidance	0.83	(0.25, 2.76)	$\chi^2 = 0.09$	0.76
Hyperarousal	0.95	(0.22, 4.02)	$\chi^2 = 0.13$	0.72
Multivariate Comparison of Symptom Clusters				
Re-experiencing	1.61	(0.38, 6.82)	$\chi^2 = 0.38$	0.54
Avoidance	0.71	(0.17, 3.00)	$\chi^2 = 0.05$	0.82
Hyperarousal	1.09	(0.20, 5.78)	$\chi^2 = 0.08$	0.78

CHAPTER V

DISCUSSION & CONCLUSION

The aim of this study was to examine the relative contributions of specific PTSD symptom clusters in the prediction of suicide behavior among veterans with and without a history of TBI. These findings suggest that the answer to the question “*What are the relative contributions of specific PTSD symptom clusters to the prediction of suicide attempt(s)?*” is “none.” Statistical analyses did not identify any individual symptom clusters as predictors of suicide behavior among veterans with a diagnosis of PTSD. To a certain extent, this finding is not consistent with other studies of specific PTSD symptom clusters as risk factors for suicide ideation and attempt (Bell and Nye , 2007; Guerra et al., 2011; Jurisiae and Marusie , 2009; Lemaire & Graham , 2011). Past research has speculated that such inconsistent findings might be due to the heterogeneity within the 17 PTSD symptoms (Bryan & Anestis, 2011). This heterogeneity has been reported to have the potential of yielding over 1,750 possible distinct presentations of PTSD making patterns of symptom endorsement difficult to identify (Benedek, 2010).

The findings further suggest that the answer to the question “*What are the relative contributions of the specific PTSD symptom clusters in the prediction of Veteran suicide attempt(s), taking into account the presence of TBI?*” is “none.” No individual symptoms clusters were identified as predictors of suicide behavior among veterans with both a diagnosis of PTSD and TBI. Although these results are not reflective of previous studies cited in the literature, a recent study found no increased risk for suicide among

veterans with mTBI (Barnes, Walter, & Chard, 2012; Simpson & Tate, 2005). They also cited a potential benefit in utilizing symptom severity scores as markers of suicide risk after they found that mTBI patients endorsed higher overall severity scores on PTSD measures. It is possible that the present study's focus on the presence or absence of PTSD symptoms lacks the sensitivity to accurately assess suicide risk in a group with a high prevalence for suicide.

5.1 PTSD Symptom Severity & Suicide Risk

A secondary review of literature was conducted with the purposes of shedding light on these inconsistent findings. The current study solely focused on the presence of symptoms; this secondary review of literature extended its focus beyond the presence of symptoms by searching for articles that examined the relationship between PTSD symptom clusters, symptom frequency, symptom severity and suicide. Four electronic databases (OVID, MEDLINE, PsychINFO, and Published Literature on Traumatic Stress [PILOTS]) were searched. The following keywords were used: Veteran, PTSD, PTSD symptoms, PTSD symptomology, posttraum, symptoms, clusters, and symptom severity. Only recent literature published between 2000 and 2011, was included.

This search identified a sparse body of literature examining the relationship between suicide behavior, specific PTSD symptoms, and symptom severity. Between the years 2000 and 2011 only eight studies were identified as having examined this association. Descriptive information about these studies (sample characteristics, PTSD measures used, suicide measures used, and findings) are presented in Table 5.

TABLE 5*Studies Comparing Specific PTSD Symptoms and Suicide*

Author	Subjects (N)	Population	PTSD Measure(s)	Suicide Measure(s)	Suicide Variable	Results
Lemaire &Graham (2011)	1740	OEF/OIF Veterans	Clinical Interview	Clinical Interview	Ideation	Avoidance
Bell & Nye (2007)	50	Vietnam Veterans	Clinician Administered PTSD Scale (CAPS)	Beck Scale for Suicide Ideation (BSS)	Ideation	Re-experiencing
Guerra et al. (2011)	393	OEF/OIF Veterans	Structured Clinical Interview (SCID); Davidson Trauma Scale (DTS)	Beck Scale for Suicide Ideation (BSS); Scale for Suicide Ideation (SSI)	Ideation	Numbing
Ya'acov & Amir (2004)	103	Israeli Outpatient	PTSD Scale; Trauma Event Questionnaire	Suicide Risk Scale (SRS)	Ideation	Arousal
Nadorff et al. (2011)	583	University Students	PTSD Checklist - Civilian (PCL-C); Disturbing Dreams and Nightmare Severity Index (DDNSI)	Suicide Behaviors Questionnaire (SBQ)	Ideation	Re-experiencing (nightmares)
Mazza (2000)	106	High School Students	Scale-Post-Traumatic Stress Disorder Subscale (APS-PTS)	Psychopathology Adolescent Psychopathology Scale-Ideation; Suicide Attempt History (APS-SAH); Suicide Ideation Questionnaire	Suicide Attempt History (SAH)	Overall, unspecified, PTSD symptoms related to SI and SAH
Jurisiae &Marusie (2009)	50	Victims of MVA	Impact of Event Scale (IES)	Beck Scale for Suicide Ideation (BSS)	Ideation and SAH	Re-experiencing= Ideation;
Bryan & Anestis (2011)	157	OIF Veterans	PCL-M - only re-experiencing items	Acquired Capability for Suicide Scale (ACSS)	Acquired Capability for Suicide (ACS)	Hyperarousal=(SAH) Reexperiencing=ACS

Only four of the eight studies are relevant to the current findings as they are the only studies of Veterans with combat-related PTSD.

Overall, results from these studies failed to provide a clear consensus as to how PTSD symptoms contribute to the occurrence of suicide. Of the eight studies, five examined the association between PTSD symptoms and suicidal *ideation*. Only two of the five studies identified re-experiencing (Bell & Nye, 2007; Nadorff et al., 2011), one identified arousal (Ya'acov & Amir, 2004), one identified avoidance (Lemaire & Graham, 2011), and one identified numbing as the PTSD symptoms most closely associated with suicide ideation (Guerra et al., 2011). Two of the eight studies examined the association between PTSD symptoms and suicide *attempt* histories. Of these studies, one reported re-experiencing symptoms were associated with suicide ideation and arousal symptoms were associated with suicide attempt history (Jurisiae & Marusie, 2009). The other study indicated that PTSD symptoms were associated with a suicide ideation and suicide attempt history (Mazza, 2000). Although Mazza noted an increase in suicide ideation and attempt history among individuals with “high” levels of PTSD symptomology, their analysis only examined general PTSD severity and did not discriminate what symptom cluster(s) contributed to these findings.

The final study focused on examining the association of PTSD symptoms and the Acquired Capability for Suicide (ACS; Bryan & Anestis, 2011). ACS is conceptualized in this study as a gradual habituation to physiological pain and the fear of death as a result of repeated exposure to painful and provocative events. ACS is a concept of the interpersonal-psychological theory of suicidal behavior (IPT) and most closely relates

to ones acquired intent for suicide (Joiner et al., 2009). Bryan and Anestis (2011) concluded that severity of re-experiencing symptoms contributed to an increase in ones' ACS. This would further support the Barnes et al. (2012) study that suggested possible utility in examining PTSD symptom severity as a predictor of suicide risk.

Previous work by Freeman et al. (1995) found that patients with a history of suicide attempts endorsed higher levels of dissociation than those patients without a history of suicide attempt. In a later study, Freeman, Roca, & Moore (2000) found that patients with a history of suicide attempts reflected higher levels of psychopathology. Specifically, the study found that individuals with a history of a suicide attempt endorsed elevated scores on the Mississippi PTSD Scale (Freeman, Roca, & Moore, 2000). Schooler et al. (1999) found that the severity of re-experiencing symptoms appeared to be a predictor of chronic intrusive and persistent distress. Similarly, research has shown that the degree, to which intrusive symptoms are found distressing, rather than the presence or frequency of re-experiencing symptoms predicted avoidance (Dougall et al., 1999). In a study examining PTSD and suicide risk among individuals physically disabled from a motor-vehicle accident, PTSD re-experiencing symptoms were positively correlated with active suicidal ideation (Jurisiae & Marusie, 2009). In this same study, a history of suicide attempts was predicted by hyperarousal and gender with men being more likely to attempt suicide (Jurisiae & Marusie, 2009). Finally, Bell and Nye's (2007) study further supports the utility of symptom severity as a marker for suicide risk as they reported that the severity of re-experiencing symptoms were significantly related to suicide ideation in a sample of Vietnam veterans (Bell & Nye,

2007). Bell and Nye hypothesized that thoughts of suicide were dependent on subjective levels of distress associated with specific PTSD symptom clusters. According to Bell and Nye (2007), re-experiencing symptoms are believed to possess higher levels of disturbance therefore increasing the likelihood of suicide occurring. This hypothesis is understudied and would benefit from more research involving the association of PTSD symptom severity and suicide.

5.2 Limitations

While the current study is one of few studies that have examined PTSD symptoms as risk factors for suicide among Veterans with and without a history of TBI, it is important to acknowledge several limitations.

The study is limited by the way in which PTSD symptoms were measured. PTSD diagnosis and symptoms were identified by extensive chart review that examined a variety of PTSD related notes, screeners and clinical interviews. Although all participants had a diagnosis of PTSD and were receiving active treatment for PTSD at least a year within their suicide attempt, this is not reflective of best practices in the assessment of PTSD (Blake et al., 1995). In examining the methodology of studies identified in the secondary literature review, nine different measures were used to measure PTSD symptoms across all studies. PTSD measures varied from using clinical interviews, to clinician administered PTSD measures, self-report measures, and chart reviews. Some studies attempted to study PTSD symptom suicide research by only using the endorsement of PTSD symptoms in the absence of a formal PTSD diagnosis (Bryan & Anestis, 2011; Mazza, 2000). Findings from such studies are unreliable as the mere

presence of symptoms in the absence of a diagnosis of PTSD is insufficient to infer an association between PTSD and suicide risk. Such variability in the measurement of PTSD symptoms may explain the lack of consistent findings. Although there are various methods one can use to assess PTSD symptomology, only three of the eight studies adhered to the “gold standard” of PTSD assessment by using the Clinician Administered PTSD Scale (CAPS; Blake et al., 1995) (Bell & Nye, 2007; Guerra et al., 2011; Lemaire & Graham, 2011).

Adhering to a “gold standard” would address some of the common challenges that exist in properly diagnosing PTSD. For instance, when diagnosing PTSD, clinicians often fail to apply the diagnostic criteria that all endorsed PTSD symptoms are linked to a single identifiable traumatic event (Briere, 2004). This feature ensures that PTSD symptoms are directly related with a traumatic event and not associated with secondary stressor(s) or other identifiable mental illness with similar symptoms. Like most of the studies identified in the literature review, it is difficult to definitively diagnose PTSD with screeners and self-report measures. Although many self-report measures and screeners are useful tools at identifying the types of trauma a person has been exposed to, or the degree of severity of the traumatic event, they often fail to assess for all the elements of PTSD symptoms and are not suitable to make a definitive diagnosis. In addition, they often lack the ability to continuously ensure that endorsed symptoms are related to an index trauma. Instead, structured interviews such as Clinician Administered PTSD Scale (CAPS) or the Structure Clinical Interview for DSM (SCID; First et al., 1996) are better equipped to account for these diagnostic markers. These

measures capture all elements of symptoms such as frequency and intensity of symptoms. These measures are also better suited to detect changes in symptoms over time whereas self-report measures typically only capture symptoms within a specific time period (Barnes et al., 2012).

A second limitation of this study is having focused too narrowly on one specific aspect of PTSD symptomology. Like the present study, the current literature varies widely in determining whether to examine the presence, frequency, or severity of PTSD symptoms. As observed in the current findings, studying the mere endorsement of symptoms yields insufficient variability when examining PTSD in population whose base rate for suicide behavior is so prominent. Rather than attributing suicide risk to one particular element of symptom endorsement, all aspects of symptoms endorsement may be required to obtain a more complete clinical picture. Various studies conducting factor analysis on PTSD indicate that symptom clusters are difficult to isolate without taking into account all symptom clusters and their respected elements.

There are also issues in the way in which TBI was measured and coded in the present study. Although the histories of TBI were confirmed through chart review, the archival database nature of this study did not allow for a more refined assessment of TBI and its concomitant symptoms. Furthermore, coding of TBI as a dichotomous variable reduced the ability to capture variability of symptom endorsement that may have been present within distinct TBI severity groups. It is possible that certain symptoms associated with mTBI may contribute to suicide potential than others. For example, symptoms often associated with post concussive syndrome, such as sleeping difficulties,

executive dysfunction, and migraines, have been reported to be associated with the increased occurrence of suicidal thoughts and behaviors (Breslau, 1992; Raust et al., 2007; Ribeiro et al., 2012).

Although a gold standard for the assessment of TBI has yet to be identified, various instruments are available to aid in the diagnosis of TBI. Interviews such as the Ohio University TBI Identification Method (OSU TBI-ID) have been cited as empirically supported methods for identifying TBIs. This tool is known to capture rich information necessary to make a definitive diagnosis of TBI as it provides a history of injuries that includes severity; initial and persistent sequela, functional impairment, and temporal information regarding age of injury and time elapsed since injury (Corrigan & Bogner, 2007).

Another limitation of this study concerns the measurement of suicide history. Working within the constraints of the existing database, suicide attempt histories were confirmed through clinical notes (referred to as “suicide behavior reports”). The information in these notes was subject to clinician error and bias in reporting suicide behavior. Furthermore, the lack of available information regarding all aspects of suicide risk assessment (i.e., method, lethality, intent, etc.) restricted the suicide risk variable to a dichotomous level. Current literature supports the use of self-report measures to assess suicidal risk. Kaplan’s (1994) study found that twice as many participants endorsed suicidal ideation on self-report measures than they had during the interview. This may be due to the fact that self-report measures allow clinicians to obtain data about sensitive information individuals may not openly communicate in person. Among the

eight studies identified in the literature review, seven different measures were used to study suicide ideation, suicide attempt history, and the ACS. The most commonly used, three out of eight times, was the Beck Scale for Suicide self-report measure (BSS; Bell & Nye, 2007; Guerra et al., 2011; Jurisiae & Marusie , 2009). A comprehensive review of suicide assessment measures conducted by Brown (2002, p.38) concluded that a thorough evaluation of suicidality should include both interviewer-administered and self-report measures and “should never be based on a score on a single scale (p.38).”

The cross-sectional and retrospective nature of the study also limits the present study. Participant’s histories of suicide attempts were obtained from electronic medical records, but this data did not allow for the examination of PTSD symptoms and presence of TBI contemporaneous with the reported suicide attempts. Therefore, results from the present study cannot speak directly to the relationship between the clinical risk factors of PTSD and actual suicide attempt.

The small sample size limited the statistical power of the present study. The number of Veterans with TBI may have limited the statistical power to identify a relationship. Without an adequately powered comparison group of soldiers with a TBI diagnosis that includes level of injury (mild/moderate/severe), the impact of this particular variable is difficult to fully determine. Similarly, the generalizability of the study was also impacted by the sample as it was confined to a highly specific population of combat veterans, with PTSD, who were enrolled in mental health treatment. It is important to highlight several strengths of the current study. This study was among two existing studies that have attempted to examine how PTSD symptoms may increase the

risk for suicide behavior among Veterans with and without a history of TBI. The current study was also among a few of the studies that have examined suicide attempts in order to venture beyond the established relationship between suicide ideation and PTSD.

5.3 Implications for Future Research

Researchers and clinicians should continue to examine PTSD at the symptom level and employ the use of “gold standard” methods when assessing PTSD and suicide in order to address the limitations and inconsistencies found in the existing literature. Broadening the scope of research and clinical work to include PTSD symptom severity as a possible marker for suicide risk and other mental health outcomes may prove to be beneficial in the assessment and treatment of individuals with PTSD who struggle with suicide. More research is needed to examine the risk among individuals who attempt suicide vs. those who ideate. Although suicide ideation is necessary, it is not always indicative of an impending attempt since many people live their lives experiencing suicidal ideation without ever engaging in the behavior (Nock et al., 2008). Because of this, it is not surprising that researchers have found that the best predictor of future suicide behavior is a history of previous suicide behavior (Mann, Wateraux, Haas, & Malone, 1999; Rudd, Joiner, & Rajab, 1996). Suicide attempt history has been found to be predictive of future suicidal behavior even controlling for 13 other suicide risk factors (Joiner et al., 2005). Additional research is needed to examine how these risk factors present themselves among the high-risk Veteran population.

Finally, more research on specific PTSD symptoms as predictors of suicide is needed. Furthermore, research examining suicide risk associated with specific PTSD and

post concussive symptoms should attempt to discriminate which of the shared symptoms between both disorders uniquely contributes to suicide risk.

5.4 Conclusion

Despite the limitations of this present study, it continues to be among a handful of existing studies that have sought to examine the risk for suicide attempts associated with specific PTSD symptoms. Although the results for the current study did not yield conclusive evidence that would speak to such association, the findings provide clarity and direction for future research of suicide risk and PTSD symptomology. Research on specific symptoms continues to be essential in the assessment and treatment of both PTSD and suicide.

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