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# Reactivity and Recovery Among OIF/OEF/OND Combat Veterans: Do Those with Subthreshold PTSD Differ From Veterans with and without PTSD?

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# Reactivity and Recovery Among OIF/OEF/OND Combat Veterans: Do Those with Subthreshold PTSD Differ from Veterans with and without PTSD?

by

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## Table of Contents

## List of Tables

## List of Figures

**Abstract**

This study expanded the current literature by assessing PTSD in relation to reactivity and recovery from negative emotional arousal among OEF/OIF/OND Veterans. Cardiac impedance was employed during a speech task and a trauma imagery procedure. Those in the PTSD-S group displayed lower SBP and higher TPR reactivity relative to the PTSD- and PTSD+ groups; lower CO reactivity relative to the PTSD+ group; and more CO recovery than those in the PTSD+ group to the trauma task. For speech task, Veterans in the PTSD-S group exhibited lower HR reactivity for both speech preparation and delivery than those in the PTSD- group. Depression was not a significant mediator in the relation between PTSD and reactivity. However, further analyses revealed that it served as a moderator between PTSD and reactivity during speech preparation (SBP, HR, and PEP reactivity), and speech delivery (HR, PEP, and CO reactivity). Simple slopes analysis revealed that depression was positively associated with HR and SBP (speech preparation) and HR (speech delivery) for those in the PTSD-S group. For those in the PTSD- group, depression was positively associated with PEP during the speech task (to include preparation) and negatively associated with SBP and CO (speech preparation) and HR and CO (speech delivery). For those in the PTSD+ group, depression was negatively associated with CO and positively associated with PEP. For the most part, Veterans in the PTSD-S group exhibited lower reactivity to both tasks than Veterans in the PTSD+ group or combat-exposed controls without PTSD. In light of the emerging evidence relating blunted reactivity to unhealthy behaviors and negative health outcomes (e.g., depression, obesity), it would appear that both

extremes, exaggerated and diminished reactivity are maladaptive responses to stress and that the most optimally response to stress is a moderate reaction.

# Chapter 1

## Introduction

Approximately 2.5 million service members have served in recent conflicts abroad (Department of Veterans Affairs, Public Health, 2013). The all-volunteer force has experienced multiple deployments of individual service members, and service members have been subjected to longer deployments and shorter dwell times at home between deployments (Institute of Medicine, 2010). Veterans of war commonly experience significant levels of acute, severe, and chronic stress during their deployment(s), and their stress often persists throughout community reintegration. Deployment-related combat experiences place Veterans at increased risk for chronic stress and mental health related outcomes (Dohrenwend et al.,2006; Jelinek et al., 2008; Morgan, 2008). There is widespread concern that this new cohort of Veterans will follow a similar path as Vietnam Veterans, with a high proportion experiencing chronic and pervasive stress throughout their lives (Resnik,et al., 2012).

While a fair amount of psychophysiological stress research has been conducted using Veteran samples, a majority of the published study samples are comprised of Vietnam Veterans. Additionally, there are a number of limitations in the literature as it is related to Veterans. These gaps consist of the predominant use of only combat trauma-related tasks such as script driven imagery to measure psychophysiological stress; the disregard of the potential utility of impedance cardiography measures ; and a focus on the *magnitudes* of reactivity with little mention of *recovery* from negative emotional arousal.

## Combat Stress and the Veteran

Combat-related stress arises from physical and psychological factors associated with modern combat. Of notable concern is the unexpected attacks leading to a constant state of vigilance; the absence of a defined front line; difficulty distinguishing enemy combatants from civilians; the ubiquity of improvised explosive devices (IEDs); caring for the badly injured or dying; graves registration service; and having responsibility for the care of prisoners of war (Institute of Medicine, 2008). Veterans who serve in conflicts abroad are also at risk for being wounded or maimed, and witnessing the aftermath of violence. They may be required to kill others, especially given the proximity of combatants and civilians and the ambiguity of the enemy. The level of combat experienced is the most significant and important determinant of mental health among Veterans (Joint Mental Health Advisory Team 7 (J-MHAT), 2011), and may result in the development of Posttraumatic Stress Disorder.

## Posttraumatic Stress Disorder (PTSD)

The American Psychological Association (APA) has defined *chronic stress* as stress that is constant and persists over an extended period of time (American Psychiatric Association) and which can occur in response to everyday stressors or stem from traumatic experiences. This definition is important to Veterans in particular, as the APA's definition of chronic stress subsumes *posttraumatic stress disorder (PTSD)*. The DSM-IV diagnostic criterion for PTSD is utilized in the current study and is provided in Table 1. Under the DSM-IV, the diagnostic criterion for PTSD includes three symptom clusters: re-experiencing (persistent re-experiencing of the traumatic event), avoidance (persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness) and hyperarousal (persistent symptoms of increased arousal). Several different subtypes of PTSD should be noted, and are discussed below.

Table 1. DSM-IV Criteria for Posttraumatic Stress Disorder

**DSM-IV Criteria for Posttraumatic Stress Disorder**

A. The person has been exposed to a traumatic event in which both of the following have been present:

(1) 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
(2) the person's response involved intense fear, helplessness, or horror.

B. The traumatic event is persistently re-experienced in one (or more) of the following ways:

(1) recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions.
(2) recurrent distressing dreams of the event.
(3) acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur upon awakening or when intoxicated).
(4) intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.
(5) physiological reactivity on exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.

C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by three (or more) of the following:

(1) efforts to avoid thoughts, feelings, or conversations associated with the trauma
(2) efforts to avoid activities, places, or people that arouse recollections of the trauma
(3) inability to recall an important aspect of the trauma
(4) markedly diminished interest or participation in significant activities
(5) feeling of detachment or estrangement from others
(6) restricted range of affect (e.g., unable to have loving feelings)
(7) sense of a foreshortened future (e.g., does not expect to have a career, marriage, children, or a normal life span)

D. Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following:

(1) difficulty falling or staying asleep
(2) irritability or outbursts of anger
(3) difficulty concentrating
(4) hypervigilance
(5) exaggerated startle response

E. Duration of the disturbance (symptoms in Criteria B, C, and D) is more than one month.

F. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning**.**

*Specify if*:
**Acute:** if duration of symptoms is less than 3 months
**Chronic:** if duration of symptoms is 3 months or more
**With Delayed Onset:** if onset of symptoms is at least 6 months after the stressor

**PTSD and Dissociation**

Dissociation is a clinical term describing a wide array of experiences from mild detachment from immediate surroundings to more severe detachment from physical and emotional experience. The dissociative subtype of PTSD is characterized by blunted reactivity to such reminders and a predominance of avoidance symptoms (Lanius et al., 2010; McTeague & Cuthbert, 2012), whereas the non-dissociative subtype of PTSD is characterized by heightened hyperarousal symptoms (Lanius et al., 2010; McTeague & Cuthbert, 2012). Unlike the reactivity to reminders of traumatic cues - with a predominance of re-experiencing and stereotypical, non-dissociative subtype of PTSD which is more fear-based, the dissociative subtype of PTSD is more distressed-based (McTeague & Cuthbert, 2012).

**Subthreshold PTSD.** As of December 2012, VA databases indicated that 286,134 OIF/OEF/OND Veterans were diagnosed with PTSD (Epidemiology Program, Post Deployment Health Group, Office of Public Health, Veterans Health Administration, Department of Veterans Affairs, 2013). However, as a result of increased levels of military-related stress, many more Veterans who separate from military service experience significant distress but do not meet full diagnostic criteria for PTSD (Friedman, Resick, Bryant, Brewin, 2011). This has been termed subthreshold, partial, or subsyndromal PTSD.

Veterans who present with significant distress but do not meet the full diagnostic criteria for PTSD have been regarded as having subthreshold PTSD. Subthreshold PTSD is not a diagnosis, *per se* but with the arrival of the newest edition of the DSM, is housed under Adjustment Disorder. Subthreshold PTSD, while prevalent in the Department of Veterans Affairs Medical Centers' primary-care clinics, has seen numbers diminish over the last 10 years due to changes in DSM criteria. These changes have resulted in more and more Veterans being provided with a full PTSD diagnosis. It is estimated that approximately 18% of Veterans in

primary care clinics receive treatment for subthreshold PTSD (Kornfield, Klaus, McKay, Helstrom, & Oslin, 2012). Like Veterans diagnosed with full PTSD, these Veterans have experienced a tremendous amount of military-related stress which is associated with increased vulnerability to stress-related mental health issues (Kornfield, Klaus, McKay, Helstrom, & Oslin, 2012) and are likely to develop full PTSD (Cukor, Wyka, Jayasinghe, and Difede, 2010; Smid, Mooren, van der Mast, Gersons, and Kleber, 2009). Therefore, it is important to study this small, but important group of Veterans.

**Psychophysiological Assessment of the Stress Response**

Intense negative emotional responses to stimuli related to traumatic or stressor events is considered a hallmark symptom of PTSD that can be manifested as either "intense psychological distress" or "physiological reactivity" (American Psychiatric Association, 2013). These intrusion symptoms can be viewed as fear-based or distress-based, making them especially amenable to psychophysiological assessments that measure autonomic responses associated with the sympathetic and parasympathetic nervous systems. Thus, psychophysiological assessment may be useful for identifying different subtypes of PTSD, e.g., fear-based versus distress-based (Bauer et al., 2013; Panknin, Dickensheets, Nixon, & Lovallo, 2002).

There has been substantial interest over the years in using psychophysiological measures to examine the effects of stress. The body's stress response enables one to cope with threatening and unsafe conditions through "fight or flight." The sympathetic branch of the autonomic nervous system plays an important role in support of the fight/flight response. When a situation is perceived to be stressful, a characteristic pattern of endocrine, cardiovascular, immune and digestive system responses ensue. The early response to acute stress is protective. Immune function is enhanced, memory of dangerous events is promoted, and blood pressure and heart

rate increases to meet physical and behavioral demands (Vanitallie, 2002). Once the threat has passed, responses are activated that return the body to a non-threatened state of arousal by way of the parasympathetic branch of the autonomic nervous system (PNS). However, when the stress is chronic –such as the case with PTSD - recovery to a baseline state may be dysregulated, leading to long-term activation of the stress response even after acute threats have passed. Over the course of days, weeks, or years, this dysregulation may contribute to the development of various stress-related symptoms associated with chronic anxiety, fear, and intrusive memories (Charney, 2004; Chrousos, 2009; Institute of Medicine, 2008; McEwen, 1998; McEwen & Wingfield, 2003).

Psychophysiological measures have the advantage of being relatively independent of an individual's ability to accurately detect and describe their emotional state (Wisco, Marx, & Keane, 2012). Of interest in psychophysiological research is the degree of reactivity to laboratory tasks. Reactivity is defined as the difference between responses during a stressful and/or demanding task and non-stress resting levels. Differences in psychophysiological reactivity have not only been found to reliably distinguish between individuals exposed to idiographic trauma cues (e.g., hearing a script describing one's personal traumatic experience) (Wisco, Marx, & Keane, 2012), but also during recovery.

**Trauma-related tasks**. There is substantial research demonstrating psychophysiological differences between individuals with and without stress-related issues (Pole, 2007). Much of this research has examined psychophysiological reactivity to standardized and idiographic trauma related stimuli, such as script driven imagery (SDI) (Bauer et al., 2013; McTeague & Cuthbert, 2012; Orr, Pitman, Lasko, & Hertz, 1993; Orr et al., 2012). Exaggerated reactivity to trauma-related cues has been associated with severity of PTSD and, when assessed soon after exposure

to a traumatic event, to predict subsequent severity and/or persistence of symptoms (Keane et al., 1998; Kleim, Wilhelm, Glucksman, & Ehlers, 2010; Suendermann, Ehlers, Boellinghaus, Gamer, & Glucksman, 2010).

Script-driven imagery (SDI) is a passive task that involves presenting individuals with an audio description ("script") of their individual traumatic experience(s). There is robust support for increased heart rate (HR), skin conductance (SC) and facial muscle activity (facial electromyography - EMG) reactivity to SDI in individuals with PTSD, relative to trauma-exposed individuals without PTSD (Orr, Metzger, Miller, & Kaloupek, 2004). Studies of Vietnam, WWII, and Korean veterans (Orr et al., 1993; Pitman et al., 1987; Pitman et al., 1990) have found larger SC, HR, and facial EMG (lateral frontalis) responses during imagery of personal combat experiences in veterans with combat-related PTSD compared to combat veterans without PTSD.

When individuals with PTSD recall past traumatic events that occurred years earlier, they produced larger HR responses compared with individuals who experienced similar traumatic events but who do not have PTSD (Orr, Pitman, Lasko, & Hertz, 1993). Exaggerated reactivity to these cues in individuals with PTSD suggests that these emotional responses have failed to extinguish or habituate over time. The extinction or habituation of intense emotional responses to trauma memories can be considered a hallmark of effective and appropriate emotional regulation. Thus, exaggerated reactivity would indicate impaired emotional regulation of trauma memories.

While a number of studies have demonstrated exaggerated reactivity to trauma-related passive tasks (Keane et al., 1998; Orr & Roth, 2000), recent literature indicates that not all individuals with PTSD show this heightened psychophysiological reactivity, but rather may

show attenuated or blunted reactivity (D'Andrea, Pole, DePierro, Freed, & Wallace, 2013; Dixon-Gordon, Gratz, & Tull, 2013; McTeague et al., 2010; McTeague & Cuthbert, 2012). For example, in a recent study with PTSD patients and controls, McTeague and Lang (2012) found that overall, PTSD patients as a group demonstrated exaggerated startle reflex, autonomic responding (SC and HR) and facial expressivity (EMG) during an idiographic passive trauma-related imagery task compared to a control group. However, upon further analysis within the PTSD group, single trauma patients reported exaggerated startle reflex and autonomic responses, while the multiple trauma patients displayed blunted reactivity associated with more chronic and severe PTSD, despite reporting greater arousal. Additionally, compared to the single trauma group, the multiple trauma group reported elevated distress, more functional impairment, more severe ratings of clinician rated PTSD and poorer treatment prognosis. The authors argue that the physiological hyperactivity observed for most PTSD studies may have been driven by the majority of patients having a discrete traumatic exposure, whereas the smaller groups of individuals with cumulative traumas, or multiple traumas may show blunted startle reactivity to such trauma-cues (McTeague et al., 2012; McTeague & Lang 2012). It is important to note that the McTeague sample consisted of patients who presented for various traumas (e.g., sexual assault, car accident, war). Therefore, it is important to utilize a Veteran only sample, as many OIF/OEF/OND Veterans have been deployed more than once and are more likely to have experienced more than one trauma.

The different patterns of psychophysiological reactivity shown by individuals with posttraumatic stress (PTS) issues is driving speculation regarding the existence of different subtypes of PTSD (Bauer et al., 2013; Lanius et al., 2010; McTeague & Cuthbert, 2012), e.g., fear-based versus distress-based. This builds on the premise that PTSD is often comorbid with

other psychiatric conditions, such as depression or dissociation (Lanius et al., 2010). Given the symptom overlap between PTSD and other psychiatric disorders, as well as the addition of a dissociative subtype of PTSD to DSM-5 (2013), psychophysiology may provide an adjunct strategy that provides useful information to clinicians.

In addition to the inconsistent results of exaggerated or blunted reactivity, another shortcoming within research using trauma-related passive tasks to assess psychophysiological responses has to do with the types of physiological measures employed. Within the research on trauma-related passive cues among Veterans, HR, SC, and facial EMG have emerged as particularly reliable markers of PTSD and stress status, while other measures of autonomic nervous system activity have received little attention. Of particular interest is impedance cardiography- a non-invasive technique that can provide information regarding the mechanical functioning of the heart (e.g., output & contractile force). Measures of impedance cardiography provide good measures of the sympathetic nervous system (SNS), yet have been overlooked in this research to date. Using impedance cardiography measures in addition to other measures of SNS activity allows for a more complete picture of the SNS contribution to the stress response, allowing for more accurate conclusions.

**Non-trauma related motivated performance tasks.** Motivated performance tasks that use non-trauma-related stressors, such as a speech task, are typically considered to evoke general distress rather than the trauma-related fear often associated with exposure to stimuli related to one's traumatic experience (e.g., SDI). Because some with PTSD are reported to show exaggerated reactivity to trauma-related stimuli, a similar pattern might be expected in responses to non-trauma related motivated performance tasks. However, recent evidence suggests that blunted reactivity to some stressors (i.e., exhibiting a response that is relatively small in

magnitude) signals emotional and motivational dysregulation (Salomon, Clift, Karlsdottír, & Rottenberg, 2009; Salomon, Bylsma, White, Panaite, & Rottenberg, 2013). Specifically, Salomon and colleagues found that those with Major Depressive Disorder as assessed with the SCID demonstrated blunted reactivity to a speech task compared to healthy controls (Salomon, et al., 2009; Salomon, et al., 2013) and those with remitted depression (Salomon, et al., 2013), suggesting a lack of appropriate emotional and motivational response to the context of the speech task among the depressed group. Comparably low levels of reactivity to standardized laboratory challenges are also related to a number of other pathological states including addiction (al'Absi, Wittmers, Erickson, Hatsukami, & Crouse, 2003; Panknin, Dickensheets, Nixon, & Lovallo, 2002), disordered eating behavior (al'Absi, Wittmers, Erickson, Hatsukami, & Crouse, 2003; Panknin, Dickensheets, Nixon, & Lovallo, 2002).

In light of the recent reports by researchers regarding blunted reactivity to trauma-cues despite self-reported levels of arousal, assessing psychophysiological reactivity to both non-trauma standardized stressors as well as trauma-related stressors may provide additional information regarding emotional regulation and shed light on broader motivational deficits associated with stress-related mental health issues such as PTSD and subthreshold PTSD.

To sum, most psychophysiological studies of posttraumatic stress have focused on reactivity to trauma-related cues. Fewer studies have focused on reactivity to motivated performance tasks. Motivated performance stressors involve active performance situations that demand immediate overt or cognitive responses. Trauma-related tasks such as SDI are much more passive tasks. Indeed, in a meta-analysis on acute psychological stress paradigms, public speaking tasks were shown to be associated with greater cortisol responses (Dickerson & Kemeny, 2004). While the use of trauma-related tasks allows for the assessment of stress

response to traumatic stress, the administration of a non-traumatic active laboratory task allows for the assessment of responses to general distress. The inclusion of both task types is likely to provide much needed information regarding reactions to stress and the stress response.

**Recovery**. While assessing reactivity to trauma-related and non-trauma-related cues is informative, understanding the failure to restore physiological homeostasis following an intense emotional response – be it exaggerated or blunted -- is also important. The core of physiological responses to stress is two-fold—turning on a response that initiates a complex adaptive pathway, and then shutting off this response when the stress is past (McEwen, 1998). As such, it is equally important to evaluate cardiovascular recovery (the return to baseline levels).

Existing psychophysiology literature on traumatic stress focuses primarily on reactivity to the traumatic stimuli with little mention of post-task recovery from emotional arousal. Typically, studies report only reactivity or only recovery rather than utilizing the robust and richer results provided by information gleaned from both reactivity and recovery. Assessment of recovery provides information regarding the ability to "move on" after trauma reminders and is an indication of the ability of the parasympathetic nervous system to return the body to pre-stress levels (McEwen, Nasveld, Palmer, & Anderson,2012). Melamed (1986, 1993) suggests that those with high emotional reactivity easily enter into and maintain emotional responses in the face of stressful events in part because they are unable to regulate emotional thoughts and images before, during, and after emotional experiences.

Much of the literature on psychophysiological studies conducted with Veteran samples focuses on reactivity to laboratory tasks to the exclusion of recovery back to baseline status. However, PTSD is conceptualized as a disorder related to the failure of recovery mechanisms impeding the restitution of physiological homeostasis (Yehuda & LeDoux, 2007; Norte et al.,

2012). Indeed, Pole (2007) noted that the most robust effect to note in PTSD was the failure to show recovery to pre-stimulus baseline levels Therefore, recovery should be considered when assessing the psychophysiological reactivity of Veterans with PTSD.

In light of the current literature on trauma-related passive tasks and non-trauma related motivational performance tasks, it is necessary that studies of psychophysiological reactivity among Veterans include both task types, as well as an assessment of recovery to baseline levels. Including both reactivity and recovery will provide richer information regarding emotional regulation in everyday life as well as broader motivational deficits associated with stress.

**Pilot Work**

A pilot study was conducted to assess autonomic nervous system functioning in Veterans. The analyzed data consists of a sample of 27 Student Veterans and 14 Students who were not Veterans. Of the Student Veterans, 17 were healthy, 8 had PTSD, 1 had a traumatic brain injury (TBI) and 1 reported comorbid PTSD/mTBI. Participants were administered a public speaking task. Blood pressure, heart rate, and impedance cardiography were measured throughout rest, task and recovery periods. Psychophysiological measures of heart rate (HR), pre-ejection period (PEP; a measure of contractile force), total peripheral resistance (TPR; a measure of vascular tone) and cardiac output (CO; a measure of cardiac performance) were assessed. Combat stress symptom severity was created by summing the PCL and using a cut-point score of 45 based on the prevalence within the Veteran population (Department of Veterans Affairs National Center for Posttraumatic Stress Disorder, 2012). Because the study was underpowered, a liberal p-value of .15 was used to describe trends.

Correlations were conducted between a measure of combat stress symptom severity (PTSD checklist-military version) and a global report of stress (Perceived stress scale) for

Veterans only. There was a high correlation between combat stress severity scores and perceived stress, $r(31)=.68$, $p<.001$. Specifically, those with higher combat stress severity scores perceived significantly more stress from daily interactions.

Cardiovascular reactivity was assessed between student Veterans and Non-Veterans, $F(1,33)=3.02$, $p=.09$. Veterans exhibited greater HR ($M=11.38$,$SE=1.65$) to the speech preparation task compared to Non-Veterans (HR: $M=7.24$,$SE=1.54$). Cardiovascular reactivity was also assessed by symptom stress severity score among Veterans only. Using a PTSD checklist cutoff score of 45, trends in cardiovascular reactivity were assessed. For speech preparation task, the high PCL group demonstrated blunted reactivity (CO: M= -.17, SE= .67; PEP: M= -5.39, SE= 4.61) compared to the low PCL group (CO: M= 1.51, SE= .35; PEP: M= -21.23; SE= 5.08), (CO: $F(1,19)= 5.98$, $p= .02$; PEP: $F(1,19)= 4.54$, $p= .05$). For the speech task, the high PCL group demonstrated blunted reactivity (CO: M= -.27, SE= .68; PEP: M= -8.87, SE= 4.21) compared to the low PCL group (CO: M= 1.68, SE= .42; PEP: M= -23.89, SE= 3.94), (CO: $F(1,31)= 2.81$, $p=.10$; PEP: $F(1,31)= 4.11$, $p=.05$).

Finally, trends of cardiovascular reactivity were assessed across the different diagnostic groups. No tests of significance were conducted due to the limited number of participants in each category. Diagnostic groups consisted of healthy student Veterans and student Veterans with an existing diagnosis of PTSD. In regards to both the speech preparation and speech tasks, trends were indicative of a blunted pattern of reactivity for Veterans with post-traumatic stress issues compared to the healthy Veteran comparison group.

It should be noted that the Veterans utilized in the pilot work sample were all students. Thus, this particular sample is thought to be a much higher functioning segment of the population of persons with PTSD than the Veterans to be utilized from the James A Haley

Veterans Hospital (JAHVA). This is important to note because the student Veterans likely have less severe PTSD than the non-student Veterans we will be sampling from the JAHVA.

**Aims and Hypotheses**

The current research was designed to expand upon some of the most current literature on the psychophysiology of PTSD. The research also addressed gaps consistently seen in the literature, to include a primary focus on the use of passive trauma related stimuli, a reliance on a small set of physiological measures, and a focus on the *magnitudes* of reactivity with little mention of *recovery* from negative emotional arousal. In addition, this study allowed for a more comprehensive assessment of posttraumatic stress across a broader spectrum of Veterans who are likely to meet PTSD criteria as well as Veterans with subthreshold PTSD symptoms. We assessed psychophysiological responses of reactivity and recovery to a passive trauma task (script driven imagery task) and a non-trauma motivated performance task (speech task) among combat-exposed Veterans of recent military conflicts. Measures of cardiac impedance were assessed (TPR, CO, PEP, HR and BP).

It is important to note that although the direction of Hypotheses 1 is contrary to most evidence with Vietnam Veterans (PTSD elicits exaggerated reactivity), more recent work by McTeague noted above suggests that reactivity may be blunted, particularly for those with multiple traumas. Veterans utilized in the current study were deployed several times and were therefore more likely exposed to more than one combat-related trauma. According to recent research, this is likely to result in blunted reactivity among Veterans with PTSD. Additionally, while stress responses of Veterans with subthreshold PTSD have rarely been studied, work by McTeague suggests that those with more severe PTSD symptoms are expected to show blunted reactivity.

The following hypotheses were based on the literature cited above, as well as results from the pilot study. Aims and hypotheses are summarized below.

Aim 1: to determine differences in stress response patterns among trauma-exposed Veterans with and without combat-related PTSD and the impact of depression, dissociation and combat exposure,

Aim 2: to explore physiological reactivity and recovery among OIF/OEF/OND combat Veterans with subthreshold PTSD (PTSD-S).

H1: Veterans in the PTSD group would exhibit lower reactivity than trauma-exposed OIF/OEF/OND combat Veterans in the No PTSD group.

E1: Veterans in the PTSD-S group exhibit lower reactivity than trauma-exposed OIF/OEF/OND combat Veterans in the No PTSD, but greater reactivity compared to Veterans in the PTSD group.

H2: Dissociation moderates the relationship between PTSD and stress response.

H3: Combat exposure moderates the relationship between PTSD and cardiovascular reactivity.

H4: Depression mediates the relationship between PTSD symptoms and stress responses.

H5: Veterans in the PTSD group demonstrate less recovery than Veterans in the No PTSD group.

E2: Veterans in the PTSD-S group exhibit more recovery than Veterans in the PTSD group, but less recovery than Veterans in the No PTSD group.

# Chapter 2

## Methodology

The purpose of this study was to determine differences in stress response patterns among trauma-exposed OIF/OEF/OND Veterans with and without combat-related PTSD and the impact of dissociation, depression and combat exposures on reactivity. Additionally, the impact of subthreshold PTSD on stress response patterns was explored.

### Study Design

This study predominately utilized a between-subjects design with autonomic reactivity serving as the dependent measures and diagnostic group (PTSD, subthreshold PTSD and no PTSD) serving as the grouping variable. The two tasks were treated as separate dependent variables.

### Sample and Participant Selection

The sample consisted of 156 Veterans recruited from the James A Haley Veterans Hospital (JAHVA) Post-Deployment Health Clinic (PDHC). The PDHC is a primary care interdisciplinary clinic that is the "first stop" for all Veterans of current conflicts. The clinic registry of Veterans who received services from March 2012 to March 2015 was obtained from JAHVA PDHC via waivers of informed consent and HIPAA. The registry contains names and contact information of all Veterans who have processed through the JAHVA PDHC since it first opened in response to the influx of Veterans due to the Iraq and Afghan conflicts. To insure that the trauma was as recent as possible, Veterans who had processed through the clinic in the past 24 months were selected as our sampling frame. Study information was sent to Veterans using

contact information from the registry. The information included a letter inviting Veterans to participate, a tri-fold information pamphlet describing the research and participation requirements, how to participate, compensation provided, and potential risks of participating. The packet also included an "opt out" postcard as well as a copy of consent forms to review. Approximately 2 weeks after mailing the information packet, those who returned the opt-out card were deleted from the sampling frame. The remaining names on the list were randomized by computer. Veterans were contacted - one by one - going down the list until the sample size was obtained. Veterans interested in the study were scheduled for a consent/eligibility assessment described below. Additional recruitment strategies included placing the trifold brochure in the JAHVA primary care Annex. Those who completed the study were provided with a $50 stipend. Recruitment documents are provided in Appendix A.

To be included in the study, Veterans were required to be 18+ years of age or older; and understand and provide consent. Veterans with hypertension, diabetes, and other conditions and medications that contraindicate participation (e.g., pregnancy, psychosis, and severe cognitive issues) were excluded. Veterans who presented with cardiovascular disorders or diabetes were excluded because they differ in their cardiovascular responses to stress.

**Assessments and Measures**

Measures are presented as those that are utilized to characterize the sample and main study variables. Variables utilized to characterize the sample are also potential covariates.

**Sample characteristics.** Sample characteristics included demographics, military history, health information, and psychiatric symptoms.

*Demographics.* A demographics questionnaire assessed sex, age, race/ethnicity, marital status, education, employment status, and educational status. The demographic questionnaire is provided in Appendix B.

*Military history.* Participants were asked to provide information on branch of service, years served in the military, deployment history and grade/rank at separation from the military. The military history questionnaire is provided in Appendix B.

*Health information.* Information regarding biological and behavioral factors was collected either during screening or at the study visit. Questions included exclusionary criteria to include history of heart disease, arrhythmias, and high blood pressure, mental health diagnoses, current mental health treatment, and medications, to include Over the Counter (OTC) medications. The health information questionnaire is provided in Appendix C.

*Psychiatric symptoms.* Psychiatric symptoms were assessed with the *Symptom Check List 90-Revised* (SCL-90-R; Derogatis, 1983). The SCL measures the nine primary psychiatric symptom dimensions (somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism). The scale has good internal consistency (Derogatis, Rickels, & Rock, 1976), test-retest reliability (Derogatis, 2000). The overall Global Severity Index (GSI) was used to characterize the general mental health of the sample Derogatis, 2000). The GSI Cronbach alpha reliability for the sample was 0.99. The Symptoms Checklist is provided in Appendix D.

The sample was also characterized based on functioning using the *SF-36 Health Survey (SF-36,* McHorney, Ware, & Raczek, 1993*).* This is a short questionnaire with 36 items that measure functioning in eight domains (physical functioning (10 items), social functioning (two items), role limitations due to physical problems (four items), role limitations due to emotional

problems (three items), mental health (five items), energy and vitality (four items), pain (two items), and general perception of health (five items). Internal consistency values (Cronbach's alpha) ranged from .83-.91. The overall Cronbach alpha for this sample was 0.93. The SF-36 questionnaire is provided in Appendix E.

**Main study variables.**

*Posttraumatic stress disorder (PTSD)*. PTSD was measured with the Posttraumatic Stress Disorder Checklist (PCL-M), a 17-item self-report measure of the DSM-IV (Weathers et al., 2013; APA, 2013).The PCL-M (military) asks about symptoms in relation to "stressful experiences" associated with being deployed. Symptoms form three subscales: intrusion, avoidance, and arousal. Respondents are asked to rate on a 5-point scale how much "you have been bothered by each symptom in the past month." The psychometric properties have demonstrated very strong reliability (alpha > .95) and test-retest reliability (alpha > 0.96). Cronbach alpha reliabilities were 0.90 for the arousal subscale, 0.89 for the avoidance subscale; and 0.85 for the intrusion subscale. The Cronbach alpha reliability coefficient for the total scale was 0.94.

While the gold standard for diagnosing PTSD is a structured clinical interview such as the Clinician Administered PTSD Scale (CAPS), the PCL can be utilized to provide a *presumptive* diagnosis. This is defined as meeting DSM-IV symptom criteria as defined by at least 1 B item (re-experiencing; questions 1-5), 3 C items (avoidance, questions 6-12), and at least 2 D items (hyperarousal; questions 13-17). Symptoms rated as "Moderately" or above (responses 3 through 5 on individual items) are counted as present. The scale is provided in Appendix F.

*Subthreshold PTSD (PTSD-S).* Subthreshold PTSD was measured using the PCL-M. Responses across all 17 items were summed. Those who did not meet the DSM-IV criteria noted above, but whose score was > 40 on the PCL-M were classified as subthreshold PTSD (Kornfield, Klaus, McKay, Helstrom, & Oslin, 2012).

*Depression symptom severity*. Self-reported depression symptom severity was assessed with the Beck Depression Inventory-II (BDI-II, Beck, Steer, & Brown, 1996). The BDI-II is commonly used for quantifying levels of depression and consists of 21 self-report items that utilize a four-point scale ranging from symptom not present (0) to symptom very intense (3). The scale takes approximately 5 to 10 minutes to complete. The BDI-II is widely known and has been tested for content, concurrent, and construct validity (Beck, Steer, & Brown, 1996). Beck and colleges (1996) have reported a coefficient alpha = .92 for outpatients and alpha = .93 for college student samples. The BDI-II has displayed good convergent validity with the Hamilton Depression Rating Scale, 0.89 correlation (Moberg et al., 2001). The measure has also displayed great test-retest reliability with a 0.93 correlation over a one-week period (Beck, Steer, & Brown, 1996). The Cronbach alpha reliability coefficient for this sample was 0.94. The scale is provided in Appendix G.

*Combat exposure*. Combat exposure was measured with the *Combat Experiences Scale* taken from the Deployment Risk and Resilience Inventory (DRRI; King, King, Vogt, Knight, & Samper, 2006). This 15-item scale was designed to measure exposure to stereotypical warfare experiences such as firing a weapon, being fired on (by enemy or friendly troops), witnessing injury and death, and going on special missions and patrols that involve such experiences. Items are dichotomous (0 = *No;* 1 = *Yes).* Scores are summed, range of 0 - 15; higher scores are indicative of greater exposure to combat. Alpha reliability is reported as .85 (King, King, Vogt,

Knight, & Samper, 2006). For this sample, the Cronbach alpha reliability coefficient was .90. The *Combat Experiences Scale* is provided in Appendix H.

*Dissociation.* Dissociation was measured with the 28-item Dissociation Experiences Scale (Bernstein & Putnam, 1986; Carlson & Putnam, 1993). The Dissociative Experiences Scale (DES) is a simple 28 item questionnaire widely used to screen for the frequency of dissociative symptoms. Participants are asked to indicate the frequency of 28 dissociate experiences. DES items inquire about phenomena that are considered key aspects of the dissociation construct. These include experiences of amnesia, gaps in the continuity of awareness, depersonalization, derealization, absorption, and identity alteration. Instructions specify that participants should not include experiences that occurred while under the influence of alcohol or drugs. The DES provides item, subscale and total scores, which range from 0 to 100. The DES has been found to have very good reliability and validity as a measure of the frequency of dissociative experiences, with Cronbach's alpha of 0.95 (Frischholz et al., 1990). The total score was used for this research and was calculated by averaging the 28 item scores. Because an adobe fillable form was utilized to capture the total DES score, item scores were not available to conduct a reliability assessment (Appendix I).

**Stress-eliciting Study Tasks**

Two laboratory tasks designed to elicit personal traumatic distress and general distress were utilized.

**Non-trauma-related motivated performance task.** This task consists of preparing and giving a speech. It is a commonly-used, standardized laboratory reactivity task. Blunted reactivity to this task has been associated with states that confer risk for poor health, including depression (Salomon, et al., 2013; Salomon, et al., 2009). Participants are asked to prepare a

speech for a judge as a result of obtaining an improperly issued driving citation. They are instructed to tell a story about the incident as if they were arguing their case in traffic court. They have 3 minutes to prepare their speech, and 3 minutes to deliver the speech. Participants were instructed that their speech would be evaluated and judged for style, content, and quality of presentation. Participants were asked to talk continuously for 3 minutes. Should participants stop talking, they were prompted to begin speaking again. The task elicits mixed beta and alpha-adrenergic responses, with a large parasympathetic withdrawal. Task instructions are available in Appendix K.

**Passive trauma-related task: script-driven imagery (SDI).** The script-driven imagery task was an abbreviated version of that previously used in published studies (Carson et al., 2000; Orr, Pitman, Lasko, & Hertz, 1993). Participants wrote two personalized scripts approximately 10-12 lines in length, that portrays a given individual's traumatic event(s). Participants were seated in a small office for privacy. There was no time limit for creating the two scripts. Participants were provided with the following instructions:

*We would like you to write a description of the recent traumatic event that you experienced (as indicated above). Include in your description the bodily sensations you were aware of at the time. We will interview you in more detail about this experience later.*

*Sometimes it is difficult to think of something to write "on the spot." It may help to close your eyes and imagine yourself back in the situation. Try to generate the same sensations and feelings that you experienced at the time. While the image is vivid in your memory, jot down the details of the scene and the sensations you experienced.*

*Describe the traumatic situation. Please include such details as who was there, what you were doing, where you were, how things looked, what you heard, etc.*

They were also provided with a list of bodily sensations that people may experience and told:

*Listed below are a number of bodily sensations that people may experience in various situations. Circle all of the responses that you experienced in the situation you just described. Please include in your scripts at least 5 sensations that you experienced during the event.*

Soon after the scripts were written by the participant, the PI constructed sixty-second audio-recordings from the written scripts. These were played back to participants during the lab session. Prior to the actual task, participants were informed that two scripts based on the two scripts that they wrote in the first visit were recorded and would be presented. Each script was presented for 60-seconds. As the script was read, participants were asked to close their eyes and imagine each event as vividly as possible. After the script was read, they were instructed to stop imagining the event and relax (recovery period-5 minutes) until further instructions were provided. At the end of the recovery period for each script, participants were asked to open their eyes and answer questions regarding emotions they felt during the script presentation. A 12 point Likert-type scale was used to rate the degree to which they experienced six emotions (i.e., happiness, sadness, anger, fear, disgust, and surprise) while during the task and to rate the valence, arousal, and vividness of their imagery for each script (Orr, Lasko, Shalev, & Pitman, 1995). The next script began after the participant finished the final item on the questionnaire. Task documents are available in Appendix L.

**Psychophysiological Recording**

A Biopac MP150 system (Biopac Systems, Inc., Goleta, CA) was used to collect signals. All data was sampled at 1000 Hz, edited for artifact and scored using MindWare software (MindWare Technologies, Ltd., Gahanna, OH) and exported for statistical analyses. A Biopac NICO100C (Biopac Systems, Inc., Goleta, CA) was used to obtain the transthoracic impedance waveforms (Z0, dZ/dt) using a tetrapolar lead configuration. In accordance with guidelines, four disposable aluminum/mylar band electrodes were placed around the neck and torso (Sherwood et al., 1990). A Biopac ECG100C was used to obtain the electrocardiogram (ECG) using disposable Ag/AgCl electrodes placed in a modified Lead II placement on the distal end of the right

collarbone and the other on the lower left rib cage. Modified Lead II placement was utilized to minimize artifacts due to movement while still providing a large QRS complex, and was modified because no third ground electrode may be used while concurrently collecting impedance signals. ECG was measured continuously to obtain values for heart rate (HR) according to published guidelines (Berntson et al., 1997; Jennings et al., 1981). ECG and dZ/dt signals were ensemble-averaged and edited to obtain values for stroke volume, cardiac output, and pre-ejection period in accordance with published measurement guidelines (Sherwood et al., 1990). Blood pressure was measured using a noninvasive BP monitor (NIBP100D) to collect systolic and diastolic blood pressure according to published guidelines (Shapiro et al, 1996).

**Procedures and Experimental Protocol**

**Consent/eligibility assessment.** Prior to eligibility assessment, informed consent was obtained. Once consented, inclusion/exclusion criteria were assessed for each participant. Those eligible for the study were provided with script instruction and were left in an office to create scripts for the script driven imagery task, followed by completion of selected questionnaires and measures using Survey Monkey– a password protected survey website – displayed on a password protected medical laptop recording system. After completing the questionnaires, participants were scheduled for the psychophysiological assessment study visit.

**Psychophysiology assessment.** Upon arrival, participants were greeted and reminded of study requirements. They were asked to complete information concerning smoking habits, caffeine consumption, exercise, and menstrual cycle (females only). Next, the researcher attached electrodes as described in the *Psychophysiological Recording* section. After placement of electrodes, participants were led into a small recording chamber and seated in a comfortable chair. The researcher attached leads to electrodes and then attached a blood pressure cuff to the

upper part of the participant's non-dominant arm in accordance with published guidelines (Shapiro et al., 1996). Two blood pressure readings were taken to ensure functionality of the equipment. The researcher left the room and instructed the participant to sit back and relax. Prior to engaging in the main study tasks, participants underwent a 10-minute resting baseline during which they watch a travelogue video about Alaska. The purpose of this video was to present an emotionally neutral stimulus that provided a stable estimate of resting physiological activity (Jennings, Kamarck, Stewart, Eddy, & Johnson, 1992). After each task, participants were asked to sit quietly for a 10-minute recovery period during which physiological responses were recorded. At the conclusion of the recovery period, participants were disconnected from the physiological recording equipment. They were weighed, and height, waist and hip measurements taken. Participants were debriefed, thanked, dispersed a $50 Wal-Mart gift card, and provided with a list of VA mental health contacts should they need to speak with someone concerning discomfort arising from participating in the study.

**Data Quantification-Reduction and Analysis**

During the resting baseline, impedance cardiography signals, respiration, ECG were collected during the last five minutes, and three blood pressure recordings were taken at minutes 6, 8, and 10. Impedance, respiration, and ECG data were collected continuously throughout each task and recovery period. Blood pressure readings were taken during the first and third minute segments of the speech task. Blood pressure was only obtained once before and after the script-driven imagery task, so as not to interfere with the integrity of the protocol. Blood pressure readings were taken on minutes 1, 3, 5, 7, and 9 of the recovery periods for both tasks. The ECG impedance cardiography values (i.e., HR, PEP, TPR, CO) were obtained via ensemble averaging of the dZ/dt waveform for each minute of data collected using MindWare IMP software

(MindWare Technologies, Ltd., Gahanna, OH). The data were screened for artifact by visual inspection of the ensemble-averaged dZ/dt waveforms. Total peripheral vascular resistance was calculated from impedance-derived cardiac output and blood pressure. TPR was calculated as TPR = MAP/CO * 80, where MAP (Mean Arterial Pressure) = ((SBP – DBP)/3) + DBP.

**Data preparation.** Prior to analyzing the proposed hypotheses, sample characteristics assessment scores were summarized using frequencies and means as appropriate. Reactivity and recovery was calculated, followed by the assessment of outliers.

To calculate reactivity, the values for systolic BP (SBP), diastolic BP (DBP), heart rate (HR), pre-ejection period (PEP), total peripheral resistance (TPR) and cardiac output (CO) were averaged for the last 5 minutes of the baseline to provide a *baseline segment*. This procedure was repeated for the first three-minutes of both the speech preparation and speech tasks to create a *speech preparation segment* and a *speech task segment*. The two trauma script segments were calculated in the same fashion, using the second 'imaginal' minute to create the two *SDI task segments*. The arithmetic difference between each task segment and the baseline segment was calculated to obtain a reactivity score, providing each Veteran with a HR, PEP, CO, TPR, SBP, and DBP change score (i.e. reactivity score) for each task. Not all participants provided two trauma scripts. As a result, impact scores provided by the participant as part of the SDI procedure were utilized to determine the most distressing segment. For participants who provided two written scripts, the script reported as being the most distressful was utilized in the analysis.

Recovery was calculated utilizing the area under the curve (AUC) method (Kario et al., 2003). The difference between peak stress response (highest value for each measurement during task) and average baseline value was calculated to create the recovery *span* (distance to be

recovered after stressor, to return to baseline value). Then the difference from peak stress response to the average of each recovery minute was calculated. These values were then divided by the recovery span and multiplied by 100, to create a percent recovered value for each minute, valued between 0% and 100% recovered in each minute. Values that exceeded 100% (the difference between peak stress response and recovery minute average was greater than the recovery span) were considered 100% recovered in that minute, and values less than 0% (the difference between peak stress response and recovery minute average was negative, that is, recovery minute average was greater than the peak stress response) were considered 0% recovered. Finally, an average of the percent recovery values for each of the 10 minutes was taken to equal the AUC average percent recovered for each participant for each physiological index. Calculating recovery in this fashion allowed for greater variability in a participant's recovery period.

**Main analyses.** Prior to undertaking the main analyses, outliers were assessed. Data points thought to be outliers were first assessed as to the nature of the outlier. If it was obvious that the outlier was due to incorrectly entered data or an equipment error, then the outlier was dropped. Otherwise, Winsorising was utilized. Winsorising allows for the retention of all data points by replacing outliers with the nearest "non-suspect" data point. Age, sex, and BMI were entered in as covariates for all analyses based on a large body of literature that has linked them to cardiovascular reactivity and recovery. Analyses were conducted using IBM SPSS 19.0, and effect sizes are reported as partial eta-squared ($\eta^2_p$).

Analyses of group differences were conducted using a series of one-way between subjects ANCOVAs (Hypotheses 1 and 5). PTSD group was entered the between subjects factor and cardiovascular reactivity change scores (PEP, CO, TPR, HR, SBP, DBP) as the dependent

variables. Age, BMI, and sex were entered as covariates. Separate ANCOVAs were created for the speech preparation and speech tasks, and for the trauma-related SDI task. Testing was one-tailed with alpha = .05. For groups with more than 2 levels, contrasts were utilized to determine significance.

To assess if combat exposure or dissociation moderated the relationship between PTSD group and cardiovascular reactivity, moderation analyses were conducted with the SPSS PROCESS module for moderation and mediation (hypotheses 2 and 3). The PROCESS module does the centering and interaction terms automatically. For each task (prep, speech, trauma imagery), age, sex, and BMI were entered as covariates. PTSD group (PTSD+/PTSD-) was entered as the independent variable, combat exposure or dissociation was entered as the moderator variable, and cardiovascular reactivity (PEP, CO, TPR, HR, SBP, DBP) was entered as the dependent variable. Age, sex and BMI were entered as covariates. If the interaction was significant, then moderation was supported. Testing was two tailed with alpha = .05.

To determine if depression symptoms mediated the relationship between PTSD and cardiovascular reactivity, a mediation analysis was conducted (Hypothesis 4). The SPSS PROCESS module for moderation and mediation was utilized, which incorporates the Preacher and Hayes (2004) bootstrapping approach for estimating indirect effects in simple mediation. PROCESS was utilized for each task, with PTSD symptoms entered as the independent variable, depressive symptoms entered as the mediator, and cardiovascular reactivity index (PEP, CO, TPR, HR, SBP, DBP) was entered as the dependent variable. Age, sex and BMI were entered as covariates. This was done for each task.

According to modern mediation, it is no longer necessary to rely on statistical significance criteria for individual paths in a mediation model in order to assess whether a

variable functions as a mediator. The pattern of significance for individual paths in a mediation model is not pertinent to whether the indirect effect is significant. In modern mediation, the idea is that the c-path (path from IV to DV) gets smaller with the addition of a mediator. Therefore, we are interested in knowing if c path (the direct path) – c' path is significant. Mathematics has shown that a*b = c-c' (when both the DV and the mediator are continuous variables). The slopes for the paths of a (IV to mediator) and b (mediator to DV) are determined automatically in PROCESS, and also tested with bootstrapping approach to determine if a*b (the indirect effect) is significant. If the indirect effect, a*b is significant (e.g., included in the bootstrapping confidence interval), then mediation is assumed.

# Chapter 3

## Results

### Participant Characteristics

The sample was composed predominantly of males (90%) and ranged in age from 22 to 62 years of age. The average age was 37.68 years (*SD*=9.91 years). The sample was mostly white (69%), of non-Hispanic ethnicity (72%), with approximately half of the sample married (48%). Most participants had obtained some college credit (92%). Roughly half of the sample worked either full or part time (55%), and were enrolled in an educational program (55%). Most retired from Active Duty (86%), were enlisted personnel (85%), with 15+ years of service (38%) and reported two or more deployments (59%). Demographics are provided in Table 2.

Table 2. *Sample Characteristics (N=152)*

| | | | | No PTSD(n=83) | |
|---|---|---|---|---|---|
| | Total Sample N=152 (%) | PTSD+ (n=69) n (%) | No PTSD (n=83) n (%) | PTSD- (n=60) n (%) | PTSD-S (n=23) n (%) |
| **Sex** | | | | | |
| Male | 140 (92) | 63 (91) | 74 (89) | 52 (87) | 22 (96) |
| **Race** | | | | | |
| White | 107 (70) | 48 (70) | 58 (70) | 42 (70) | 16 (70) |
| Black | 29 (19) | 10 (15) | 18 (22) | 14 (23) | 4 (17) |
| Other | 19 (13) | 11 (16) | 7 (8) | 4 (7) | 3 (13) |
| **Ethnicity** | | | | | |
| Non-Hispanic | 112 (74) | 47 (68) | 63 (76) | 47 (78) | 16 (70) |
| **Marital Status** | | | | | |
| Married/Union | 92 (60) | 34 (49) | 39 (47) | 29 (48) | 10 (44) |
| Divorce/Separated | 32 (20) | 17 (25) | 14 (17) | 9 (15) | 5 (22) |
| Never Married | 31 (20) | 13 (19) | 18 (22) | 12 (20) | 6 (26) |
| **Education** | | | | | |
| HS/GED | 13 (8) | 7 (10) | 6 (7) | 4 (7) | 2 (9) |
| Some college | 66 (43) | 24 (35) | 41 (49) | 27 (45) | 14 (61) |
| AA | 32 (21) | 14 (20) | 15 (18) | 13 (22) | 2 (9) |
| BS | 23 (15) | 13 (19) | 10 (12) | 6 (10) | 4 (17) |
| MS | 22 (14) | 11 (16) | 11 (13) | 10 (17) | 1 (4) |

Table 2. *(Continued)*

| | Total Sample N=152 (%) | PTSD+ (n=69) n (%) | No PTSD (n=83) n (%) | PTSD- (n=60) n (%) | PTSD-S (n=23) n (%) |
|---|---|---|---|---|---|
| **Employment** | | | | | |
| Working | 73 (48) | 29 (42) | 54 (65) | 41 (68) | 13 (57) |
| **School** | | | | | |
| Enrolled | 83 (54) | 34 (49) | 49 (59) | 38 (63) | 11 (48) |
| **Employed and School** | | | | | |
| Part-time | 18 (11) | 4 (6) | 14 (16) | 12 (20) | 2 (8.7) |
| Full-time | 27 (17) | **11 (16)** | **16 (19)** | **10 (17)** | **6 (26)** |
| **Service Component** | | | | | |
| Active | 133 (87) | 58 (84) | 73 (88) | 53 (88) | 20 (87) |
| Guard Reserve | 22 (13) | 11 (16) | 10 (12) | 7 (16) | 3 (13) |
| **Years Served** | | | | | |
| < 5 | 38 (25) | 20 (29) | 17 (21) | 11 (18) | 6 (26) |
| 6 to 10 | 39 (25) | 18 (26) | 21 (25) | 13 (23) | 8 (25) |
| 11 to 15 | 19 (12) | 7 (10) | 11 (13) | 7 (12) | 4 (17) |
| 16-20 | 17 (11) | 4 (6) | 14 (17) | 10 (17) | 4 (17) |
| >20 | 42 (27) | 20 (29) | 20 (24) | 19 (32) | 1 (4) |
| **Rank** | | | | | |
| Enlisted | 132 (86) | 57 (83) | 73 (88) | 52 (87) | 21 (91) |
| **Total Deployments** | | | | | |
| 1 | 61 (40) | 29 (42) | 30 (39) | 22 (40) | 8 (35) |
| 2 | 60 (39) | 29 (42) | 30 (39) | 22 (40) | 8 (35) |
| 3 or more | 34 (21) | 11 (16) | 18 (23) | 11 (20) | 7 (30) |
| **Combat Exposure** | 6.34 (4.44) | 8.04 (4.33)a | 4.93 (4.03) | 3.77 (3.58)ab | 7.96 (3.57)b |
| **Age** (M/SD) | 37.59 (9.86) | 38.61 (10.41) | 36.75 (9.35) | 38.58 (9.64) | 23 (6.60) |
| **BMI** (M/SD) | 33.80 (28.93) | 37.34 (42.45) | 30.85 (5.43) | 30.62 (5.73) | 31.47 (4.56) |

## Preliminary Analyses

Preliminary analyses included assessing that scripts written by the Veterans during the Script Driven Imagery (SDI) task to determine if the events described in the scripts caused distress to the Veterans within the past seven days; determining if the tasks themselves elicited reactivity; determining if demographics and mental health characteristics differed by PTSD group; and determining if baseline physiology values differed by PTSD group.

**Script subjective distress check**. Two Oneway ANOVAs were conducted on subjective distress within the past seven days caused by the participant's index event, as reported on the Impact of Events Scale-Revised (Weiss, & Marmar, 1996). Results indicated that all PTSD groups were significantly different from each other on ratings of distress for both Script 1 ($p$'s < .01) and Script 2 ($p$'s < .02). Post hoc tests revealed that Veterans in the PTSD group were significantly more distressed in the past seven days due to events described in the scripts than Veterans in either of the other two groups. Veterans in the PTSD-S group were significantly more distressed by the events described in the scripts in the past 7 days than Veterans in the PTSD- group. Unfortunately, not all Veterans were willing to write two separate scripts. When Veterans wrote two scripts, the script rated as the most distressing in the past 7 days was utilized in all further analyses. Means, standard deviations, and omnibus F test results are provided in Table 3.

Table 3.

*Differences in Impact Scores by PTSD Group*

| | PTSD+ M(SD) | PTSD- M(SD) | PTSD-S M(SD) | *F* |
|---|---|---|---|---|
| Script A | 42.38 (21.05) | 10.84 (12.12) | 24.10 (17.10) | 51.04*** |
| Script B | 43.86 (23.13) | 6.77 (7.76) | 21.18 (18.72) | 52.56*** |

**Stimulus elicitation**. A series of repeated measures ANOVAs were conducted to determine if tasks elicited reactivity within subjects. Baseline and task segments for each cardiovascular measure (HR, PEP, CO, TPR, SYS, and DIA) were entered as the within subjects variables. There were significant effects of time on all cardiovascular measures, with the exception of TPR. Total peripheral resistance was not significant for the SDI task. However,

given that individuals' TPR can either decrease or increase in response to stress, this is not surprising. Means and significance testing are provided in Table 4.

Table 4.

*Mean Baseline and Task Segment Scores by Cardiovascular Measure*

| | | Baseline *M (SE)* | Task Segment *M (SE)* | *F* | $\dot{\eta}^2$ |
|---|---|---|---|---|---|
| Speech Preparation | HR | 68.29 (0.91) | 77.94 (1.10) | 254.61*** | .63 |
| | PEP | 120.02 (1.42) | 107.58 (1.72) | 132.16*** | .47 |
| | CO | 5.84 (0.15) | 6.74 (0.21) | 42.99*** | .22 |
| | TPR | 1407.23 (43.58) | 1348.08 (46.12) | 6.82** | .04 |
| | SYS | 123.20 (0.95) | 132.08 (1.02) | 176.11*** | .54 |
| | DIA | 76.19 (0.67) | 81.47 (0.76) | 97.48*** | .39 |
| Speech Delivery | HR | 68.47 (0.94) | 82.71 (1.18) | 374.71*** | .72 |
| | PEP | 119.78 (1.41) | 104.56(1.67) | 135.66*** | .48 |
| | CO | 5.87 (0.15) | 7.52 (0.24) | 77.84*** | .34 |
| | TPR | 1386.95(43.45) | 1248.13 (40.78) | 23.97*** | .14 |
| | SYS | 123.04 (0.94) | 138.26 (1.37) | 190.23*** | .56 |
| | DIA | 76.19 (0.67) | 84.98 (1.21) | 65.56*** | .30 |
| Trauma Imagery | HR | 68.42 (0.97) | 71.01 (1.06) | 26.52*** | .17 |
| | PEP | 118.66 (1.48) | 115.26 (1.55) | 17.77*** | .12 |
| | CO | 5.92 (0.17) | 6.30 (0.19) | 23.84*** | .09 |
| | TPR | 1392.71 (47.82) | 1399.06 (48.12) | <1 | <.01 |
| | SYS | 122.87 (1.00) | 130.21 (127.21) | 53.03*** | .29 |
| | DIA | 76.10 (0.69) | 82.10 (1.03) | 62.21*** | .32 |

Note: HR = heart rate, PEP = pre-ejection period, CO = cardiac output, TPR = total peripheral resistance, SYS = systolic blood pressure, DIA = diastolic blood pressure.

**Task engagement and effort.** A one sample t-test was utilized to determine engagement and effort, which is determined by HR being different than zero (Blascovich, 2001; Blascovich, 2004). Heart rate for the speech preparation ($t(152)=19.53$, $p<.001$), speech delivery ($t(152)=20.49$, $p<.001$) and script imagery task ($t(152)=3.36$, $p<.01$) were all significantly different from zero, indicating engagement and effort.

**Group differences in demographic variables.** ANOVAs were conducted to determine PTSD group differences in demographic variables (Table 2). Results indicated PTSD group differences in age and combat exposure. Specifically, the PTSD-S group was significantly younger than both the PTSD+ and PTSD- groups. There were no group differences in gender or BMI. Additionally, although no differences between them, the PTSD and PTSD-S groups reported significantly more combat exposure than the PTSD- group. Types of combat exposures and frequency of sample endorsing each experience is provided in Table 5.

Table 5.
*Frequency of Combat Experiences*

| | *% (n)* |
|---|---|
| 1. I went on combat patrols or missions. | 70 (106) |
| 2. I or members of my unit encountered land or water mines and/or booby traps. | 54 (82) |
| 3. I or members of my unit received hostile incoming fire from small arms, artillery, rockets, mortars, or bombs. | 85 (129) |
| 4. I or members of my unit received "friendly" fire from small arms, artillery, rockets, mortars, or bombs. | 21 (32) |
| 5. I was in a vehicle (for example, a truck, tank, APC, helicopter, plane, or boat) that was under fire. | 49 (74) |
| 6. I or members of my unit were attacked by terrorists or civilians. | 63 (95) |
| 7. I was part of a land or naval artillery unit that fired on the enemy. | 19 (29) |
| 8. I was part of an assault on entrenched or fortified positions. | 23 (35) |
| 9. I took part in an invasion that involved naval and/or land forces. | 22 (33) |
| 10. My unit engaged in battle in which it suffered casualties. | 48 (73) |
| 11. I personally witnessed someone from my unit or an ally unit being seriously wounded or killed. | 41 (62) |
| 12. I personally witnessed soldiers from enemy troops being seriously wounded or killed. | 51 (77) |
| 13. I was wounded or injured in combat. | 20 (31) |
| 14. I fired my weapon at the enemy. | 38 (58) |
| 15. I killed or think I killed someone in combat. | 32 (48) |

The sample was also characterized by mental health measures. A series of ANOVAs were conducted to determine PTSD group differences in mental health characteristics (Table 6). Groups differed on depression, anxiety, and dissociation symptoms. Veterans in the PTSD group reported significantly more anxiety, dissociative, and depressive symptoms than Veterans in both the PTSD-S and PTSD- groups, while Veterans in the PTSD-S group reported significantly more anxiety and depressive symptoms than those in the PTSD- group.

Table 6.

*Mean and standard deviations of Mental health characteristics by total sample, PTSD+ group, PTSD- group, and No PTSD group (PTSD- vs PTSD-S)*

| Variable | Total Sample | PTSD+ | No PTSD | No PTSD | |
|---|---|---|---|---|---|
| | | | | PTSD- | PTSD-S |
| | *Mean (SD)* | *Mean (SD)* | *Mean (SD)* | *Mean (SD)* | *Mean (SD)* |
| PTSD symptoms | 44.53 (16.66) | 59.55 (9.05)ac | 32.04(9.77) | 27.18 (6.48)ab | 44.70(3.32)bc |
| General mental health (SCL-GSI) | 0.95 (.75) | 1.44 (.68)*ac* | .54(.52) | .42(.47)*ab* | .84(.51)*bc* |
| Combat traumas | | 8.04 (4.33)a | 4.93 (4.03) | 3.77 (3.58)ab | 7.96 (3.57)b |
| Depression symptoms | 19.32 (12.62) | 28.84(11.12)ac | 11.40(7.14) | 9.48(6.46)ab | 16.39(6.51)bc |
| Anxiety symptoms | 15.71 (11.84) | 23.36(11.14)ac | 9.35(8.07) | 6.98(6.74)ab | 15.52(8.12)bc |
| Functioning (SF-36) | | | | | |
| Physical functioning | 72.27(24.11) | 66.01(22.27)*a* | 77.59(24.46) | 78.73(24.79)*a* | 74.55(23.85) |
| Social functioning | 68.84(25.11) | 51.58(20.14)*ac* | 82.95(19.33) | 86.83(17.09)*ab* | 72.62(21.51)*bc* |
| Physical limitations | 60(41.10) | 46.59(41.58)*a* | 71.96(37.00) | 75.94(35.00)*a* | 61.90(40.79) |
| Emotional limitations | 58.51 (43.19) | 36.36(39.97)*ab* | 78.54(35.73) | 84.28(31.76)*a* | 63.33(41.75)*b* |
| Emotional wellbeing | 61.14(20.96) | 49.45(18.29)*a* | 70.98(17.84) | 75.25(14.34)*ab* | 60.00(21.34)*b* |
| Energy/fatigue | 44.13 (21.25) | 36.10(17.40)*a* | 50.79(21.94) | 54.41(22.01)*ab* | 41.52(19.21)*b* |
| Pain | 64.47(20.53) | 56.86(19.01)*a* | 70.75(19.71) | 71.90(19.18)*a* | 67.73(21.20) |
| Perception of mental health | 64.01(17.78) | 59.04(14.98)*a* | 68.05(18.93) | 67.40(18.04)*a* | 70.00(21.91) |
| Dissociation | 16.49(13.23) | 23.87(14.64)ab | 10.36 (7.81) | 9.07 (7.09)a | 13.74 (8.73)b |

Note: letters a, b, c indicate significant differences in pairs.

Finally, a series of ANCOVAs were conducted to determine PTSD group differences in baseline measures. PTSD group was entered as the independent variable, baseline measures entered as dependent measures, and BMI, age and gender entered as covariates (Table 7). There were no significant PTSD group differences for any of the baseline cardiovascular measures.

Table 7. *Mean and Standard deviations for Baseline Variables by PTSD Group*

| | | No PTSD | |
|---|---|---|---|
| | PTSD+ | PTSD-S | PTSD- |
| | *Mean (SD)* | *Mean (SD)* | *Mean (SD)* |
| HR (bpm) | 69.92 (11.51) | 66.49 (12.77) | 68.28 (11.09) |
| PEP (ms) | 119.72 (17.15) | 123.16 (16.01) | 119.11 (18.34) |
| CO (liter/min) | 6.06 (2.04) | 5.92 (1.29) | 5.56 (1.84) |
| TPR (resistance units) | 1333.44 (453.94) | 1326.41 (496.99) | 1511.14 (613.12) |
| SBP (mmHg) | 122.15 (10.48) | 125.05 (9.87) | 124.07 (13.23) |
| DBP (mmHg) | 75.60 (7.90) | 75.12 (8.68) | 77.30 (8.59) |

Note: HR: heart rate, PEP: pre-ejection period, CO: cardiac output, TPR: total peripheral resistance, SYS: systolic blood pressure, DIA: diastolic blood pressure.

**Main Analyses**

The main analyses of this study are presented below by hypothesis. Only those findings that were statistically significant - or borderline significance - are provided below.

**Hypothesis 1: Cardiovascular reactivity to tasks.** Cardiac output reactivity to the trauma imagery task was significant ($F(1,148)=3.95$, $p=.04$, $\eta^2=.03$). Contrary to hypothesis 1, Veterans in the PTSD group exhibited greater cardiac output reactivity to the trauma imagery task than Veterans in the No PTSD group. Cardiac output reactivity to speech delivery was borderline signficant ($F(1,148)=2.48$, $p=.09$, $\eta^2=.02$). Veterans in the PTSD group exhibited lower cardiac output reactivity during speech delivery than Veterans in the No PTSD group (See Figure 1).

Splitting the subsyndromal group from the No PTSD group provided additional insight into the effects of subthreshold PTSD on cardiovascular reactivity. Veterans in the PTSD-S

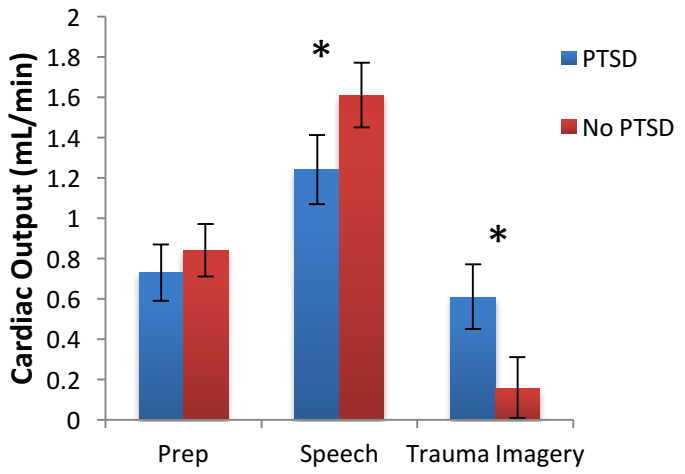


*Figure 1*. Effect of PTSD and No PTSD on Cardiac Output Reactivity.

group exhibited lower heart rate reactivity to speech preparation ($F(1,147)= 5.02$, $p= .03$, $\dot{\eta}^2=.03$) and delivery ($F(1,147)=3.44$, $p=.06$, $\dot{\eta}^2=.03$) than Veterans in the PTSD- group (Figure 2); and

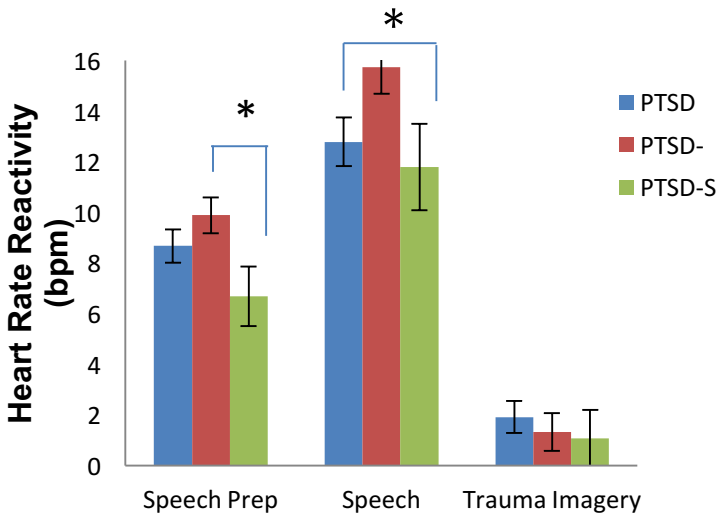


*Figure 2*. Effect of PTSD, PTSD- and PTSD-S on Heart Rate Reactivity

lower cardiac output reactivity to the trauma imagery task ($F(1,147)= 6.64$, $p= .01$, $\dot{\eta}^2=.04$) than Veterans in the PTSD+ group (Figure 3).

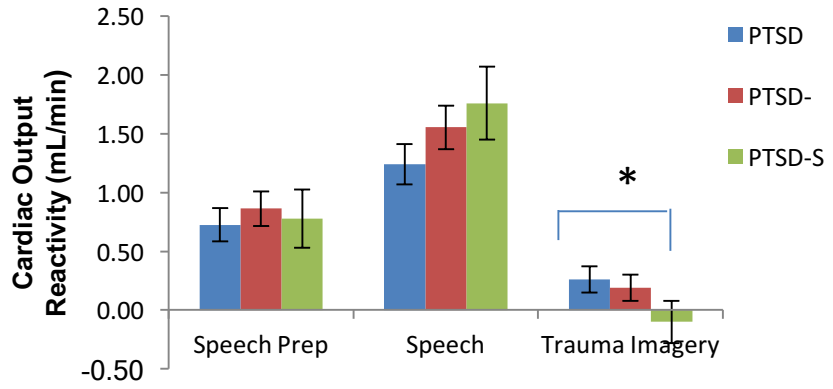


*Figure 3*. Effect of PTSD, PTSD- and PTSD-S on Cardiac Output Reactivity.

Additionally, Veterans in the PTSD-S group exhibited lower systolic blood pressure to the trauma imagery task than Veterans in the PTSD- ($F(1,147)=2.91$, $p=.09$) and PTSD+ ($F(1,147)=3.17$, $p=.08$) groups (Figure 4).

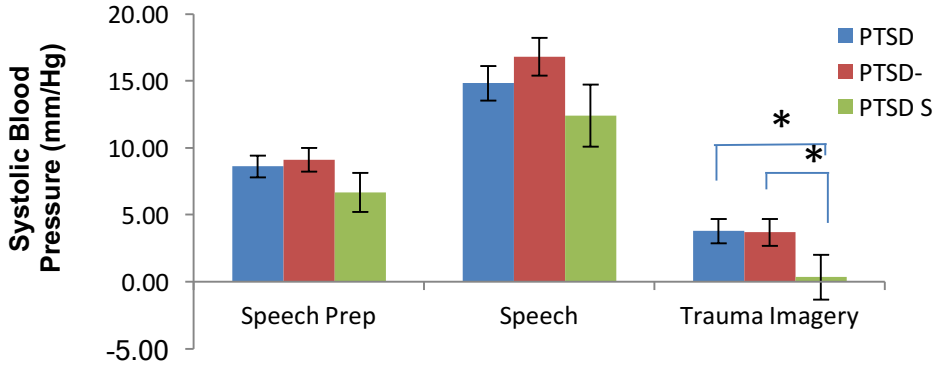


*Figure 4*. Effect of PTSD, PTSD- and PTSD-S on SBP Reactivity.

Finally, Veterans in the PTSD-S group exhibited increases in TPR reactivity to the trauma imagery task, whereas Veterans in the PTSD- ($F(1,147)=5.25$, $p=.02$) and PTSD+ ($F(1,147)=6.65$, $p=.01$) groups exhibited decreases in TPR reactivity (Figure 5).

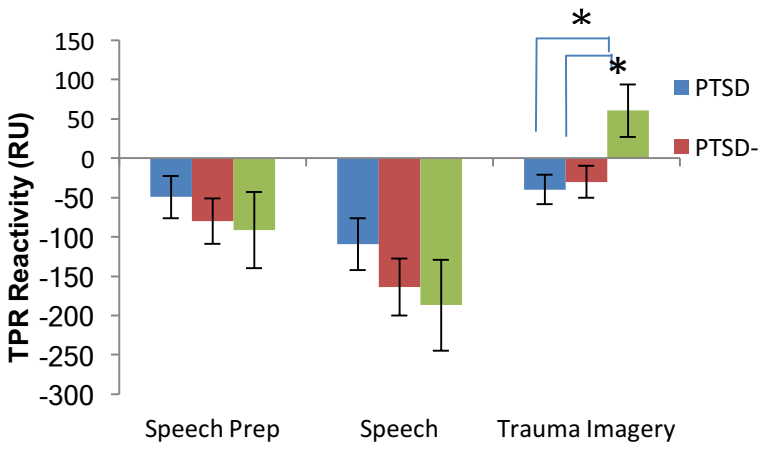


*Figure 5.* Effect of PTSD, PTSD- and PTSD-S on TPR Reactivity.

**Hypothesis 2: Dissociation as a moderator between PTSD and cardiovascular reactivity.** Dissociation did not moderate the relationship between 2-level PTSD (PTSD/No PTSD) and cardiovascular reactivity, However, after controlling for dissociation, age, sex, and BMI, speech delivery was borderline significant ($F(1,146)=2.95, p=.08, \dot{\eta}^2=.02$). Veterans in the PTSD group exhibited lower heart rate reactivity than Veterans in the No PTSD group. Results are depicted in Figure 6.

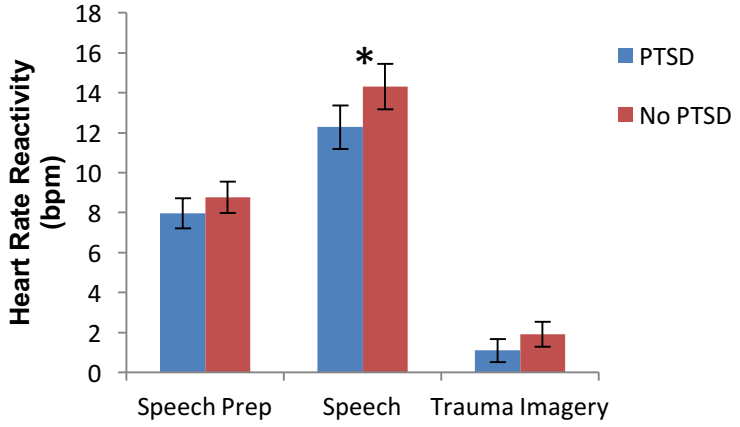


*Figure 6.* Effect of PTSD and No PTSD Groups on Heart Rate Reactivity, Controlling for Dissociation, Sex and BMI.

Dissociation did not serve as a moderator in the relationship between 3-level PTSD and cardiovascular reactivity. However, after controlling for dissociation, age, sex and BMI, the pattern of results reported above for TPR reactivity did not change. Additionally, the effect of PTSD on heart rate reactivity to speech delivery was no longer significant, but heart rate reactivity to the speech preparation task remained significant. ($F(1,144)=2.99$, $p=.05$. $\dot{\eta}^2=.04$). Again, the PTSD-S/PTSD comparison was not significant.

**Hypothesis 3: Combat exposure as a moderator between PTSD and cardiovascular reactivity.** There was a significant interaction between combat exposure and PTSD group for cardiac output reactivity to the trauma imagery task ($F(1,146)=4.41$, $p=.04$, $\dot{\eta}^2=.03$). The interaction is depicted in Figure 7. Simple slopes analyses were conducted. The slope for the No PTSD group was significant ($b= -.05$, $t(146)= -2.0$, $p= 0.04$). Lower levels of combat exposure were associated with higher reactivity, while higher levels of combat exposure were associated with lower reactivity. For Veterans in the PTSD group, number of combat experiences was not related to cardiac output ($b=.02$, $t(146)=0.95$, $p>.05$).

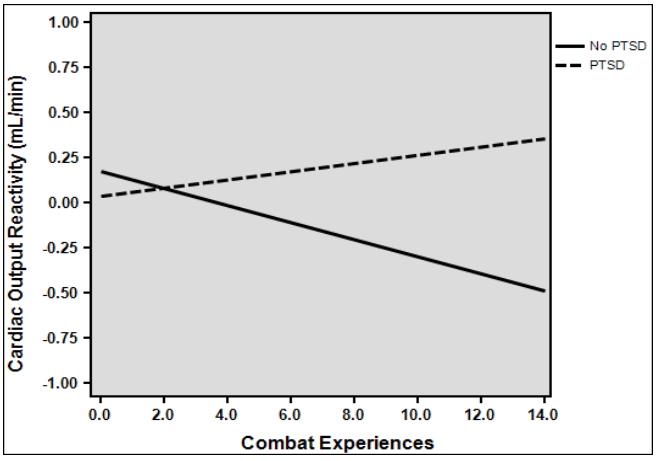


*Figure 7*. Combat Experiences and Cardiac Output Reactivity as a Function of PTSD group during Trauma Imagery.

Additional findings included significant systolic BP for both speech preparation ($F(1,146)= 5.65$, $p= .02$, $\dot{\eta}^2= .04$; $B= -0.32$, $SE= 0.14$,[$CI$: -0.70, - .06]) and speech delivery

($F(1,146)= 4.48$, $p= .04$, $\dot{\eta}^2= .03$; $B= -0.41$, $SE=0.30$, [$CI$:-1.01, 0.20], after controlling for age, sex, BMI and PTSD group. For all parameter estimates, an increase in combat exposure was associated with a decrease in cardiovascular reactivity. Finally, subthreshold PTSD was parsed out from the No PTSD group to determine if combat exposure served as a moderator between the 3-level PTSD group and reactivity. No interactions were significant for any of the cardiovascular indices.

**Hypothesis 4: Depression as a mediator between PTSD symptoms and cardiovascular reactivity.** Depression was not found to mediate the relationship between PTSD symptoms and cardiovascular reactivity in the current study. Correlations tables are provided in Figure 8.

**Hypothesis 5: PTSD and recovery.** Cardiac output recovery was borderline significant, $F(1,149)= 3.90$, $p= .05$, $\dot{\eta}^2= .03$ for the trauma imagery task. In accordance with the proposed hypothesis, those in the PTSD group exhibited a lower % of CO recovery than Veterans without PTSD. Recovery from the speech task did not differ by Veteran group (See Figure 8).

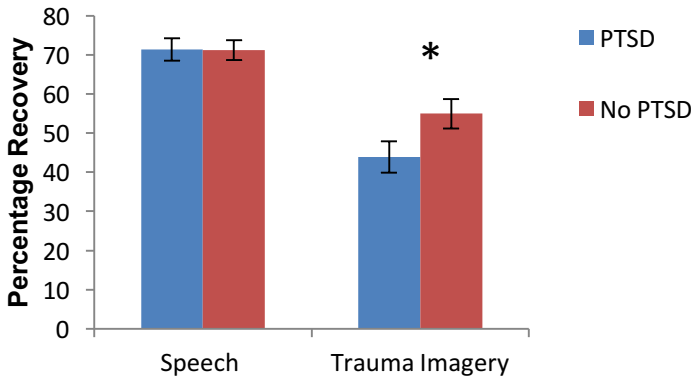


*Figure 8*. Area-Under-the-Curve CO Percentage Recovery by PTSD group for Speech and Trauma Imagery Tasks.

Table 8.
Correlations, Means and Standard Deviations for Main Study Variables by Trauma Imagery (A), Speech Prep (B) and Speech (C) Tasks.

Trauma Imagery Task

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. SBP | - | | | | | | | | | | | |
| 2. DBP | .236*** | | | | | | | | | | | |
| 3. HR | .139# | .008 | | | | | | | | | | |
| 4. Pep | .037 | -.153# | -.160* | | | | | | | | | |
| 5. CO | -.002 | .009 | .339*** | -.335*** | | | | | | | | |
| 6. TPR | .215** | .157# | -.113 | .300*** | -.618*** | | | | | | | |
| 7. PCL | -.014 | .107 | .126 | -.036 | .085 | -.034 | | | | | | |
| 8. BDI | -.026 | .107 | .146# | -.1-8 | .137# | -.132 | .806*** | | | | | |
| 9. DES | .121 | .237** | .109 | -.018 | .013 | .049 | .558*** | .511*** | | | | |
| 10. BMI | .021 | -.278*** | -.168* | .074 | -.013 | -.057 | -.033 | .066 | -.080 | | | |
| 11. Age | -.072 | .020 | .149# | -.031 | .097 | -.195* | -.020 | .102 | -.105 | -.039 | | |
| 12. Sex | -.038 | -.042 | .122 | .018 | -.070 | .049 | .067 | .003 | .003 | .101 | -.148 | |
| Mean | 2.98 | -44.7 | 1.29 | -3.34 | .286 | -21.06 | 44.60 | 19.31 | 16.51 | 30.28 | 37.58 | .90 |
| SD | 6.85 | 9.37 | 5.28 | 9.64 | .859 | 161.57 | 16.63 | 12.62 | 13.19 | 4.40 | 9.83 | .29 |

Speech Prep Task

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. SBP | - | | | | | | | | | | | |
| 2. DBP | .295*** | | | | | | | | | | | |
| 3. HR | .505*** | .236** | | | | | | | | | | |
| 4. Pep | -.505*** | -.041 | -.585*** | | | | | | | | | |
| 5. CO | .420*** | .187* | .555*** | -.688*** | | | | | | | | |
| 6. TPR | -.244** | .073 | -.405*** | .554*** | -.794*** | | | | | | | |
| 7. PCL | -.084 | -.070 | -.072 | .060 | -.106 | .093 | | | | | | |
| 8. BDI | -.020 | -.095 | .033 | .063 | -.073 | .037 | .806*** | | | | | |
| 9. DES | .105 | -.019 | .107 | -.045 | .027 | .039 | .588*** | .511*** | | | | |
| 10. BMI | -.139# | -.039 | -.203* | .197* | -.173* | .046 | -.033 | -.066 | -.080 | | | |
| 11. Age | .170* | -.056 | -.055 | -.127 | .046 | -.263** | -.020 | .102 | -.105 | -.039 | | |
| 12. Sex | -.004 | .073 | .041 | .007 | .031 | -.112 | .067 | .003 | .003 | .101 | -.148# | |
| Mean | 8.51 | 5.30 | 8.85 | -12.12 | .787 | -67.43 | 44.60 | 19.31 | 16.51 | 30.28 | 37.58 | .90 |
| SD | 6.95 | 5.22 | 5.62 | 12.04 | 1.15 | 228.42 | 16.63 | 12.62 | 13.19 | 4.40 | 9.83 | .29 |

Speech Task

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. SBP | - | | | | | | | | | | | |
| 2. DBP | .518*** | | | | | | | | | | | |
| 3. HR | .430*** | .309*** | | | | | | | | | | |
| 4. Pep | -.382*** | -.228** | -.553*** | | | | | | | | | |
| 5. CO | .241** | .118 | .503*** | -.526*** | | | | | | | | |
| 6. TPR | .051 | .199* | -.289*** | .341*** | -.725*** | | | | | | | |
| 7. PCL | -.132 | .017 | -.154# | .091 | -.148# | .139# | | | | | | |
| 8. BDI | -.101 | -.046 | -.075 | .126 | -.182** | .102 | .806*** | | | | | |
| 9. DES | -.006 | .045 | .001 | .049 | -.030 | .086 | .558*** | .511*** | | | | |
| 10. BMI | -.152# | .001 | -.253** | .182* | -.023 | -.106 | -.033 | -.066 | -.080 | | | |
| 11. Age | .159* | -.046 | -.025 | .000 | .071 | -.302*** | -.020 | .102 | -.105 | -.039 | | |
| 12. Sex | .018 | .133 | .080 | -.110 | .010 | -.032 | .067 | .003 | .003 | .101 | -.148# | |
| Mean | 15.25 | 9.89 | 13.79 | -14.96 | 1.44 | -142.67 | 44.60 | 19.31 | 16.51 | 30.28 | 37.58 | .90 |
| SD | 11.01 | 8.58 | 8.32 | 15.03 | 1.43 | 281.05 | 16.63 | 12.62 | 13.19 | 4.40 | 9.83 | .298 |

Note: SYS: systolic blood pressure, DIA: diastolic blood pressure HR: heart rate, PEP: pre-ejection period, CO: cardiac output, TPR:total peripheral resistance, PCL: posttraumatic stress disorder checklist; BDI: Beck depression inventory; DES: dissociation event scale; BMI: body mass index

Area-under-the-curve percentage recovery was also assessed after parsing out the subthreshold PTSD group from the No PTSD group. The comparison between the PSTD-S group and the PTSD group was significant ($F(1, 147)= 6.29$), $p= .01$, $\dot{\eta}^2= .07$. Consistent with predictions, Veterans in the PTSD-S group exhibited more recovery than Veterans in the PTSD+ group. There were no significant differences in cardiac output recovery for the speech task or the PTSD-S and PTSD- groups for the trauma imagery task (See Figure 10)

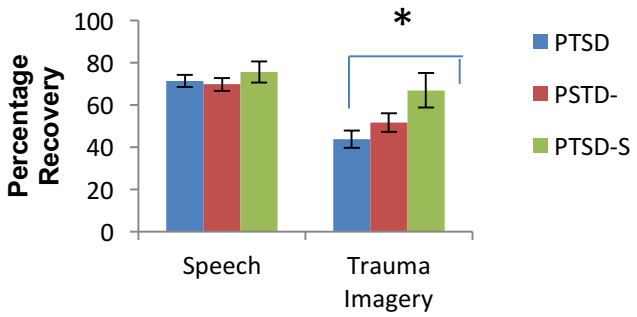


*Figure 9*. Area-Under-the-Curve Percentage Cardiac Output Recover.

**Other Analyses**

After conducting the main analyses, it became apparent that depression may better serve as a moderator between PTSD and cardiovascular reactivity. To test this assumption, moderation analyses were conducted with the 2-level and 3-level PTSD variables as the independent grouping variables and depression as the moderator variable, with each cardiovascular index serving as the dependent variable. There were significant interactions between 2-level PTSD group and depression symptom scores among cardiovascular indices for speech prep (HR reactivity: F(1,145)=5.86, p=.02) and DBP reactivity: F(1,145)=5.69, p=.02), speech (HR reactivity: F(1,145)=4.94, p=.03, and SBP reactivity: F(1,145)=3.34, p=.07 ) and trauma imagery tasks (CO reactivity: F(1,127)=5.80, p=.04).

Simple slopes analysis was conducted for the significant interactions. Results are reported in Table 9. For Veterans in the PTSD group, a positive relationship was found between

*Table 9*

Results of simple slope analyses for significant 2-level PTSD x depression interaction.

| Task | PTSD Group | b | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|---|
| *Speech Prep* | | | | | | | |
| HR | No PTSD | -.14 | .08 | -1.62 | .11 | -.30 | .03 |
| | PTSD | .11 | .06 | 1.92 | .06 | .00 | .23 |
| | | | | | | | |
| DBP | No PTSD | -.19 | .08 | -2.38 | .02 | -.35 | -.03 |
| | PTSD | .04 | .06 | 0.78 | .44 | -.07 | .16 |
| *Speech* | | | | | | | |
| HR | No PTSD | -.25 | .12 | -2.00 | .05 | -.49 | .00 |
| | PTSD | .09 | .09 | 1.03 | .31 | -.08 | .26 |
| | | | | | | | |
| SBP | No PTSD | -.42 | .17 | -2.55 | .01 | -.75 | -.10 |
| | PTSD | -.05 | .12 | -.43 | .67 | -.28 | .18 |
| | | | | | | | |
| *Trauma Imagery* | | | | | | | |
| CO | No PTSD | -.02 | .02 | -1.08 | .28 | -.06 | .02 |
| | PTSD | .04 | .01 | 1.32 | .01 | .01 | .07 |

HR=heart rate; DBP = diastolic blood pressure; SBP=systolic blood pressure; CO=cardiac output

depression and HR reactivity for speech preparation, and CO for the trauma imagery task. Among Veterans in the No PTSD group, a negative relationship was noted between depression symptoms and DBP to speech preparation and HR and SBP to speech delivery. Results are displayed in Figures 10-14.

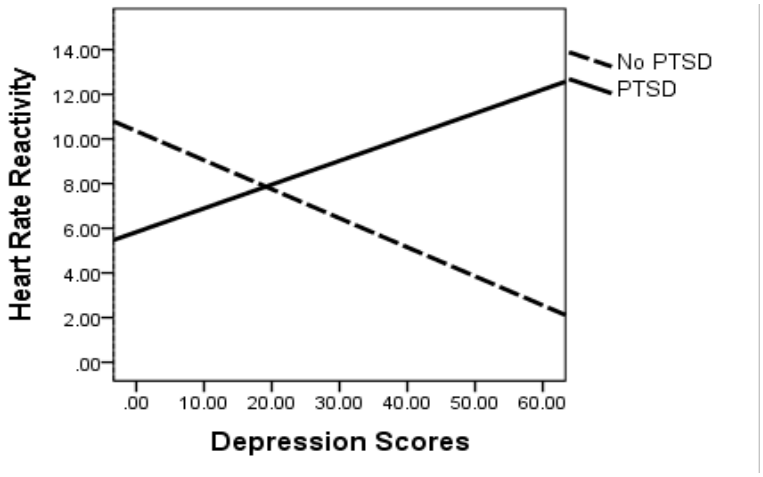


*Figure 10.* Interaction between 2-level PTSD and depression scores on heart rate reactivity during speech preparation.

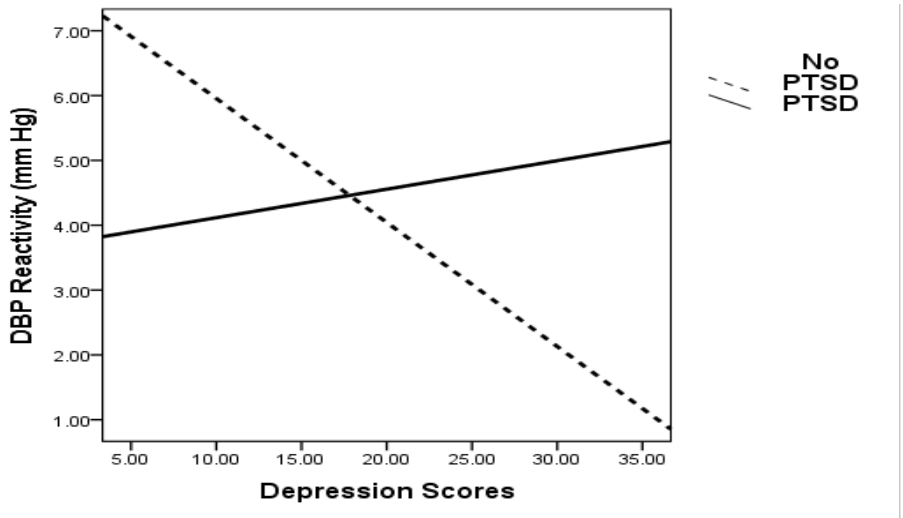


*Figure 11.* Interaction between 2-level PTSD and depression scores on DBP reactivity during speech preparation.

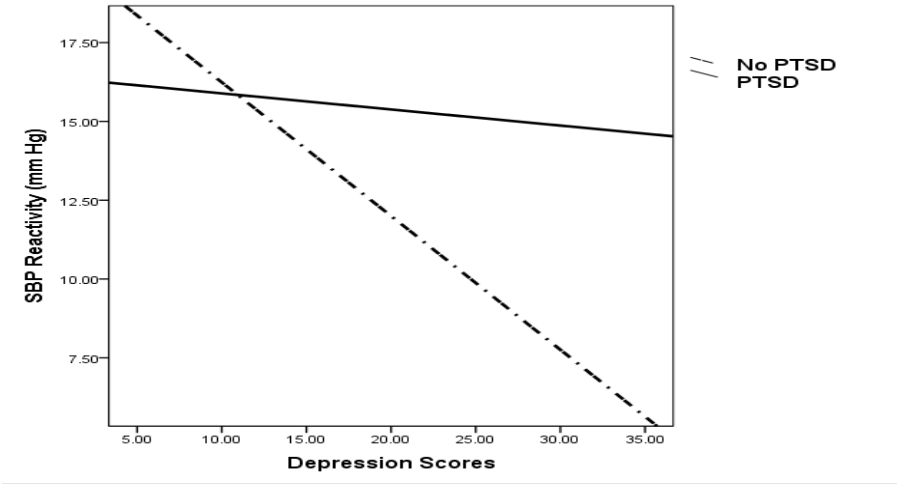


*Figure 12.* Interaction between 2-level PTSD and depression scores on SBP reactivity during speech task.

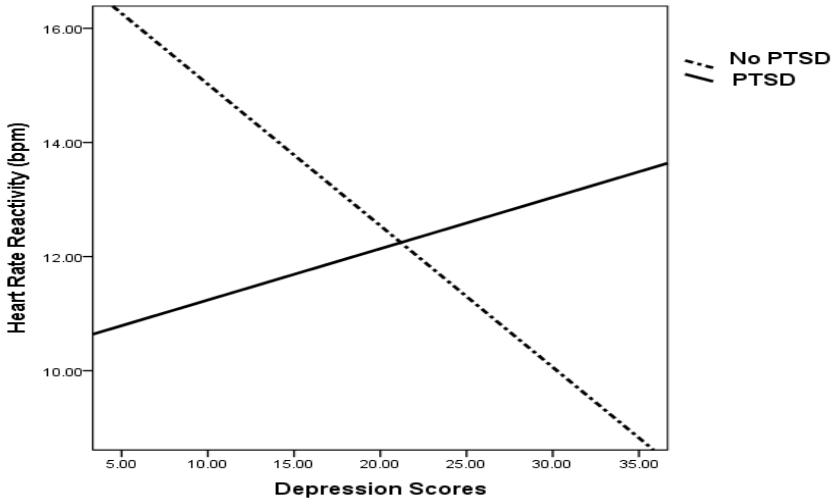


*Figure 13.* Interaction between 2-level PTSD and depression scores on HR reactivity during speech task.

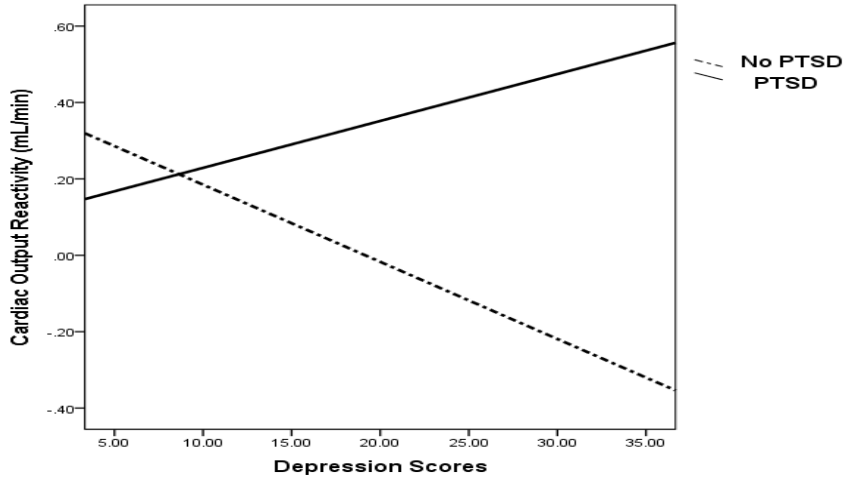


*Figure 14.* Interaction between 2-level PTSD and depression scores on CO reactivity during trauma imagery task.

Further delineating the PTSD-S group from the No PTSD group shed additional light on the relationship between PTSD group and depression on cardiovascular reactivity. There were significant interactions between 3-level PTSD group and depression symptom scores among cardiovascular indices during speech preparation (SBP: $F(1,145)= 5.97$, $p=.02$; HR: $F(1,145)=6.80$ , $p=.01$; PEP: $F(1,145)=4.72$,$p=.03$), and speech delivery (HR: $F(1,145)=7.39$ $p=.01$ and PEP: $F(1,145)= 8.30$ , $p<.001$; and CO: $F(1,145)=6.87$, $p<.01$). There were no

interactions between the 3-level PTSD variable and depression on CV indices for the trauma imagery task.

Simple slopes analysis was conducted for the significant interactions. Results are reported in Table 10. A positive correlation was noted between depression and HR reactivity to preparation and speech delivery and SBP to speech preparation among Veterans in the PTSD-S group. However, a negative relationship between depression and reactivity was found among Veterans in PTSD- group for indices of DBP and CO to speech preparation, and HR and CO to speech delivery, while a positive relationship between depression and PEP reactivity was noted to speech preparation and delivery. Veterans in the PTSD+ group exhibited a negative relationship

*Table 10.* Results of simple slope analyses for significant 3-level PTSD x depression interaction.

| **Task** | **PTSD Group** | **b** | **se** | **t** | **p** | **LLCI** | **ULCI** |
|---|---|---|---|---|---|---|---|
| *Speech Prep* | | | | | | | |
| HR | PTSD- | -.13 | .08 | -1.60 | .11 | -.29 | .03 |
| | PTSD+ | .04 | .04 | 1.01 | .31 | -.04 | .11 |
| | PTSD-S | .21 | .07 | 3.02 | <.001 | .07 | .34 |
| | | | | | | | |
| SBP | PTSD- | -.23 | .10 | -2.19 | .03 | -.43 | -.02 |
| | PTSD+ | -.03 | .05 | -0.52 | .60 | -.12 | .07 |
| | PTSD-S | .18 | .09 | 2.01 | .05 | .01 | .35 |
| | | | | | | | |
| PEP | PTSD- | .43 | .18 | 2.38 | .02 | .07 | .79 |
| | PTSD+ | .12 | .09 | 1.36 | .18 | -.05 | .29 |
| | PTSD-S | -.20 | .15 | -1.29 | .20 | -.50 | .11 |
| | | | | | | | |
| CO | PTSD- | -.04 | .02 | -2.13 | .04 | -.07 | -.01 |
| | PTSD+ | -.01 | .01 | -1.37 | .17 | -.03 | .00 |
| | PTSD-S | .01 | .01 | .98 | .33 | -.01 | .04 |
| Speech Task | | | | | | | |
| HR | PTSD- | -.30 | .12 | -2.52 | .01 | -.54 | -.07 |
| | PTSD+ | -.04 | .06 | -0.75 | .45 | -.16 | .07 |
| | PTSD-S | .22 | .10 | 2.14 | .03 | .02 | .42 |
| | | | | | | | |
| PEP | PTSD- | .74 | .22 | 3.31 | <.001 | .30 | 1.18 |
| | PTSD+ | .22 | .11 | 2.14 | .03 | .02 | .43 |
| | PTSD-S | -.29 | .19 | -1.52 | .13 | -.66 | .09 |
| | | | | | | | |
| CO | PTSD- | -.08 | .02 | -3.57 | <.001 | -.12 | -.03 |
| | PTSD-+ | -.03 | .01 | -3.13 | <.001 | -.05 | -.01 |
| | PTSD-S | .01 | .02 | 0.72 | .47 | -.02 | .05 |

HR=heart rate; SBP=systolic blood pressure; PEP=pre-ejection period; CO=cardiac output

between depression symptoms and CO reactivity for speech delivery and a positive relationship for PEP during speech delivery. Results are displayed in Figures 15-20.

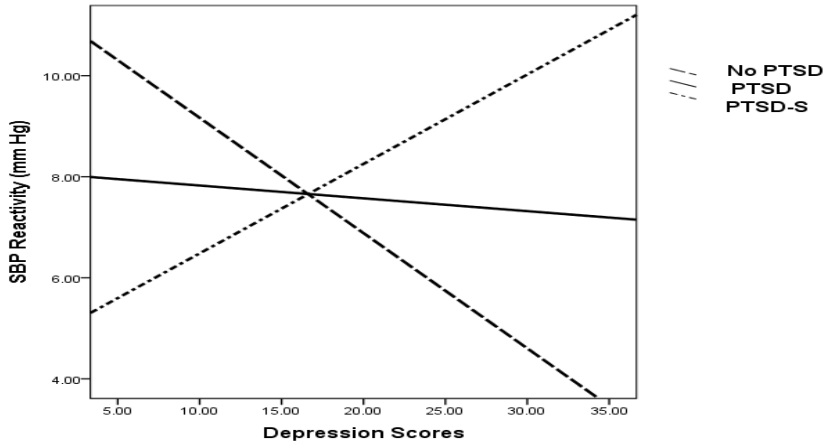


*Figure 15.* Interaction between 3-level PTSD and depression scores on SBP reactivity during speech preparation.

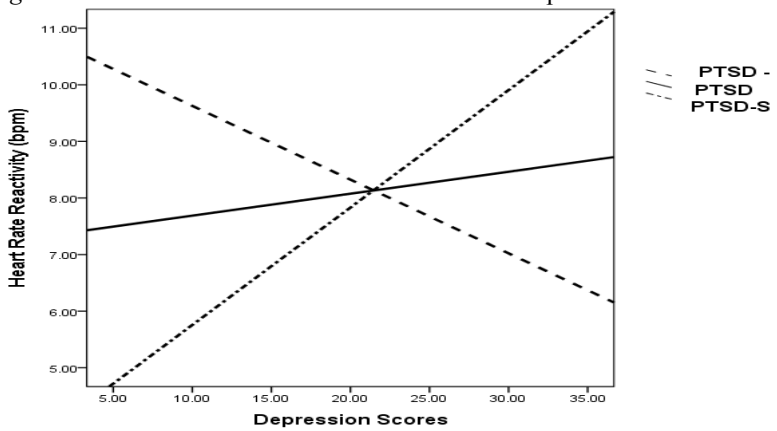


*Figure 16.* Interaction between 3-level PTSD and depression scores on HR reactivity during speech preparation.

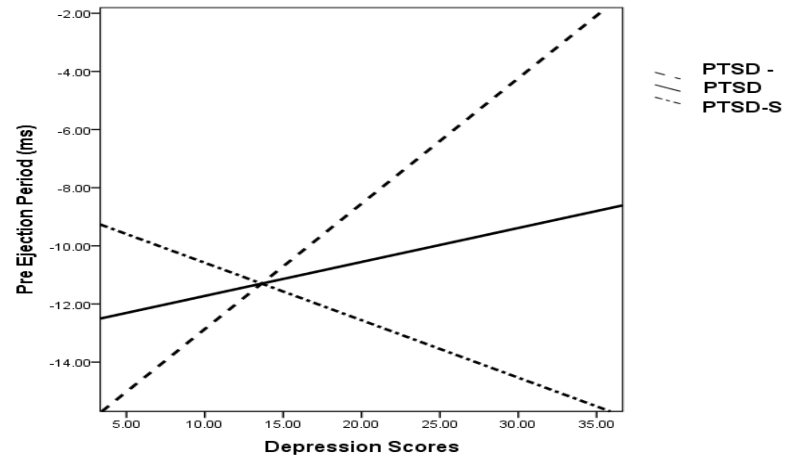


*Figure 17.* Interaction between 3-level PTSD and depression scores on PEP reactivity during speech preparation

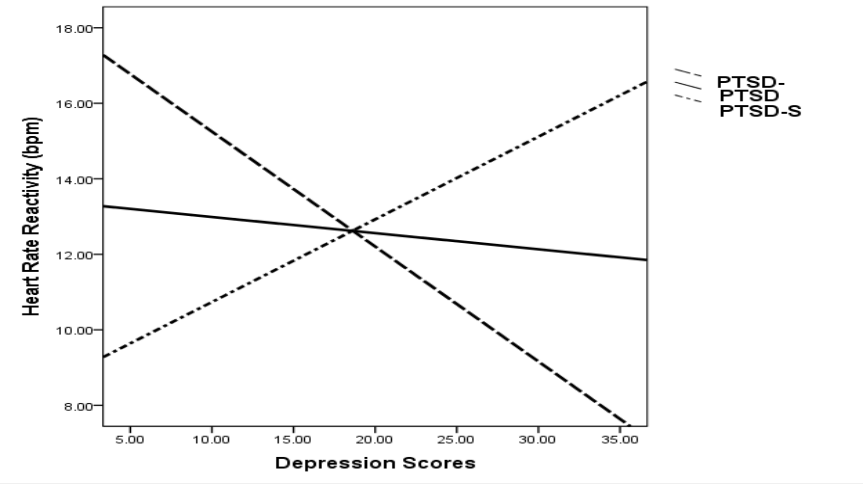


*Figure 18.* Interaction between 3-level PTSD and depression scores on HR reactivity during speech task.

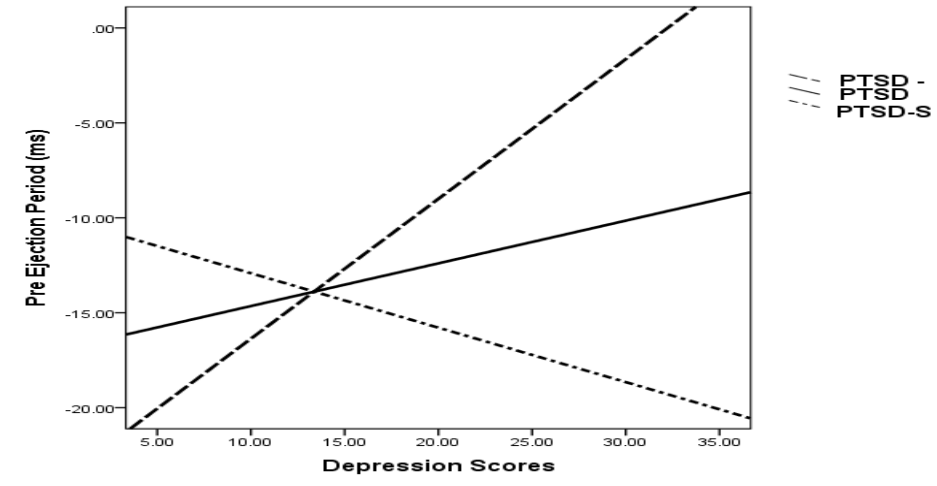


*Figure 19.* Interaction between 3-level PTSD and depression scores on PEP reactivity during speech task.

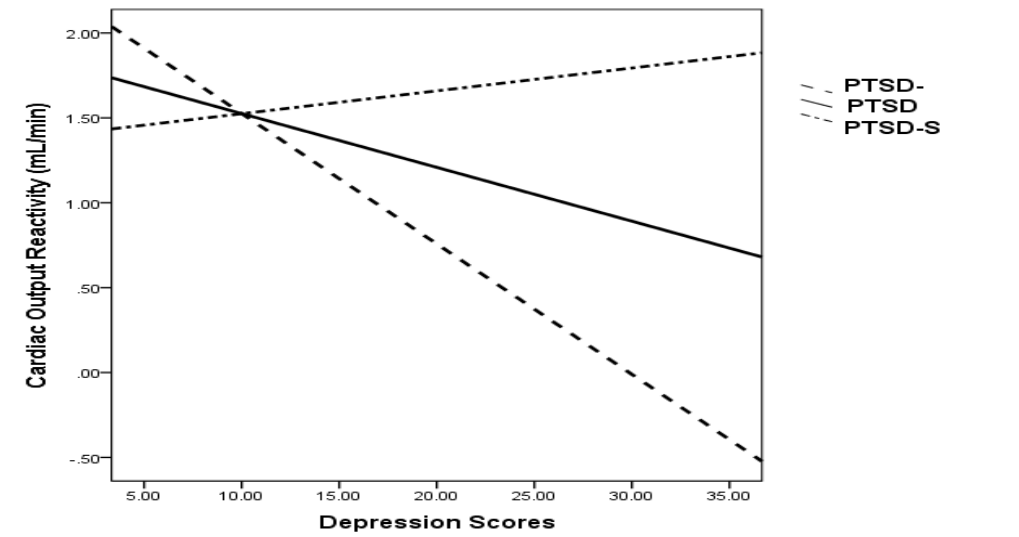


*Figure 20.* Interaction between 3-level PTSD and depression scores on CO reactivity during speech task.

# Chapter 4

## Discussion

The primary purpose of this research was to expand the current literature on subthreshold PTSD by assessing the relationships between PTSD, reactivity and recovery from negative emotional arousal or stress among current-era combat Veterans, Secondarily, we examined the moderating effects of combat exposures and dissociation, as well as the mediating effects of depression in the relationship between PTSD and cardiovascular reactivity. Measures of cardiac impedance were employed during a non-trauma motivated performance speech task and a passive trauma imagery procedure. While the emphasis of this research was on Veterans with subthreshold PTSD, we conducted assessments between the PTSD/No PTSD groups so that comparisons to prior literature distinguishing only PTSD from no PTSD could be made. Additionally, we conducted PTSD-S/PTSD-/PTSD assessments to compare our results to prior literature that distinguishes only PTSD-S from PTSD- and to further expand the literature comparing PTSD-S from PTSD-. After co-varying for age, sex and body mass index, cardiovascular reactivity and recovery were significantly associated with subthreshold PTSD. Combat experiences served as a moderator in the relationship between PTSD and reactivity. Depression was not a significant mediator in the relationship between PTSD and cardiovascular reactivity as hypothesized in the current study. However, additional analyses indicated that depression served as a moderator in the relationship between PTSD and reactivity.

For the trauma imagery task, Veterans in the PTSD group exhibited greater cardiac output reactivity than Veterans in the No PTSD group; and higher levels of combat exposure

were associated with lower CO reactivity among those in the No PTSD group. For Veterans in the PTSD group, number of combat experiences was not related to cardiac output reactivity. In terms of recovery, Veterans in the PTSD group exhibited a lower % of CO recovery than Veterans in the No PTSD group. Among Veterans in the PTSD- group, depression was associated with greater CO reactivity. After parsing out the PTSD-S group from the No PTSD group, Veterans in the PTSD-S group displayed lower SBP reactivity and higher TPR reactivity relative to Veterans in both the PTSD- and PTSD+ groups; and lower CO reactivity relative to Veterans in the PTSD+ group. In terms of recovery, Veterans in the PTSD-S group exhibited more CO recovery than Veterans in the PTSD+ group. For the non-trauma speech task, Veterans in the PTSD group exhibited lower cardiac output reactivity during speech delivery than Veterans in the No PTSD group; and greater combat exposure was associated with lower systolic BP reactivity for speech preparation and speech delivery, after controlling for dissociation, age, sex and BMI. Among Veterans in the PTSD- group, depression was associated with greater HR reactivity during speech preparation. Among those in the No PTSD group, depression was associated with lower DBP reactivity during speech preparation and lower HR and SBP reactivity during speech delivery. After parsing out the PTSD-S group from the No PTSD group, the following results were found. Veterans in the PTSD-S group exhibited lower HR reactivity for both speech preparation and delivery than Veterans in the PTSD- group. After controlling for dissociation, Veterans in the PTSD+ also displayed lower HR reactivity relative to those in the PTSD- during both speech preparation and delivery. Among the PTSD-S group, depression was associated with higher HR and SBP reactivity during speech preparation and higher HR reactivity during speech delivery. Among the PTSD- group, depression was positively associated with PEP reactivity during the speech task (to include preparation) and negatively associated

with SBP and CO reactivity during speech preparation as well as HR and CO during speech delivery. Among Veterans in the PTSD+ group, depression was negatively associated with CO reactivity and positively associated with PEP reactivity. Because two different tasks were administered and these tasks measure different constructs, explanation of results will be presented by task, followed by results of the recovery analysis.

**Explanation of Findings**

Overall, those in the PTSD group demonstrated exaggerated reactivity during the passive trauma imagery task compared to our combat-exposed control group without PTSD (No PTSD). This finding is contrary to our hypothesis, but similar to the work of McTeague and Lang (2012). While a preponderance of the research has demonstrated that PTSD is related to elevated physiological responses and altered autonomic nervous system (ANS) functioning during trauma cues (McTeague et al., 2010; Orr et al., 1993; Orr, et al., 1995; Orr, Macklin, Pineles, Chang, & Pitman, 2012; Pittman, Orr, Forgue, Altman, de Jong, & Herz, 1990; Pole, 2007), McTeague and colleagues (2010) have suggested that multiple traumas are associated with lower reactivity among persons with PTSD. However, in the current study, a measure to assess trauma was not administered. Rather, with the nature of OEF/OIF/OND and multiple deployments, it was thought that multiple deployments and combat exposures would equate to the experience of traumatic combat events. Thus, lower reactivity was expected. While most of the Veterans in these two groups reported experiencing a number of combat-related exposures (PTSD: M=8.04; No PTSD: M=4.93), the experience of combat exposures itself may not equate to experiencing a traumatic event, as defined by clinical guidelines (e.g., DSM-IV). Exaggerated reactivity to these cues in individuals with PTSD suggests that these emotional responses have failed to extinguish or habituate over time. The extinction or habituation of intense emotional responses to

trauma memories can be considered a hallmark of effective and appropriate emotional regulation. Emotion dysregulation is defined here as a multi-faceted construct involving: (a) a lack of awareness, understanding, and acceptance of emotions; (b) the inability to control behaviors when experiencing emotional distress; (c) a lack of access to adaptive strategies for modulating the duration and/or intensity of aversive emotional experiences; and (d) an unwillingness to experience emotional distress in the pursuit of meaningful goals/activities (Gratz & Roemer, 2004). Recent studies have demonstrated a relationship between emotion dysregulation and PTSD. Specifically, PTSD has been found to be positively associated with both overall emotion dysregulation and the specific dimensions of lack of emotional acceptance, difficulties engaging in goal-directed behaviors and controlling impulsive behaviors when upset, limited access to emotion regulation strategies, and lack of emotional clarity (Ehring & Quack, 2010; Tull,Barrett, McMillan, & Roemer, 2007; Weiss, Tull, Davis, et al., 2012).

During the speech task, Veterans in the PTSD group displayed a trend toward lower cardiac output reactivity compared to Veterans in the No PTSD group. While this supports our hypothesis, it is at odds with the finding of the trauma imagery task above. This is likely attributed to the two types of tasks utilized in the current study. Unlike the trauma imagery task, which is a much more passive exercise requiring one to listen to, and formulate, an image of the situation being described. On the other hand, the speech task requires effort and action on the part of the individual and is often referred to as a motivational performance task. Findings are most likely due to motivational dysregulation, which reflects problems in goal-directed behavior and motivation, and is a key neurobehavioral concept underlying adaptive responses (Lovallo, 2011). As such, dysregulation may be important in the formation of observed abnormal behavioral patterns. For example, an individual may perceive a task as too difficult for their

resources resulting in the failure to effectively mobilize effort on a task (Gendolla and Krusken, 2001; Gendolla and Krusken, 2002). This is often displayed as attenuated or blunted reactivity. However, parsing out the subthreshold group from the No PTSD group provided additional insight into our findings.

Contrary to our hypothesis, Veterans in the PTSD-S group exhibited blunted reactivity during both tasks. During the speech task, individuals in the PTSD-S group exhibited more blunted reactivity compared to those without PTSD, yet their reactivity was no different than those with PTSD. During the imaginal phase of trauma task, those with subthreshold levels of PTSD demonstrated more blunted reactivity compared to those with and without PTSD. Lovallo (2011) contends that the pathological states associated with blunted reactivity share dysregulated emotion and motivation systems. This dysregulation signals difficulties with mood and behavior regulation. Consist with this idea of reduced physiological response to stress, it has been proposed that blunted physiological reactions to stress may be a maker of central motivational dysregulation (Carroll et al., 2009, 2011), a suboptimal functioning of the physiological systems in the brain that support motivation and motivated behavior, where disengagement in the motivational areas of the brain occure when faced with an acute challenge.

It is worth noting that, although Veterans in the subthreshold PTSD group exhibited more blunted patterns than the PTSD+ group, the self-report of Veterans in the PTSD-S group paints a different picture. Compared to the PTSD+ group, those with subthreshold symptoms reported less depression (M=16 v M= 28), less anxiety (M=15, M=23), better physical (M=74, M=66) and social (M=72, M=51) functioning, fewer emotional limitations (M=63, M=36), and better perception of overall mental health (M=70 v M=59). While research has suggested that blunted responses may be anything but protective (Lovallo, 2012; Wright, 2012), it is possible that in the

short-term, blunted responses confer some type of benefit which may be detrimental to the overall system in the long-term.

PTSD and comorbid depression are common among Veterans with PTSD, making measurement of the constructs often difficult due to symptom overlap. Additionally, the literature notes that those with PTSD are more likely to exhibit exaggerated reactivity (McTeague, 2010), while depressive symptomatology has been linked to blunted reactivity (Schwerdtfeger and Rosenkaimer, 2011). This research, coupled with the correlations among depression, PTSD, and cardiovascular reactivity in the current study, and the fact that PTSD and depression co-occur separately, led to the thought that depression might better serve as a moderator in the relation between PTSD and cardiovascular reactivity, rather than as a mediator as hypothesized in the current study. Additional analyses revealed that this was in fact the case. The presence of depression in the relationship between PTSD and reactivity may prove to be an important factor in the findings of increased reactivity to trauma cues. Interestingly, we found a positive association between depression symptoms and reactivity among Veterans with PTSD and subthreshold PTSD, such that depression did not serve to dampen the response but rather enhanced it. Findings held regardless of significant CV indices (e.g., HR, DBP, SBP) or task examined. These results are supportive of recent research by O'Kearny and Parry (2014). Using the imaginal phase of script driven imagery, reactivity was compared among individuals with PTSD only and those with comorbid depression. Higher reactivity of the PTSD group compared to the depressed group was not significant. Furthermore, the higher reactivity of the PTSD group compared to the PTSD group with comorbid depression revealed no evidence that the presence of depression resulted in lower reactivity among those with PTSD and comorbid depression. Additionally, like O'Kearny and Parry (2014), the presence of depression in the absence of

PTSD resulted in blunted reactivity. Other studies have reported similar findings (Rottenberg et al., 2007; Salomon et al., 2009). This appears to indicate that the trauma re-experienced by those with PTSD and comorbid depression is distinctive from depression alone in triggering high physiological reactivity and may be due a result of both emotional, as well as motivational dysregulation.

In the current study, Veterans with PTSD exhibited less recovery than Veterans without PTSD and – after parsing out the subthreshold PTSD group from the No PTSD group -those with subthreshold PTSD. There were no significant differences noted in recovery observed for the comparison of PTSD-S and PTSD-. Our findings are expected and congruent with current research reporting delayed recovery among those with PTSD (Norte et al 2013; Sack, 2004; Yehuda 2007; Pole, 2007). While adaptive in the short-term, chronic over-activation of either axes results in the inability to recovery to a homeostatic state, resulting in long-term activation of the stress response even after acute threats have passed or subsided (Carlson & Chamberlain; 2005; Goertzel, et al., 2006; Korte, Koolhaas, Wingfield, & McEwen, 2005; Lupien et al., 2006). Thus, the physiological mechanisms underlying the two processes of reactivity and recovery should be assessed so as to provide greater insight into the cardiovascular mechanisms underlying the stress response than either measure alone.

Finally, literature has demonstrated that dissociation impacts reactivity among persons with PTSD. Dissociation was not found to serve as a moderator in the current study. Studies that have compared reactivity between PTSD with high and low dissociation found conflicting results, with some high dissociators showing exaggerated autonomic arousal and others showing suppression (Sack et al, 2012). Still, other studies have shown no relationship between dissociation and reactivity during trauma imagery tasks. (Kaufman, et al, 2002; Nixon, Resick,

& Griffen, 2004; Halligan, Michaekl, Wilhelm, Clark & Ehlers, 2006). The Dissociation Experiences Scale (DES) utilized in this study is only a screen; it is suggested that those with a total DES score of 30 or more be further evaluated **(**Carlson & Putnam, 1993**).** The sample in the current study was very low in dissociation on average (M=16.49;SD=13.23), with only 14% of the sample endorsing a dissociation score greater than 30. Lack of findings in the current study may be due to the low endorsement of dissociation in the current sample, resulting in the lack of power required to identify effects that accurately reflect the true impact of dissociation as a moderator in the relationship between PTSD and cardiovascular reactivity. Additionally, other literature assessing the impact of dissociation on reactivity has typically utilized a sample comprised only of Veterans diagnosed with PTSD using the CAPS, and then split into high and low dissociators. These samples likely have higher rates of dissociation than the current sample.

**Limitations**

There are several limitations to the current study that warrant further discussion. These limitations include utilizing the PCL to distinguish PTSD groups rather than administering the gold standard CAPS clinical interview for PTSD; the classification of Veterans with subthreshold PTSD into the No PTSD group; the presence of comorbidities among the Veterans; and the use of cumulative combat exposures as a proxy for multiple traumas.

The PTSD checklist (PCL) was administered to classify Veterans into the PTSD groups. The National Center for PTSD has suggested that the PCL can be scored according to DSM criteria to provide a presumptive diagnosis for PTSD (NCPTSD, 2012). However, it is not a substitute for the Clinician Administered PTSD Scale (CAPS), which is considered the gold standard for diagnosing persons with PTSD. Unfortunately, this study lacked the funding required to acquire persons licensed to interpret CAPS interviews. As a result, there are likely to be persons misclassified in the groups.

As mentioned previously, PTSD is often comorbid with other mental health disorders, particularly Major Depressive Disorder. Major depressive disorder has been associated with attenuated cardiovascular reactivity and impaired recovery (Salomon et al., 2009). With the exception of depressive symptoms, comorbidities were not assessed in the current study. The presence and/or absence of comorbid disorders in conjunction with PTSD has resulted in varying patterns of reactivity and recovery (McTeague & Cuthbert 2012a; McTeague & Lang 2012b; McTeague, Lang, LaPlante, Cuthbert, Shumen & Bradley, 2010). Thus it appears that PTSD entails a range of symptoms and comorbidity patterns suggesting that it may be best understood as a heterogeneous collection of responses to exposure to a psychologically-traumatic event that may be maladaptive in the long-term.

Finally, recent research has reported different patterns of reactivity based upon the experience of multiple versus single traumas (McTeague and colleagues, 2010; McTeague and colleagues, 2012a; McTeague and colleagues 2012b). Due to limited resources, traumas, *per se*, were not assessed with a clinical interview. Rather, the study attempted to measure the number of combat traumas experienced by administering the Combat Exposures Scale.

**Future Directions**

Despite the strong foundation provided by existing literature on the psychophysiology of PTSD, further research is necessary to improve this understanding and to better identify PTSD subgroups that explain the large degree of variability in the associations among important PTSD variables. Such knowledge could lend incredible insight into appropriate treatment strategies for Veterans with PTSD who fall within certain subgroups. While the current study sheds some light on cardiovascular reactivity of Veterans with subthreshold PTSD, much work is still needed.

Future studies should recruit participants directly from providers so that the presence or absence of current PTSD is accurately known. We also utilized Veterans who had experienced combat trauma only. Additional studies should be conducted to determine if current findings are trauma specific or if they can be generalized to other types of trauma, specifically, military sexual trauma. The current study included only measures of the sympathetic nervous system. In order to obtain a more comprehensive assessment of how the autonomic nervous system functions, it is important that future studies incorporate measures to assess both sympathetic and parasympathetic branches of the autonomic nervous system

Literature has demonstrated that dissociation impacts reactivity among persons with PTSD. While dissociation was not found to serve as a moderator in the current study, it is likely due to the low levels of dissociation within the current sample. Future research should continue to focus on dissociation, with a focus on more complex relationships between dissociation and combat experiences.

Finally, studies assessing the relationship between reactivity and successful treatment outcomes may prove useful, particularly in the VA. Patients seeking psychological care for PTSD at the VA are currently offered a host of treatments, without much guidance as to which particular treatment might be best for particular subsets of patients. Although individuals with subthreshold PTSD have sometimes been included with full cases in treatment studies, few studies have specifically examined the treatment of individuals with partial PTSD. Prospective studies assessing the relation between pre-treatment psychophysiological reactivity and treatment outcome may prove useful in determining which particular subtypes of PTSD patients would likely benefit from particular evidence-based therapies.

**Summary and Conclusions**

A fair amount of research has been conducted assessing the psychophysiology of PTSD, without much regard to subthreshold PTSD. The current study found that Veterans with subthreshold PTSD differed in their cardiovascular responses to a trauma cue when compared to other Veterans. While only a few people exposed to a traumatic event will develop PTSD, many other individuals have multiple symptoms and notable functional impairment, yet they do not have enough symptoms in the required categories to be given a full diagnosis. The symptoms – though below the threshold to meet diagnostic criteria - are often clinically significant. The current study found that these same Veterans may perform just as well as other Veterans to motivational performance tasks until something triggers thoughts or reminders of their index trauma. These thoughts and reminders may impair the person's ability to function in social or family life, including occupational instability, marital problems and divorces, family discord, academic performance and difficulties in parenting. PTSD symptoms are thought to arise as a result of cognitive and behavioral avoidance of trauma-related thoughts, reminders, activities and situations (Foa, Hembree, Riggs, Rauch, & Franklin (2009). Not surprisingly, research examining the psychophysiology of PTSD has relied upon a passive trauma imagery task (e.g. script-driven imagery) to illicit a stress response similar to that experienced during one's index trauma. Utilizing tasks other than that tied to one's trauma may provide a more complete picture of psychosocial and psychophysiological function. The current study also found that depression is an influential component in the complex relationship between PTSD and cardiovascular reactivity. Due to symptom overlap, the comorbidity between depression and PTSD is high and is associated with greater symptom severity and lower levels of functioning (Shalev, Freedman, Peri, Brandes, Sahar, Orr, & Pitman, 2014).

In sum, exaggerated reactivity to trauma-related cues has been associated with severity of PTSD and, when assessed soon after exposure to a traumatic event, to predict subsequent severity and/or persistence of symptoms (Keane et al., 1998; Kleim, Wilhelm, Glucksman, & Ehlers, 2010; Suendermann, Ehlers, Boellinghaus, Gamer, & Glucksman, 2010). It has been proposed that both extremes, exaggerated and attenuated reactivity, could be maladaptive responses to stress and could promote allostatic overload (McEwen, 1998). In the current study, Veterans in the subthreshold PTSD group exhibited lower reactivity to the trauma imagery task than other Veterans. Recent evidence suggests that low or blunted reactivity to stress may actually have serious adverse consequences for health and behavior (Phillips, Ginty, Hughes, 2013) as exaggerated reactivity. In light of the emerging evidence relating blunted reactivity to unhealthy behaviors and negative health outcomes (e.g., depression, obesity), it would appear that both extremes, exaggerated and diminished reactivity are maladaptive responses to stress and that the most optimally response to stress is a moderate reaction (Lovallo, 2011).

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# Appendices

## Appendix A: Recruitment Documents

Dear [Patient]:

We are conducting a research study supported by the VA to find out more about how OEF/OIF/OND Veterans react to and cope with stressful experiences. We are inviting veterans who have visited the Post Deployment Health Clinic at the James A Haley VA within the past 12 months to participate in the study. The enclosed brochure explains the study. We will provide you with a $50 stipend for participating in a 2 hour study visit. We will also provide you with parking.

If you **are not** interested in being in the study, please drop the enclosed stamped, self-addressed postcard into any US Mail box.

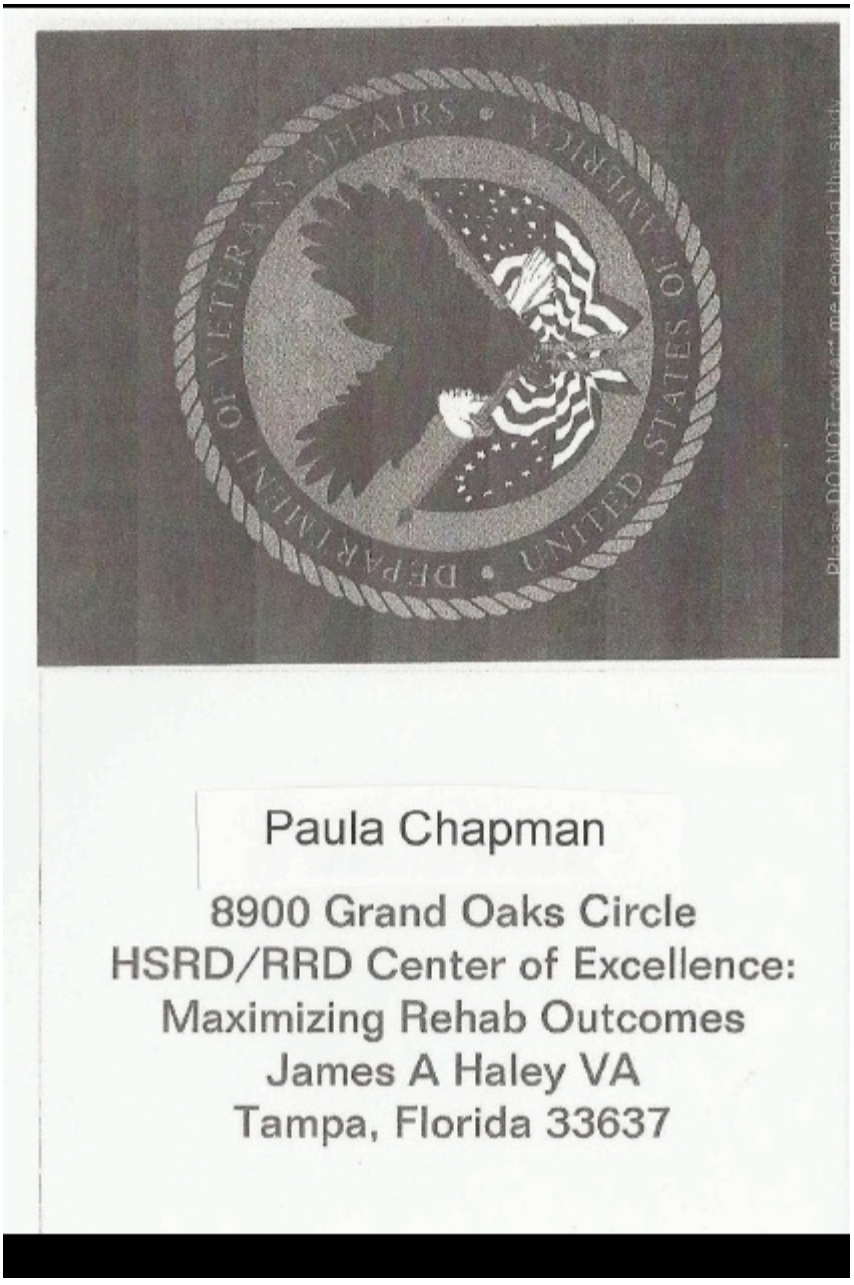
If you are interested in learning more about the study or participating, you may call me at 813-558-3909 or you may wait for me to contact you.

Thank you for your service.

Sincerely,

Paula L Chapman, PhD
Principle Investigator
Research Department
HSR&D/RR&D Center of Excellence: Maximizing Rehabilitation Outcomes
8900 Grand Oaks Circle
James A Haley Veterans Hospital
Tampa, Florida 33637

Opt Out Card


DEPARTMENT OF VETERANS AFFAIRS • UNITED STATES OF AMERICA •
Please DO NOT contact me regarding this study
Paula Chapman
8900 Grand Oaks Circle
HSRD/RRD Center of Excellence:
Maximizing Rehab Outcomes
James A Haley VA
Tampa, Florida 33637

## Appendix B: Military and Demographic Questionnaire

Please provide the following basic information about you and your military service.

**1.** Please select your primary service component

Active Duty____ Reserve _____ National Guard ____

2. How long did you serve in the U.S militiary?

- ○ a. Less than 1 year
- ○ b. 1 to 5 years
- ○ c. 6 to 10 years
- ○ d. 11 to 15 years
- ○ e. 16 to 20 years
- ○ f. 21 years or more

3. Rank:_____

4. What is the highest degree or level of school you have completed?

- ○ a. Less than high school
- ○ b. High school diploma/ GED
- ○ c. Some college credit, no degree
- ○ d. Associate degree
- ○ e. Bachelors degree
- ○ f. Masters degree
- ○ g. Professional degree
- ○ h. Doctorate degree
- ○ i. Doctor of Ministry degree
- ○ j. Other_____

5. Have you ever served on active duty in the U.S. Armed forces? **Mark one answer.**

- ○ a. Yes, now on active duty
- ○ b. Yes, on active duty in the past, but not now
- ○ c. No, never on active duty
- ○ d. No, never served in the U.S. Armed Forces

6. In which branch or branches did you serve on active duty? **Mark all that apply**.

- ○ a. Army
- ○ b. Navy
- ○ c. Air Force
- ○ d. Marine Corps
- ○ e. Coast Guard
- ○ f. Other (Public Health, Merchant Marine)

7. Did you deploy in support of the U.S. Armed Forces?

| | Deployed (Yes/ No) | Dates of Deployment MM/YYYY-MM/YYYY | Did you serve in a combat zone* while deployed? (Yes/No) |
|---|---|---|---|
| OIF | | | |
| OEF | | | |
| August 1990 to August 2001 (includes Persian Gulf War) | | | |

8. What is your age? ____

9. Are you male or female?

○ a. Male ○ b. Female

10. What is your current marital status?

○ a. Married/Civil Union
○ b. Widowed
○ c. Divorced
○ d. Separated
○ e. Never married
○ f. Re-married

11. Do you have any children?

○ a. Yes ○ b. No

12. What is your race? **Mark all that apply.**

○ a. White
○ b. Black or African American
○ c. American Indian or Alaska Native
○ h. Asian
○ i. Pacific Islander
○ j. Other, please specify:

13 Are you of Hispanic, Latino, or Spanish origin?

○ a. No
○ b. Yes, Cuban
○ c. Yes, Puerto Rican
○ h. Yes, Mexican, Mexican American, Chicano
○ i. Yes, another Hispanic, Latino, or Spanish origin, please specify :

*Thank you very much for your participation*

**Appendix C: Health Information Questionnaire**

**Background Information**

1. Age: _____

2. Sex: □ Male □ Female

3. How would you describe your race or ethnicity?

□ American Indian or Alaska Native
□ Asian or Asian-American
□ Arab or Middle Eastern
□ Black or African American
□ Hispanic or Latino
□ Native Hawaiian or Other Pacific Islander
□ White or Caucasian
□ Mixed/Multiracial
□ Other, Non-specified

4. Have you ever been diagnosed with any of the following conditions:

Heart disease Hypertension (high blood pressure) Stroke
High cholesterol Arrhythmia (irregular heartbeat) Diabetes
Heart valve problems

5. Please list all prescription and non-prescription medications that you are currently taking. Be sure to also include any medications you have taken in the last 48 hours, even if it is something you do not regularly take (such as aspirin or cold medicine).

_____

___

_____

___

6. When did you last eat? _____ am / pm (circle one)

What did you eat? _____

7. Do you drink beverages containing caffeine? Yes No (check one)

a.If yes, when did you last drink a caffeinated beverage?
Time: _____ am / pm (circle one)
b. How many caffeinated drinks have you had today? _____
c. How many servings (8 oz.) of "energy drinks" (e.g., Redbull, Rockstar, etc.) do you consume in a typical day? Regular: _____ Diet: _____
d. How many servings (8 oz.) of soda do you consume in a typical day?
Regular: _____ Diet: _____

8. Do you smoke nicotine cigarettes? when did you last smoke? Time: _____am /pm (circle one)
a. How many nicotine cigarettes have you smoked today? _____
b. How many nicotine cigarettes do you normally smoke in a day? _____

9. Which of the following describes your typical diet?

□ Omnivore (Meat, etc.) □ Vegetarian □ Vegan □ Pescetarian (only fish, no other meat) □ Other:

10. When did you last exercise? Please consider any activity that elevated your heart rate for 30 or
more minutes. Date: _____ Time: _____ Activity: _____

**FOR WOMEN ONLY**

11. When was the first day of menstruation during your last cycle (mm/dd/yyyy)? _____

12. Are you pregnant? Yes No Not Sure (check one)

## Appendix D: Symptom Checklist- 90-R

### Symptom Checklist-90-R

| | |
|---|---|
| **Name of instrument** | **Symptom Checklist-90-R (SCL-90-R)** |
| **Summary overview** | "A brief multidimensional self-report inventory that screens for nine symptoms of psychopathology and provides three global distress indicators." The SCL-90-R provides an overview of symptom severity and intensity. The instrument can be administered multiple times, with progress reports available to graphically display change in clinical status. |
| **Publisher/source** | Publisher: Pearson Assessments<br>Author: Leonard R. Derogatis, PhD |
| **Source contact information** | Phone: 1-800-627-7271<br>Fax: 1-800-632-9011<br>Web site: www.pearsonassessments.com |
| **Access information** | Available for purchase not available in public domain |
| **Pricing information** | -SCL-90-R Answer Sheets Test items included. (25 per pkg) $27<br>-SCL-90-R Mail-In Scoring Profile Reports Price includes scoring and answer sheet without test items $11.40<br>-SCL-90-R Mail-In Scoring Interpretive Reports Price includes scoring and answer sheet without test items $17.50<br><br>Refer to web site for current pricing information and software pricing. |
| **How to obtain instrument** | Phone or web site (see above) |
| **Self vs. other administered** | Self-administered |
| **Method of administration** | Paper and pencil, audiocassette, or online administration |
| **Time for administration** | 12 – 15 minutes |
| **Method of scoring** | Hand scoring, mail-in scoring, optical scan scoring, or computer scoring (Software must be purchased.) |
| **Time for scoring** | Not indicated |
| **Staff training** | See web site for details. |
| **Staff training level needed for scoring and reporting** | Not indicated |
| **Reporting options** | Profile, interpretive, and progress reports are available. Profile reports present raw and normalized T scores. Interpretive reports provide profile scores and a narrative summary. Progress reports graphically display changes in client scores for up to five administrations. |
| **Languages available** | Not indicated |
| **Scales (if appropriate)** | Nine primary symptom dimensions (somatization, obsessive compulsive, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism), and three global indices: global severity index, positive symptom distress index, positive symptom total |
| **Appropriate clinical** | Adolescent and adult clients with mental health presentations |
| **Appropriate level(s) of care** | All levels of care (normed on inpatients and outpatients) |
| **Stand-alone instrument vs. system** | Stand-alone instrument |
| **Age range** | 13 years and older |

## Appendix E: SF 36 Health Survey

**SF-36(tm)**
**Health Survey**

Instructions for completing the questionnaire: Please answer every question. Some questions may look like others, but each one is different. Please take the time to read and answer each question carefully by filling in the bubble that best represents your response.

1. In general, would you say your health is:

   ❑ Excellent
   ❑ Very good
   ❑ Good
   ❑ Fair
   ❑ Poor

2. Compared to one year ago, how would you rate your health in general now?

   ❑ Much better now than a year ago
   ❑ Somewhat better now than a year ago
   ❑ About the same as one year ago
   ❑ Somewhat worse now than one year ago
   ❑ Much worse now than one year ago

3. The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

   a. Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports.
      ❑ Yes, limited a lot.
      ❑ Yes, limited a little.
      ❑ No, not limited at all.

   b. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf?
      ❑ Yes, limited a lot.
      ❑ Yes, limited a little.
      ❑ No, not limited at all.

   c. Lifting or carrying groceries.
      ❑ Yes, limited a lot.
      ❑ Yes, limited a little.
      ❑ No, not limited at all.

   d. Climbing several flights of stairs.
      ❑ Yes, limited a lot.
      ❑ Yes, limited a little.
      ❑ No, not limited at all.

   e. Climbing one flight of stairs.
      ❑ Yes, limited a lot.
      ❑ Yes, limited a little.
      ❑ No, not limited at all.

f. Bending, kneeling or stooping.
- ❑ Yes, limited a lot.
- ❑ Yes, limited a little.
- ❑ No, not limited at all.

g. Walking more than one mile.
- ❑ Yes, limited a lot.
- ❑ Yes, limited a little.
- ❑ No, not limited at all.

h. Walking several blocks.
- ❑ Yes, limited a lot.
- ❑ Yes, limited a little.
- ❑ No, not limited at all.

i. Walking one block.
- ❑ Yes, limited a lot.
- ❑ Yes, limited a little.
- ❑ No, not limited at all.

j. Bathing or dressing yourself.
- ❑ Yes, limited a lot.
- ❑ Yes, limited a little.
- ❑ No, not limited at all.

4. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

a. Cut down the amount of time you spent on work or other activities?
☐ Yes ☐ No

b. Accomplished less than you would like?
☐ Yes ☐ No

c. Were limited in the kind of work or other activities
☐ Yes ☐ No

d. Had difficulty performing the work or other activities (for example, it took extra time)
☐ Yes ☐ No

5. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

a. Cut down the amount of time you spent on work or other activities?
☐ Yes ☐ No

b. Accomplished less than you would like
☐ Yes ☐ No

c. Didn't do work or other activities as carefully as usual
☐ Yes ☐ No

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?
- ❑ Not at all

- ❑ Slightly
- ❑ Moderately
- ❑ Quite a bit
- ❑ Extremely

7. How much bodily pain have you had during the past 4 weeks?
- ❑ Not at all
- ❑ Slightly
- ❑ Moderately
- ❑ Quite a bit

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?
- ❑ Not at all
- ❑ Slightly
- ❑ Moderately
- ❑ Quite a bit
- ❑ Extremely

9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks.

a. did you feel full of pep?
- ❑ All of the time
- ❑ Most of the time
- ❑ A good bit of the time
- ❑ Some of the time
- ❑ A little of the time
- ❑ None of the time

b. have you been a very nervous person?
- ❑ All of the time
- ❑ Most of the time
- ❑ A good bit of the time
- ❑ Some of the time
- ❑ A little of the time
- ❑ None of the time

c. have you felt so down in the dumps nothing could cheer you up?
- ❑ All of the time
- ❑ Most of the time

- ❑ A good bit of the time
- ❑ Some of the time
- ❑ A little of the time
- ❑ None of the time

d. have you felt calm and peaceful?

- ❑ All of the time
- ❑ Most of the time
- ❑ A good bit of the time
- ❑ Some of the time
- ❑ A little of the time
- ❑ None of the time

e. did you have a lot of energy?

- ❑ All of the time
- ❑ Most of the time
- ❑ A good bit of the time
- ❑ Some of the time
- ❑ A little of the time
- ❑ None of the time

f. have you felt downhearted and blue?

- ❑ All of the time
- ❑ Most of the time
- ❑ A good bit of the time
- ❑ Some of the time
- ❑ A little of the time

g. did you feel worn out?

- ❑ All of the time
- ❑ Most of the time
- ❑ A good bit of the time
- ❑ Some of the time
- ❑ A little of the time
- ❑ None of the time

h. have you been a happy person?

- ❑ All of the time
- ❑ Most of the time
- ❑ A good bit of the time
- ❑ Some of the time
- ❑ A little of the time
- ❑ None of the time

i. did you feel tired?

- ❑ All of the time
- ❑ Most of the time
- ❑ A good bit of the time
- ❑ Some of the time
- ❑ A little of the time
- ❑ None of the time

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

- ❑ All of the time
- ❑ Most of the time
- ❑ Some of the time
- ❑ A little of the time
- ❑ None of the time

11. How TRUE or FALSE is each of the following statements for you?

a. I seem to get sick a little easier than other people

- ❑ Definitely true
- ❑ Mostly true
- ❑ Don't know
- ❑ Mostly false
- ❑ Definitely false

b. I am as healthy as anybody I know

- ❑ Definitely true
- ❑ Mostly true
- ❑ Don't know
- ❑ Mostly false
- ❑ Definitely false

c. I expect my health to get worse

- ❑ Definitely true
- ❑ Mostly true
- ❑ Don't know
- ❑ Mostly false
- ❑ Definitely false

d. My health is excellent

- ❑ Definitely true
- ❑ Mostly true
- ❑ Don't know
- ❑ Mostly false
- ❑ Definitely false

## Appendix F: Posttraumatic Checklist

### PTSD CheckList – Military Version (PCL-M)

Instruction to patient: Below is a list of problems and complaints that veterans sometimes have in response to stressful military experiences. Please read each one carefully, put an "X" in the box to indicate how much you have been bothered by that problem in the last month.

| No. | Response: | Not at all (1) | A little bit (2) | Moderately (3) | Quite a bit (4) | Extremely (5) |
|---|---|---|---|---|---|---|
| 1. | Repeated, disturbing memories, thoughts, or images of a stressful military experience? | | | | | |
| 2. | Repeated, disturbing dreams of a stressful military experience? | | | | | |
| 3. | Suddenly acting or feeling as if a stressful military experience were happening again (as if you were reliving it)? | | | | | |
| 4. | Feeling very upset when something reminded you of a stressful military experience? | | | | | |
| 5. | Having physical reactions (e.g., heart pounding, trouble breathing, or sweating) when something reminded you of a stressful military experience? | | | | | |
| 6. | Avoid thinking about or talking about a stressful military experience or avoid having feelings related to it? | | | | | |
| 7. | Avoid activities or situations because they remind you of a stressful military experience? | | | | | |
| 8. | Trouble remembering important parts of a stressful military experience? | | | | | |
| 9. | Loss of interest in things that you used to enjoy? | | | | | |
| 10. | Feeling distant or cut off from other people? | | | | | |
| 11. | Feeling emotionally numb or being unable to have loving feelings for those close to you? | | | | | |
| 12. | Feeling as if your future will somehow be cut short? | | | | | |
| 13. | Trouble falling or staying asleep? | | | | | |
| 14. | Feeling irritable or having angry outbursts? | | | | | |
| 15. | Having difficulty concentrating? | | | | | |
| 16. | Being "super alert" or watchful on guard? | | | | | |
| 17. | Feeling jumpy or easily startled? | | | | | |

Weathers, F.W., Huska, J.A., Keane, T.M. PCL-M for DSM-IV. Boston: National Center for PTSD – Behavioral Science Division, 1991

**Appendix G: Beck Depression Inventory- This is a copy righted measure**

## Appendix H: Combat Exposures Measure

Combat Experiences/Exposures

| While deployed: | | |
|---|---|---|
| 1. I went on combat patrols or missions. | Yes | No |
| 2. I or members of my unit encountered land or water mines and/or booby traps. | Yes | No |
| 3. I or members of my unit received hostile incoming fire from small arms, artillery, rockets, mortars, or bombs. | Yes | No |
| 4. I or members of my unit received "friendly" incoming fire from small arms, artillery, rockets, mortars, or bombs. | Yes | No |
| 5. I was in a vehicle (for example, a truck, tank, APC, helicopter, plane, or boat) that was under fire. | Yes | No |
| 6. I or members of my unit were attacked by terrorists or civilians. | Yes | No |
| 7. I was part of a land or naval artillery unit that fired on the enemy. | Yes | No |
| 8. I was part of an assault on entrenched or fortified positions. | Yes | No |
| 9. I took part in an invasion that involved naval and/or land forces. | Yes | No |
| 10. My unit engaged in battle in which it suffered casualties. | Yes | No |
| 11. I personally witnessed someone from my unit or an ally unit being seriously wounded or killed. | Yes | No |
| 12. I personally witnessed soldiers from enemy troops being seriously wounded or killed. | Yes | No |
| 13. I was wounded or injured in combat. | Yes | No |
| 14. I fired my weapon at the enemy. | Yes | No |
| 15. I killed or think I killed someone in combat. | Yes | No |

**Appendix I: Dissociation Experiences Scale- This is a copy righted measure**

## Appendix J: Speech Task Instructions

### SPEECH TASK INSTRUCTIONS

The first (next) task we would like you to do is a speech task. You will be given a situation and you must make up a speech in response to that situation. You will have 3 minutes to prepare your speech, and 3 minutes to deliver the speech. We will videotape the speech, and your speech performance will be evaluated. We will be judging for style, content, and quality of your self-presentation. We ask that you talk continuously for the entire 3minutes. If you stop talking, you will be prompted to begin speaking again.

This is the situation you must construct a story about for your speech.

You are driving down a neighborhood street when you suddenly realize that there is a police officer behind you with his red light flashing. When you pull over, the officer gives you a ticket for failing to stop at a stop sign the block before. You are sure that no stop sign existed. When you finally talk him into going back so you can show him that there is no sign there, you realize that there is a stop sign, but it is almost completely hidden by the trees. The officer gives you a $100 ticket.

Tell a story about this incident as if you were arguing your case in traffic court and include the following 3 points:

1. The events that led up to the officer giving you a ticket,
2. Whether you think you should or should not have been given a ticket.
3. The extent of the city's responsibility in keeping road signs in good view.

You may include more information than these three points in your speech, but do at least include responses to these three points. In a moment you will be given a card with these points that you may use during the 3 minute preparation. Do you have any questions?

## Appendix K: Script Driven Imagery Task Documents

Instructions for Collection of Information for Script Preparation

- The script preparation session may be more emotionally distressing for the subject than the subsequent laboratory session. The success of this portion of the study depends upon your eliciting the details of the subject's traumatic life events in as much detail as possible. The subject may never have told anyone about these events, and have resisted remembering them himself. Your job is to give him emotional support while he provides the information you need. It may take time and patience. You should set aside an hour for this part of the study.

- Start by making the subject comfortable in a private room. Give him the first set of the three-page script preparation forms. Review with him the instructions on the first and second pages. Then leave him alone to write.

- After about 10-min., review what he has written. If he has been unable to write anything, ascertain the reason and assist. Sometimes subjects will be unable to write but will be able to dictate to you. Elicit details of the experience (stimulus, response, and meaning cues) and add your own notes to what the subject has produced. Limit the information to a circumscribed traumatic experience. In association with the experience, try to get the subject to circle at least one item from each type of bodily sensation appearing on the second sheet (heart, sweat, digestive, breathing, muscular tension.)

- Finally, ask the subject to complete the Impact of Event Scale (third page of package) specifically for the experience he just described. Then go on and repeat the above procedure for a second traumatic experience, if called for.

Instructions for Writing Scripts

- Scripts should be written by an investigator as soon as possible after the preparation session. Once written, scripts should not be divulged to the subject before the lab session.

- Use simple, direct, informal language; whenever possible make it the subject's own.
Have the text resemble spoken words; contractions are desirable. Scripts should be written in the second person, present tense. Usually the active voice is preferable to the passive voice, and the simple verb form ("You see the explosion") is preferable to the progressive verb form ("You're seeing the explosion").

- A script must be capable of being read out loud slowly over a 30 to 50-sec. period, about 100 words.

- A script should take the event from the beginning through to the end. It should incorporate five bodily sensations circled by the subject, preferably of different types. There should never be more than five, and there should only be less when the subject was unable to circle five bodily sensations associated with the event.

Subject ID: **Traumatic Experience** Date:

**Scene Construction Questionnaire - A**

Please write descriptions of the two most stressful aspects of the event that led to this evaluation, or two different moments during its occurrence. Describe one on this form and the other on form "B." Include in your description the bodily sensations you were aware of at the time. You will be interviewed in more detail about this experience later.

Sometimes it is difficult to think of something to write "on the spot." It may help to close your eyes and imagine yourself back in the situation. Try to generate the same sensations and feelings that you had at the time. While the image is vivid in your memory, jot down the details of the scene and the sensations you experienced.

Include details such as: where you were; what you were doing; other people who were involved, and what they did or what happened to them; and how you felt. Continue on the reverse side if necessary.

Subject ID: **Traumatic Experience A** Date:

Listed below are a number of bodily sensations that people may experience in various situations. Circle all of the responses that you experienced in the situation you just described.

| | | |
|---|---|---|
| Heart stops | Breathes faster | Body shakes |
| Heart beats slower | Breathes slower | Eye twitches |
| Heart beats faster | Even breathing | Eyes closed |
| Heart pounds | Pants | Eyes burn |
| Heart skips a beat | Shallow breathing | Eyes wide open |
| Heart races | Labored breathing | Eyes water |
| Heart quickens | Gasping for air | Feel hot all over |
| Feel sweaty | Feel tense all over | Blood rushing to head |
| Palms are clammy | Feel relaxed all over | Flushed face |
| Beads of perspiration | Tension in forehead | Head pounds |
| Sweat pours out | Clenched fist | Feel warm |
| Nauseous | Tension in back | Feel restless |
| Stomach in a knot | Grit my teeth | Jittery |
| Butterflies in stomach | Clenched jaw | Calm |
| Cramps in the stomach | Tension in the arms | Want to scream |
| Constrictions in chest | Tightness in the face | Want to smash Something |
| Body feels heavy | Hands trembling | Arms and legs warm and relaxed |

Subject ID:

**Impact of Event Scale-Revised**
**Traumatic Experience A**

Date:

With regard to *the experience you just described* rate each of the following items with regard to the *past seven days*. Rate each item with regard to *the effect of the event on you*.

| | Not at all | A little bit | Moderately | Quite a bit | Extremely |
|---|---|---|---|---|---|
| 1. Any reminder brought back feelings about it. | 0 | 1 | 2 | 3 | 4 |
| 2. I had trouble staying asleep. | 0 | 1 | 2 | 3 | 4 |
| 3. Other things kept making me think about it. | 0 | 1 | 2 | 3 | 4 |
| 4. I felt irritable and angry. | 0 | 1 | 2 | 3 | 4 |
| 5. I avoided letting myself get upset when I thought about it or was reminded of it. | 0 | 1 | 2 | 3 | 4 |
| 6. I thought about it when I didn't mean to. | 0 | 1 | 2 | 3 | 4 |
| 7. I felt as if it hadn't happened or wasn't real. | 0 | 1 | 2 | 3 | 4 |
| 8. I stayed away from reminders about it. | 0 | 1 | 2 | 3 | 4 |
| 9. Pictures about it popped into my mind. | 0 | 1 | 2 | 3 | 4 |
| 10. I was jumpy and easily startled. | 0 | 1 | 2 | 3 | 4 |
| 11. I tried not to think about it. | 0 | 1 | 2 | 3 | 4 |
| 12. I was aware that I still had a lot of feelings about it, but I didn't deal with them. | 0 | 1 | 2 | 3 | 4 |
| 13. My feelings about it were kind of numb. | 0 | 1 | 2 | 3 | 4 |
| 14. I found myself acting or feeling as though I was back at that time. | 0 | 1 | 2 | 3 | 4 |
| 15. I had trouble falling asleep. | 0 | 1 | 2 | 3 | 4 |
| 16. I had waves of strong feelings about it. | 0 | 1 | 2 | 3 | 4 |
| 17. I tried to remove it from my memory. | 0 | 1 | 2 | 3 | 4 |
| 18. I had trouble concentrating. | 0 | 1 | 2 | 3 | 4 |
| 19. Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart. | 0 | 1 | 2 | 3 | 4 |
| 20. I had dreams about it. | 0 | 1 | 2 | 3 | 4 |
| 21. I felt watchful or on-guard. | 0 | 1 | 2 | 3 | 4 |
| 22. I tried not to talk about it. | 0 | 1 | 2 | 3 | 4 |

Subject ID: **Traumatic Experience** Date:

**Scene Construction Questionnaire - B**

Please write a description of another aspect of the event that event that led to this evaluation, or of another moment during its occurrence. Include in your description the bodily sensations you were aware of at the time. You will be interviewed in more detail about this experience later.

Sometimes it is difficult to think of something to write "on the spot." It may help to close your eyes and imagine yourself back in the situation. Try to generate the same sensations and feelings that you had at the time. While the image is vivid in your memory, jot down the details of the scene and the sensations you experienced.

Include details such as: where you were; what you were doing; what other people were involved, and what they did or what happened to them; and how you felt. Continue on the reverse side if necessary.

Subject ID: **Traumatic Experience B** Date:

Listed below are a number of bodily sensations that people may experience in various situations. Circle all of the responses that you experienced in the situation you just described.

| | | |
|---|---|---|
| Heart stops | Breathes faster | Body shakes |
| Heart beats slower | Breathes slower | Eye twitches |
| Heart beats faster | Even breathing | Eyes closed |
| Heart pounds | Pants | Eyes burn |
| Heart skips a beat | Shallow breathing | Eyes wide open |
| Heart races | Labored breathing | Eyes water |
| Heart quickens | Gasping for air | Feel hot all over |
| Feel sweaty | Feel tense all over | Blood rushing to head |
| Palms are clammy | Feel relaxed all over | Flushed face |
| Beads of perspiration | Tension in forehead | Head pounds |
| Sweat pours out | Clenched fist | Feel warm |
| Nauseous | Tension in back | Feel restless |
| Stomach in a knot | Grit my teeth | Jittery |
| Butterflies in stomach | Clenched jaw | Calm |
| Cramps in the stomach | Tension in the arms | Want to scream |
| Constrictions in chest | Tightness in the face | Want to smash Something |
| Body feels heavy | Hands trembling | Arms and legs warm and relaxed |

Subject ID:

**Impact of Event Scale-Revised**
**Traumatic Experience B**

With regard to *the experience you just described* rate each of the following items with regard to the *past seven days*. Rate each item with regard to *the effect of the event on you*.

| | Not at all | A little bit | Moderately | Quite a bit | Extremely |
|---|---|---|---|---|---|
| 1. Any reminder brought back feelings about it. | 0 | 1 | 2 | 3 | 4 |
| 2. I had trouble staying asleep. | 0 | 1 | 2 | 3 | 4 |
| 3. Other things kept making me think about it. | 0 | 1 | 2 | 3 | 4 |
| 4. I felt irritable and angry. | 0 | 1 | 2 | 3 | 4 |
| 5. I avoided letting myself get upset when I thought about it or was reminded of it. | 0 | 1 | 2 | 3 | 4 |
| 6. I thought about it when I didn't mean to. | 0 | 1 | 2 | 3 | 4 |
| 7. I felt as if it hadn't happened or wasn't real. | 0 | 1 | 2 | 3 | 4 |
| 8. I stayed away from reminders about it. | 0 | 1 | 2 | 3 | 4 |
| 9. Pictures about it popped into my mind. | 0 | 1 | 2 | 3 | 4 |
| 10. I was jumpy and easily startled. | 0 | 1 | 2 | 3 | 4 |
| 11. I tried not to think about it. | 0 | 1 | 2 | 3 | 4 |
| 12. I was aware that I still had a lot of feelings about it, but I didn't deal with them. | 0 | 1 | 2 | 3 | 4 |
| 13. My feelings about it were kind of numb. | 0 | 1 | 2 | 3 | 4 |
| 14. I found myself acting or feeling as though I was back at that time. | 0 | 1 | 2 | 3 | 4 |
| 15. I had trouble falling asleep. | 0 | 1 | 2 | 3 | 4 |
| 16. I had waves of strong feelings about it. | 0 | 1 | 2 | 3 | 4 |
| 17. I tried to remove it from my memory. | 0 | 1 | 2 | 3 | 4 |
| 18. I had trouble concentrating. | 0 | 1 | 2 | 3 | 4 |
| 19. Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart. | 0 | 1 | 2 | 3 | 4 |
| 20. I had dreams about it. | 0 | 1 | 2 | 3 | 4 |
| 21. I felt watchful or on-guard. | 0 | 1 | 2 | 3 | 4 |
| 22. I tried not to talk about it. | 0 | 1 | 2 | 3 | 4 |

## Recording

In the upcoming task, we ask that you listen to four one-minute scripts. Each script is separated by a rest period of 5 minutes. When the script begins, we ask that you close your eyes and listen carefully to the script being played. We ask that you imagine the described event as vividly as possible, as if you were actually participating in the event. When the first script is over, we ask that you sit back, relax, and wait for the next script. Do you have any questions?

## Appendix L: IRB Approval Letter

RESEARCH INTEGRITY AND COMPLIANCE
Institutional Review Boards, FWA No. 00001669
12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-4799
(813) 974-5638 • FAX (813) 974-7091

5/30/2013

Paula Chapman, Ph.D.
James A. Haley Veteran's Hospital
8900 Grand Oak Circle [118M]
Tampa, FL 33637

RE: **Expedited Approval for Initial Review**
IRB#: Pro00012865
Title: Cardiovascular Behavioral Heath and Stress

**Study Approval Period: 5/30/2013 to 5/30/2014**

Dear Dr. Chapman:

On 5/30/2013, the Institutional Review Board (IRB) reviewed and **APPROVED** the above application and all documents outlined below.

**Approved Item(s):**
**Protocol Document(s):**
CVBH Protoco Version 1_05.09.2013

**Consent/Assent Document(s)*:**
CVBH Consent form Version 1_05.09.2013.pdf

*Please use only the official IRB stamped informed consent/assent document(s) found under the "Attachments" tab. Please note, these consent/assent document(s) are only valid during the approval period indicated at the top of the form(s).

It was the determination of the IRB that your study qualified for expedited review which includes activities that (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45CFR46.110 and 21 CFR 56.110. The research proposed in this study is categorized under the following expedited review category:

(4) Collection of data through noninvasive procedures (not involving general anesthesia or sedation) routinely employed in clinical practice, excluding procedures involving x-rays or microwaves. Where medical devices are employed, they must be cleared/approved for marketing.

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Your study qualifies for a waiver of the requirements for the process of informed consent as outlined in the federal regulations at 45CFR46.116(d) which states that an IRB may approve a consent procedure which does not include, or which alters, some or all of the elements of informed consent. Specifically, the waiver is for screening purposes.

Your study qualifies for a waiver of the requirement for signed authorization as outlined in the HIPAA Privacy Rule regulations at 45CFR164.512(i) which states that an IRB may approve a waiver or alteration of the authorization requirement provided that the following criteria are met (1) the PHI use or disclosure involves no more than a minimal risk to the privacy of individuals; (2) the research could not practicably be conducted without the requested waiver or alteration; and (3) the research could not practicably be conducted without access to and use of the PHI. Specifically, a partial waiver of HIPAA Authorization is granted for this study for recruitment purposes only. Pursuant to this waiver, the study team may access the Protected Health Information (PHI) of OEF/OIF/ON- era veterans who visited the James A. Haley Veterans OEF/OIF Post- Deployment Health Clinic between May 1, 2012 and May 1, 2013.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval by an amendment.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

John Schinka, Ph.D., Chairperson
USF Institutional Review Board