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Does Depression Act as a Mediating Variable Between Post-Traumatic Stress Disorder and Experienced Physical Dysfunction?
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Chapter 1

Review of the Literature

Historical Look at PTSD

Posttraumatic Stress Disorder (PTSD) has gone through a number of transformations and name changes throughout its long history. In a review of PTSD, Meagher (2007) traces the history of the disorder. As documented by Meagher, the original reports of hysterical reactions began around 1900 BC by Egyptian physicians. In 8th century BC, Homer described a number of symptoms, such as flashbacks and survivors’ guilt, experienced by Odysseus in The Odyssey. In the 4th century BC, Herodotus wrote about a soldier who went psychogenically blind after a fellow soldier was killed next to him. In the 17th century AD, Samuel Pepys witnessed a number of symptoms develop in survivors following the great fire of London. However, it was not until the 19th century that the constellation of symptoms later known as PTSD began to be given specific names. Soldiers who had fought in the Civil War but who could not continue fighting were diagnosed with nostalgia and then later soldier’s heart. Railroad workers who were injured during construction were diagnosed with railway spine. At the time, it was believed that “intense fear disrupted the nervous system” (Meagher, 2007, p 15). Traumatic hysteria became the more accepted term by the end of the 19th century. World War I brought a slightly different slant to the diagnosis. At that time, physicians noted that many soldiers were experiencing psychological symptoms with relatively few physical injuries. The condition was later termed “shell shocked.” The term was selected as officials believed that the exploding shells changed the surrounding pressure and affected the soldiers’ nervous system. World War II saw the name change again, this
time to combat fatigue. No matter what the name, however, the symptoms were often viewed as little more than a case of malingering. This changed following Vietnam, when large numbers of soldiers experienced the same constellation of symptoms and the diagnosis of Posttraumatic Stress Disorder was officially recognized.

PTSD requires exposure to a traumatic event. Core PTSD symptoms include persistent re-experiencing of the traumatic event, persistent avoidance of stimuli associated with the traumatic event and a numbing of general responsiveness -- all of a magnitude sufficient to cause significant impairment and distress to the individual (American Psychiatric Association, 2000). While many individuals develop acute stress reactions immediately following a traumatic event, a much smaller percentage of such individuals eventually develop PTSD. Research has shown that PTSD symptoms will be present initially following a trauma in the form of a brief stress reaction; however most symptoms will remit in a few months time for most people (Bryant, 2001).

It has been found that while more than half the population will experience at least one traumatic event in their lifetime, the normal course is to recover over a period of a few months and not develop PTSD (Bryant, 2003; Ehring, Klcim, Clark, Foa, & Ehlers, 2007). For example, Ehring et al. found that in the two weeks following a trauma, many trauma victims displayed symptoms of PTSD. However, by a 6-month follow-up, most of their symptoms had dissipated, leaving relatively few who went onto to develop chronic PTSD. Similarly, Foa and Riggs (1995), in a sample of individuals who had experienced a trauma, found that 70% of women and 50% of men met diagnostic criteria for PTSD following an assault using a continuous variable. Four months later at follow-up, only 21% of women and none of the men met diagnostic criteria for PTSD. The 78%
of women and 100% of men who no longer met criteria had achieved natural remission and had not undergone treatment.

**PTSD in the Military**

In certain populations, such as the military, the rate of PTSD is higher than seen in the general population due to the greater risk of exposure to traumatic events conferred by being a member of the armed services (Tanielian & Jaycox, 2008). The rate of identified military PTSD has been rapidly increasing, not only due to increased exposure to potentially traumatic situations but also due to better recognition and diagnosis of the disorder. Between 2007 and 2008 every branch of the military reported increased rates of the disorder (Tanielian & Jaycox, 2008). This has led to increased assessment and treatment efforts. For example, Tanielian & Jaycox examined the mental health needs of returning soldiers, the services and the health care systems in place to treat them, and the costs associated with these systems. Returning (N=1,965) combat soldiers from Operation Iraqi Freedom and Operation Enduring Freedom were surveyed. Results showed that approximately 18% of the veterans from the Iraqi and Afghani conflicts were suffering from a mental health condition and 14% met the criteria for PTSD. These prevalence numbers suggest that approximately 300,000 returning veterans likely meet diagnostic criteria for PTSD. Approximately 53% of the returning veterans with mental health problems sought treatment for their mental health condition but only approximately 50% of those soldiers seeking treatment received adequate care.

Tanielian & Jaycox (2008) attributed the increased incidence of PTSD to lengthier and more frequent tours of duty. Since April 2007, the average tour of duty for the Army has increased from 12 months to 15 months, with many of the soldiers
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completing multiple tours as the military decided to use reserve troops rather than reinstate the draft. Soldiers were found to return to active duty in a combat zone 2 to 4 times. Increased tours expose soldiers to more traumas, which may worsen the degree of the PTSD symptoms.

Research has not only sought to identify risk factors for the development of PTSD but also has examined factors associated with the course of the disorder in military and police populations. Koenen et al. (2003) investigated what factors affected the course of PTSD and were associated with either remission or the development of chronic PTSD using a continuous variable. They surveyed 1,377 American Legionnaires who served in Southeast Asia and followed them for 14 years. Approximately 11.8% of the veterans met DSM-III-R criteria for PTSD at baseline; however, only 10.5% of the veterans continued to meet criteria 14 years later. Most veterans (83%) never met criteria for PTSD. Pretrauma factors such as childhood abuse, family psychiatric history, and personal mental health history increased the risk of PTSD. Other possible predisposing factors identified included minority ethnic status, lower intelligence and education, and lower socioeconomic status. Peri-trauma and post-trauma factors also were found to contribute to the development of PTSD. These included trauma severity, younger age at the time of trauma, degree and nature of social support following the trauma, perceived threat to life, and belief in the cause. However, the single most predictive risk factor was exposure to combat.

Iversen et al. (2008) conducted a similar study in the United Kingdom. They surveyed a total of 4,762 servicemen in the UK Armed Forces who were either deployed in 2003 to the Iraq War or remained stationed in the UK. A 26 page questionnaire was
administered assessing deployment and post-deployment experiences, current health status and background information. The authors discovered those most likely to develop PTSD were of lower rank, not in a primary relationship (i.e., were single, divorced, or separated), and had history of childhood difficulties/adversity. They also discovered that a serviceman’s appraisal of his/her combat experience (perceived threat to life, quality of training and how prepared they felt) strongly affected the development of PTSD.

Relationship of PTSD and Health

Reports dating back to the time of Homer and the Egyptian physicians (Meagher, 2007), as well as more recent medical studies (Andreski, Chilcoat, & Breslau, 1998), support the idea that PTSD not only impacts psychological health but also has a significant effect on physical health. Substantial research has documented the toll PTSD takes on neurological, cardiovascular, and somatic functioning. According to Boscarino (2008), veterans who have been diagnosed with PTSD have 50% to 150% higher rates of many chronic diseases such as circulatory, nervous system, digestive, muscular, and respiratory disorders.

As articulated by Sledjeski et al. (2008) “[Extensive] research has also demonstrated a robust relationship between trauma exposure and poor physical health, with the development of PTSD following trauma exposure being posited as the primary mechanism through which trauma results in adverse health consequences.” Sledjeski et al. interviewed individuals as a part of a national household survey (N=5,692). The authors assessed both the presence/absence and severity of PTSD/trauma. Results indicated that those diagnosed with PTSD showed an increased incidence and severity of chronic medical conditions when compared with non-traumatized individuals. In this
study, individuals diagnosed with PTSD were more likely to report headaches, arthritis, back/neck pain, chronic pain, heart disease and ulcers. Similarly, a positive relationship was found between the number of traumatic experiences and the severity of physical health complaints. Overall, it was found that more traumatic events translated into worse health.

Similar findings have been found within the veteran population. Returning Iraqi War veterans who carry a diagnosis of PTSD report worse physical health compared to those without PTSD. According to a study of 2,863 veterans, being positive for PTSD was significantly related to lower levels of overall physical functioning (Hoge, Terhakopian, Castro, Messer, & Engel, 2007). Further, it was found that PTSD diagnosed veterans were more likely to report off from work, use more sick days, report greater physical complaints and poorer health than their non-PTSD counterparts. In addition, their self-report of poor health remained once the authors controlled for prior medical conditions.

The link between PTSD and health has been found in other countries and cultures as well. Maia, et al. (2007), examined the rate of PTSD in Brazilian police officers and the effect of PTSD on overall physical functioning. A total of 157 members of the Police Force of the State of Goias, Brazil participated. This particular branch of the police force is only deployed during large armed confrontations, riots, or possible hostage-taking. The officers were administered self-report questionnaires which examined sociodemographic status, use of health-related services, and health indicators such as reported physical health, PTSD, and overall mental health. Maia et al. discovered that those police officers diagnosed with full-PTSD were more likely to have poorer physical
health. These officers also tended to view their physical health more negatively and had far more hospital admissions and medical visits than did their non-PTSD counterparts.

**PTSD and cardiovascular disease.**

Some physical disorders have shown particularly high associations with PTSD. Numerous studies have found that coronary heart disease develops as a result of repeated sympathoadrenal arousal, which in turn helps to cause injury to the arteries (Boscarino, 2008). Coronary heart disease has a strong positive correlation with social stressors and other stressful events such as traumatic experience. This relationship has also been observed among veterans. Boscarino (2008) followed a group of 4300 Vietnam Veterans from 1985 to 2000 and found that those veterans diagnosed with PTSD were more likely to suffer from and die from cardiovascular diseases than their non-PTSD diagnosed counterparts. The sample was recruited randomly through the National Personnel Records Center. Cardiovascular-specific mortality was determined by using three databases: the Veterans Affairs Beneficiary Identification Record Locator Death File, Social Security Administration Death Master File, and the National Death Index-Plus. Those veterans who reported having a history of medical conditions prior to their trauma were eliminated from the study. Vital status was assessed from 1985 through 2000. Phone interviews, physician administered standard medical histories, PTSD measures and reviews of the mortality databases were used to determine whether mortality was related to heart disease and trauma experienced during the Vietnam War. Results showed “greater exposure to war trauma was related to an increase of post-service cardiovascular ailments” (Boscarino p. 669). In another study conducted by Boscarino & Chang (1999a), trauma was correlated with coronary heart disease. In this study, two groups of
Vietnam veterans were examined to determine if those with current PTSD, anxiety, and depression experienced increased rates of coronary heart disease compared to those without these conditions. Approximately 7,924 “theatre” veterans -- those who were stationed in Vietnam -- and 8,789 “era” veterans -- those who were in the armed forces but never stationed in Vietnam-- were interviewed for the study. Medical questionnaires, electrocardiograms (ECG’s), and psychiatric evaluations were conducted with study participants. The results indicated that those veterans with current PTSD, anxiety, or depression showed many abnormal ECG findings. Specifically, 27.8% of veterans with PTSD had abnormal ECG findings and evidence of infarctions, which are indicated by injured regions of the heart and could indicate a past heart attack.

**PTSD and immune system functioning.**

Research has also suggested that soldiers who have been exposed to traumatic events are more likely to have altered immune and neuroendocrine system functioning and show elevated levels of lymphocytes, leukocytes, and t-cells (Boscarino & Chang, 1999b; Wilson, van der Kolk, Burbridge, Fisler, & Kradin, 1999). Boscarino & Chang’s 1999 study of 2,490 “theater” Vietnam veterans with and without PTSD included blood assays for white blood cell and lymphocyte counts. The authors hypothesized that the immune system would show higher rates of abnormal functioning after being exposed to traumatic events. Their hypothesis was supported. Specifically, veterans with PTSD were found to have higher rates of total leukocytes, and subsets of leukocytes, indicating more impaired immune system functioning compared to those veterans without PTSD. Their finding is not isolated and suggests a direct link between immune functioning and history of trauma exposure. Wilson et al. (1999) measured peripheral blood lymphocytes
and serum cortisol levels in 20 participants; 10 had PTSD as a result childhood sexual trauma and 10 were volunteer staff controls who did not have PTSD. The authors observed increased immune system activation in the PTSD group as opposed to the control group.

**PTSD and chronic pain.**

Chronic pain is often reported by PTSD diagnosed veterans (Asmundson, Wright, & Stein, 2004; Roy-Byrne, Smith, Goldberg, Afari, & Buchwald, 2004; Shipherd et al., 2007). It has been suggested that PTSD may exacerbate pain and physical health problems (Poundja et al., 2006). Numerous studies have shown high rates of comorbidity. For example, Jakupcak et al. (2006) found in a sample of 45 veterans that those diagnosed with PTSD were more likely to report somatic complaints than those not diagnosed with PTSD; Shipherd et al. (2007) found a comorbidity rate of 66% for PTSD and chronic lower back pain in a PTSD sample ($N=90$), suggesting that intensity of PTSD carries an important risk; while Beckham et al. (1997), studying a sample of 129 outpatient combat veterans at a PTSD clinic, found that 80% of the participants reported high levels of pain. These last authors used retrospective chart review to obtain pretreatment, peri-treatment, and post treatment pain assessments spanning the years 2001-2004 to assess for the severity of pain. Specifically, lower back pain, general chronic pain, and osteoarthritis were tracked. Approximately 60% the veterans reported a pain condition prior to PTSD treatment. During and after PTSD treatment, pain scores were significantly reduced from pretreatment levels. Overall, the study found that the rate of chronic pain in an intensive PTSD treatment program was high, and that during and following treatment self-reports of pain were reduced. While researchers have
documented a relationship between PTSD and pain, the underlying mechanism or reason for the pattern is unknown. Consequently, this has prompted calls for further investigation into the specifics of this connection (Shipherd et al.).

The combination of PTSD and chronic pain may lead to worse health and psychological outcomes. Villano et al. (2007), studying a sample of 295 psychiatric patients from an urban outpatient mental health clinic, discovered that those with both PTSD and chronic pain had more severe medical conditions and psychiatric distress than those with only one condition, or those without either condition using a categorical variable. Furthermore, those with either PTSD or chronic pain were more likely to have greater psychological distress, worsened medical conditions, and more stress in their life than those without either condition. In this sample, 46% met criteria for only PTSD, 40% had only chronic pain, and 24% had both, suggesting that not only mental health, but also physical health, is impacted by the comorbidity of PTSD and pain. Similarly, Roy-Byrne et al., (2003) studying the relationship of fibromyalgia (assessed via the presence of diffuse pain and/or tender points) with PTSD, Chronic Fatigue Syndrome, and Major Depressive Disorder in a sample of 571 patients from a fatigue clinic, found that patients with both tender points and diffuse pain had a higher prevalence of PTSD than those with neither, only diffuse pain, or only tender points. Further, those patients with major depressive disorder who met criteria for fibromyalgia (tender points and diffuse pain) were 3 times more likely to carry a diagnosis of PTSD.

PTSD and Depression

PTSD is rarely a sole diagnosis. According to Hyer, Stanger, & Boudewyns (1999), approximately three-fourths of all veterans who returned from Vietnam met
criteria for at least one psychiatric diagnosis and most had multiple diagnoses. One of the most common comorbid disorders with PTSD is major depression, with comorbidity rates ranging from 24% to 50% across studies (Erickson, Wolfe, King, King, & Sharkansky, 2001; Gahm, Lucenko, Retzlaff, & Fukuda, 2007; Hyer, Stanger, & Boudewyns, 1999; Lapierre, Schwegler, & Labauve, 2007).

In a recent study examining the rates of depression and PTSD in soldiers returning from Operation Iraqi Freedom (n=2,275) and Operation Enduring Freedom (n=1,814), Lapierre et al. (2007) used self-report questionnaires to examine the rates of depression severity, PTSD severity, and general life satisfaction. Their results indicated that 31% of soldiers returning from Operation Iraqi Freedom (OIF) and 30% of soldiers returning from Operation Enduring Freedom (OEF) were symptomatic for PTSD. In terms of depression, 37% of soldiers returning from OIF and 38% from OEF reported clinically significant levels of depression. Approximately 24% of soldiers from OIF and 24% from OEF reported clinically significant levels of both depression and PTSD. Those with a single diagnosis (PTSD or depression), as well as those with comorbid diagnoses, were more likely to report less satisfaction with life than those without a psychological condition.

One possible reason for the high comorbidity of these two diagnoses is symptom overlap. Symptoms, such as numbing and decreased activity, are trademarks of both major depression and PTSD (Hyer et al., 1999). Hyer et al. examined whether depression was a completely separate diagnosis or was somehow related to PTSD itself using a sample of 139 elderly, combat veterans seeking treatment from psychiatric and medical clinics housed in a Veterans Affairs Medical Center. All of the participants were
veterans from World War II or the Korean Conflict and at least 60 years old. Using continuous variables, the participants were administered self-report measures, as well as structured interviews. Results suggested that “depression appears to be highly interrelated with combat trauma of older veterans with PTSD” (Hyer et al., p. 1080). However, the results indicated that while these disorders are interrelated, they are not the same entity. The authors demonstrated that PTSD and depression have many overlapping symptoms. However, when these factors were separated, PTSD demonstrated a greater influence on health status and adjustment, while depression exerted a greater influence on social support and heart rate (Hyer et al., 1999).

Erickson et al. (2001) examined the relationship between the severity of PTSD and depression over a period of 18-24 months. The researchers evaluated 2,949 Gulf War veterans immediately upon their return from the Gulf War (within 5 days) with self-report questionnaires. The soldiers were reassessed 18-24 months later using the same measures. The results suggested a complex, bidirectional relationship between PTSD and depression, which was best described when the model was broken down into depression and the 3 symptom clusters of PTSD. Specifically, they found evidence of bidirectional relationships between the avoidance-numbing and re-experiencing clusters and depression over the two-year period. The association between hyperarousal symptoms and depression was slightly different, such that early hyperarousal symptoms were predictors of future depression and preceded depression.

Gahm et al. (2007) conducted research on the relationship of adverse events—such as experiences during deployment or prior exposure to abuse—with PTSD and depressive symptoms. Using chart review, Gahm, et al. recruited 1626 active duty Army
members (20% women; 80% men) who sought treatment at a military outpatient mental health clinic between June 2003 and October 2004. The participants were given PTSD and depression measures upon their first visit to the clinic; subsequently they were individually assessed by either a licensed counselor or psychologist. Results suggested that adverse childhood events, such as childhood abuse, were related to both PTSD and depression severity, while exposure to combat was significantly related to PTSD severity but not depression. Specifically, 44.3% of the sample’s women met criteria for PTSD, while 72% of women met the criteria for depression; for men, 34.6% met the criteria for PTSD and 55.7% met the criteria for depression. Logistic regression indicated that combat exposure, witnessing the assault or death of someone else, and childhood events were significant predictors of PTSD. Witnessing someone being killed was a predictor of depression.

**Depression and Health**

Similar to the relationship between PTSD and health, depression has been shown to affect physical health. Not only does depression cause the individual to feel sad, lose interest in many activities, and become socially isolated, it may also complicate chronic illnesses (Salovey, Rothman, Detweiler, & Steward, 2000). Moreover, individuals’ perceptions of their physical health are often worse among patients with depression than among patients without depression (Salovey et al., 2000). Consequently, the connection between depression and health, in particular depression’s effect on the bodily systems (i.e. cardiovascular, immune, etc.) has been well documented in the literature.

Research has shown that when individuals experience a depression spectrum disorder – including major depressive disorder, dysthymia, or minor depressive disorder
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(depressive symptoms that fall below the DSM-IV criteria for major depressive disorder and dysthymia in terms of severity) -- their overall quality of life, including their physical health, is affected (Musselman, Evans, & Nemeroff, 1998; Salovey et al., 2000). In a review of the literature, Salovey et al. (2000) found that experiencing negative emotional states resulted in poorer patterns of health and physiological functioning. Depression was associated with increased risk for, or exacerbation of, certain health conditions (e.g., diabetes, cardiovascular disease.) compared to individuals who reported and maintained euthymic and/or positive affect. Additionally, those who were depressed experienced their health symptoms and conditions as more intense and uncomfortable, and often believed that they could not be helped (Salovey et al., 2000).

The relationship between depression and health has repeatedly emerged in samples of elderly individuals and veterans. In particular, the presence of depression among the elderly appears to worsen health outcomes. Covinsky, Fortinsky, Palmer, Kresevic, & Landefeld (1997) hypothesized that symptoms of depression are common in the elderly following hospitalization and may lead to worse health outcomes, such as a decrease in overall daily independent functioning. The authors conducted a study using a sample on 572 hospitalized medical patients who were 70 years or older and were classified as either depression positive or depression negative. The patients were assessed by medical personnel for depression and health status at admission and at 30 and 90 days following discharge and also completed a self-report measure on their physical health. Patients with depression (n=196) were more likely than those without depression (n=181) to lose their independence in daily functioning over the study period; additionally, they showed steady declines across time at 30 and 90 days following
discharge. Overall, the authors found that those with depression steadily worsened and were less likely to improve following hospitalization.

Ku, Liu, & Tsai (2006) conducted a study examining the rate of, and risk factors for, depression in a sample of elderly veterans in Eastern Taiwan. A sample of 947 veterans (334 individuals in the depressed group and 613 individuals in the non-depressed group) was recruited from 4 veterans’ homes and administered self-report questionnaires. Results showed that depression was significantly related to poorer perceived health and poorer functional status. For example, hypertension (51.5% of the depressed group, and 42.6% of the non-depressed group) and stroke (9.9% of the depressed group and 4.1% of the non-depressed group) were more prevalent in the depressed individuals. Increased rates of osteoarthritis (29.6%), cardiovascular disease (23.9%), and diabetes (14.1%) were seen in the depressed group in comparison to the non-depressed group (who had rates of 25.6%, 19.7%, and 11.1% respectively).

The connection between depression and cardiovascular disease is not limited to the elderly (Junge, 2009; Ku et al., 2006; Musselman et al., 1999). Musselman et al, (1998), summarizing the literature between 1966 – 1977, found that depression may act as a risk factor for the worsening of cardiovascular disease across populations and increases the associated rate of morbidity and mortality. More recent work from Junge (2009) suggested that the relationship between depression and heart disease/cardiovascular disease may be reciprocal, with each increasing the risk for the other.

Other diseases, such as diabetes, have been commonly associated with depression. Diabetes mellitus (DM) is a chronic metabolic disease that can lead to future
complications. Comorbidity rates for DM and depression have been shown to range from 14-30%, with depression often being associated with greater deterioration in the diabetic’s quality of life (Eren, Erdi, & Sahin, 2008; Ku et al., 2006). In this study, quality of life was defined as “the ways in which health, illness, and medical treatment influence an individual’s perception of functioning and well-being” (Eren et al., p. 99). Eren et al. used a sample of 108 participants diagnosed with DM who were recruited from an endocrinology clinic—60 who carried a diagnosis of major depressive disorder and 48 who did not. All of the participants completed semi-structured interviews, as well as self-report questionnaires. The authors discovered a significant correlation between the presence of depression and diabetes, as individuals diagnosed with both reported more chronic medical conditions and a reduced quality of life. For example, 24 individuals with depression had retinopathy (damage to the retina of the eye commonly associated with diabetes), while only 12 individuals in the non-depressed group had retinopathy. Depressed individuals were more likely to be non-compliant with diet ($n=36$) and exercise ($n=43$) regimes than were non-depressed counterparts ($n=14$ and $n=16$).

**PTSD, Depression, Health**

To date links between PTSD and depression, PTSD and health, and depression and health have been demonstrated. Past research suggests that all three variables are correlated with one other and that the presence of both PTSD and depression negatively impacts overall health (Frayne et al., 2004; Jakupcak et al., 2006; Mollica, McInnes, & Sarajlic et al., 1999).

In a study assessing the inter-relationship of PTSD, depression, and health status, Mollica et al. (1999) examined, through interviews and self-report questionnaires,
Bosnian refugees (N=573) who had fled during war-time. The authors reported that 20.6% of the participants had comorbid diagnoses of PTSD and depression, while 39.2% and 26.3% had only depression or PTSD respectively. Their results demonstrated that those with comorbid diagnoses had higher rates of functional disability.

Efforts have been made to identify the causal mechanism of the observed relations between PTSD, depression and physical status. For example, Jacupcak et al. (2006) posited that depression and anxiety sensitivity best explained the relationship between severity of PTSD symptoms and somatic complaints, since reactions and physical arousal symptoms associated with the trauma led to increased somatic complaints. The medical charts of 45 male veterans seeking treatment for PTSD were reviewed. Participants also completed self-report questionnaires for anxiety sensitivity, PTSD symptoms, depression symptoms, and somatic complaints. The authors used a proxy risk variable to demonstrate that PTSD and physical complaints were related due to the presence of anxiety sensitivity and depression. Proxy risk variables are similar to mediational analyses except “a proxy risk factor model does not require the establishment of the order of onset for each factor” (Jacupcak et al., 2006, p. 475). Other conceptualizations of the relationship between PTSD, depression, and health also exist. Poundja, Fikretoglu, & Brunet (2006), have suggested that depression may act as a mediating variable between PTSD and pain, such that when depression is entered into the equation, the relationship between PTSD and pain is minimized or disappears. Poundja, et al., studied this question in a sample of male veterans (N=130) seeking treatment for deployment-related PTSD. Participants were administered self-report measures for depression symptoms, pain, PTSD symptoms, and their deployment experiences. Overall, Poundja et al. found a
moderate positive relationship between PTSD symptom severity and pain \((r=0.29)\), but this relationship was completely mediated by depression severity.

**Experienced Physical Dysfunction**

Health has both objective and subjective components, with many diagnosed medical conditions affecting the subjective perceptions of health. However, research has largely failed to look at subjective health and objective medical conditions as an integrated variable (Becker et al., 1997; Perrig-Chiello, Perrig, & Stahelin, 1999; Reyes-Gibby, Aday, & Cleeland, 2002; Schneider et al., 2004). Most research has looked at the subjective component of health (e.g., pain) or objective aspects (e.g., chronic medical conditions) separately. For example Schneider et al. (2004) examined how objective health-related variables interfere with psychological health by examining the relationship between objective health related variables (e.g., instrumental activities of daily living) and psychological health and personality factors in explaining the self-perception of health in a sample of geriatric patients at a medical hospital. Becker et al. (1997) studied pain epidemiology and subjective quality of life in pain patients \((N=150)\). In this study, the authors found that those with higher pain reported lower quality of life. Reyes-Gibby et al. (2002) studied the impact of pain on self-rated health in a sample of older adults \((N=8222)\). Again, this research focused strictly on one facet (e.g., subjective health) and no attempt was made to assess the additional impact of actual physical condition on self-rated health.

Other studies have examined objective and subjective health components in the same sample but not as an integrated variable. As such, each dimension has been conceptualized as a separate entity (Arnold, Ranchor, Koeter, de Jongste, Sanderman,
2005; Perrig-Chiello et al., 1999). For example, Arnold et al. (2005) investigated the relationship between objective health and an individual’s health perceptions. Specifically, they studied whether objective health parameters – such as pulmonary function in chronic obstructive pulmonary disease patients -- and subjective health perceptions were mediated by symptoms of dyspnoea and physical functioning in patients with pulmonary disease and heart failure. The authors discovered that the relationship between objective health parameters and subjective health was not mediated by symptoms of dyspnoea. In this case, the subjective and objective health variables were conceptualized as separate facets. Along the same lines, a plethora of research has studied only one of these facets (Becker et al., 1997; Reyes-Gibby, Aday, & Cleeland, 2002; Schneider et al., 2004).

The current study seeks to investigate the relationship between depression severity, PTSD severity and experienced physical dysfunction. Specifically, this study hopes to add to the current research by capturing subjective health (e.g., reported pain) and objective health (e.g., medical conditions) into a single construct (e.g., experienced physical dysfunction). In keeping with prior research, it is predicted that the severity of depressive symptoms will act as a mediating variable between the severity of PTSD and subjective health (e.g., pain). Also, it is expected that the severity of depressive symptoms will act as a mediating variable between the severity of PTSD and objective health (e.g., current medical conditions). Finally, it is expected that depression will act as a mediating variable between severity of PTSD and experienced physical dysfunction.
Chapter 2
Rationale & Hypothesis

Research indicates that PTSD has been present throughout the ages, occurs in response to any number of traumatic events and can affect a large variety of people. War, in particular active combat, is often a precursor to the development of PTSD in military personnel. Many individuals may be predisposed to developing PTSD, including those with a history of childhood abuse and/or drug abuse (Bryant, 2003). Once PTSD has developed, individuals show increased rates of medical conditions -- including cardiovascular disease, diabetes, stroke, migraines, pulmonary disease among others-- and overall worse physical health as compared to non-PTSD populations (Andreski, Chilcoat, & Breslau, 1998; Sledjeski et al., 2008).

PTSD is often comorbid with other psychiatric disorders. In particular, depression is associated with PTSD (Erickson, Wolfe, King, King, & Sharkansky, 2001; Gahm, Lucenko, Retzlaff, & Fukuda, 2007; Hyer, Stanger, & Boudewyns, 1999; Lapierre, Schwegler, & Labauve, 2007). This adds an additional health burden as depression has also been linked to various medical conditions (e.g., cardiovascular disease, obesity, stroke, etc.), as well as subjective perceptions of poor health (Salovey et al, 2000).

Consequently, a strong degree of comorbidity between PTSD, depression, and overall health has been suggested. In particular, the presence of both PTSD and depression has been demonstrated to adversely affect overall health (Frayne, Seaver, Loveland, Christiansen, Spiro, Parker, & Skinner, 2004; Jakupcak, Osborne, Michael,
Cook, Albrizio, & Mcfall, 2006; Mollica, McInnes, & Sarajilic et al., 1999). Efforts have been made to identify the mechanisms behind these relationships (Jacupcak et al., 2006; Poundja et al., 2006). Poundja et al. (2006) has suggested that the primary mechanism is that depression acts as a mediating variable between PTSD and pain conditions.

The current study seeks to extend our understanding of the role that depression plays in the relationship between PTSD and health status/physical dysfunction. Specifically, in keeping with past results, it is hypothesized that the severity of depressive symptoms will act as a mediating variable between the severity of PTSD and markers of health status and physical functioning. Each aspect of EPD, (e.g., subjective health and objective health) will be examined alone and, then, a combined variable will then be examined. In an extension of prior research, health status is being conceptualized as a broad construct that includes both objective elements (e.g., diagnosed medical conditions) and subjective elements (e.g., experienced pain and self-perceptions of health status), such that higher scores equate to more physical impairment. As such, the health component of the model is best described as experienced physical dysfunction (EPD). The following specific relationships are expected:

(H1) The severity of PTSD (as assessed by CAPS scores) will show a positive relationship with the severity of poor subjective health (as assessed by the Brief Pain Inventory and self-reported health satisfaction score); the severity of depressive symptoms (as assessed by the Beck Depression Inventory) will show a positive relationship with subjective health (as assessed by the BPI and self-reported health satisfaction score); the severity of PTSD (assessed by CAPS) will show a positive relationship with the severity of depressive symptoms (assessed by the BDI). Finally,
DEPRESSION AS A MEDIATING VARIABLE

Depression will act as a mediating variable between the severity of PTSD and subjective health, such that depression will account for the relationship between the severity of PTSD and subjective health.

(H2) The severity of PTSD (CAPS score) will show a positive relationship with objective health (defined as total number of medical conditions); the severity of depressive symptoms (BDI score) will show a positive relationship with objective health (total number of medical conditions); the severity of PTSD will show a positive relationship with the severity of depressive symptoms. Finally, the depressive symptoms will act as a mediating variable between the severity of PTSD and objective health such that depression will account for the relationship between the severity of PTSD and objective health.

(H3) The severity of PTSD (CAPS score) will show a positive association with experienced physical dysfunction (as assessed by sum of standardized BPI and standardized number of medical conditions scores); the severity of depressive symptoms (BDI score) will show a positive association with experienced physical dysfunction; the severity of PTSD will show a positive relationship with depression. Finally, depression will act as a mediating variable between PTSD and experienced physical dysfunction, such that depression will account for the relationship between PTSD and experienced physical dysfunction.
Chapter 3

Methods

Participants

A minimum of 76 participants' records will be accessed through the Posttraumatic Stress Disorder and Anxiety Clinic (PTSDC) at the Cincinnati Veterans Medical Center. According to Cohen (1992), a medium effect, at an alpha of 0.05, requires a minimum of 76 participants. The PTSD and Anxiety Clinic includes an outpatient clinic, a 12-bed residential program for men and a 10-bed residential program for women. While some veterans may carry only an anxiety disorder diagnosis, the majority of veterans receiving services from the PTSDC carry a diagnosis of PTSD. All those who have entered treatment (residential and outpatient) for PTSD will be accessed for this study. The PTSDC serves veterans of all eras; however the majority of patients are veterans of Operation Enduring Freedom, Operation Iraqi Freedom, and the Vietnam War. All veterans entering treatment will have completed the self-report study measures as they will be part of the standard assessment and treatment planning process that occurred at intake. As such, this study will access routinely collected information and is archival in nature. While all human subjects' protections governing the use of archival data will be observed, no separate informed consent process is required.

Instruments

Clinician Administered PTSD Scale (CAPS).

The CAPS was created in 1990 at the National Center for Post-Traumatic Stress Disorder (See Appendix A for measure). It is considered the gold standard of PTSD
scales (Blake, Weathers et al., 1995; Weathers, Keane, & Davidson, 2001). The CAPS is a 30-item, individually administered, structured interview assessing DSM-IV criteria for PTSD. Scores on the CAPS can range from 0 to 79; 45 is the recommended threshold for PTSD classification. (National Center for PTSD, n.d.). The CAPS requires participants to think of a target traumatic event and reference their responses to this experience. The interview takes approximately 45-60 minutes to administer. The measure assesses PTSD through the examination of three clusters: Cluster B – re-experiencing symptoms (e.g., “Recurrent and intrusive distressing recollections of the event, including images, thoughts, and perceptions) Cluster C – avoidance symptoms (e.g., “Efforts to avoid thoughts, feelings, or conversations associated with the trauma”) and Cluster D – hyperarousal symptoms (e.g., “difficulty falling or staying asleep”). Each symptom is scored for frequency (e.g., “Have you ever tried to avoid thoughts or feelings about the event?...How often in the past month?”) and intensity (e.g., “How much effort did you make to avoid these thoughts or feelings...How much did that interfere with your life?”). For scoring purposes, a frequency of 1 and an intensity score of 2 or more, signify that a symptom is present (National Center for PTSD, n.d.). A diagnosis of PTSD is given when at least 1 symptom from Cluster B, 3 symptoms from Cluster C, and 2 symptoms from Cluster D have been endorsed (National Center for PTSD, n.d.).

Overall, the CAPS has shown excellent psychometric properties (Blake et al., 1995). Initial studies found that the CAPS’ test-retest reliabilities ranged from 0.77 to 0.96 for the 3 symptom clusters and 0.90 to 0.98 for all 17 items. Both severity and frequency ratings have shown good internal consistency, ranging from 0.85 to 0.87 respectively. When compared to the Structured Clinical Interview for DSM Disorders
DEPRESSION AS A MEDIATING VARIABLE

(SCID)--the standardized diagnostic interview most frequently used by researchers--the CAPS was found to have good sensitivity at 0.84, strong specificity at 0.95, and a kappa coefficient of 0.78.

**Brief Pain Inventory (BPI).**

The Brief Pain Inventory (BPI) is a 9-item self-report measure designed to assess the severity of chronic pain and its influence on daily functioning (See Appendix B for measure). The BPI is a self-report measure which assesses current and past -week functioning in terms of best and worst points (MD Anderson Cancer Center, n.d.). In order to calculate the total scores, items 3 through 6 are used to capture overall pain severity. An example severity question from the BPI is “Please rate your pain by circling the one number that best describes your pain at its worst in the last 24 hours (0 to 10 scale; 0=no pain and 10=pain as bad as you can imagine).” The severity scores are then collapsed into a mean score which can range from 0 to 10. The total BPI severity score is used to determine pain level using the following values: 0 to 4 = mild pain; 5-6 = moderate pain and 7-10 = severe pain. The influence of pain on daily functioning -- or pain interference -- is assessed using 7 questions (Items 9A - 9G), which tap pain-related functional impairment. An example interference item is “Circle the number that describes how, during the past 24 hours, pain has interfered with your general activity (0-10 scale; 0=does not interfere and 10=completely interferes).” As with the severity score, the interference items are collapsed into a mean score which can range from 0 to 10, indicating the average rate of impairment due to their pain. Four questions, items 1-2 and 7-8, are not necessary to calculate the total scores for the BPI and are used as supplemental information. The BPI has been shown to have excellent validity and
reliability across cultures and samples, with Cronbach’s alphas ranging from 0.77 to 0.91. Convergent validity analyses have demonstrated validity coefficients ranging from 0.40 to 0.62 when compared to the Edmonson Symptom Assessment System (ESAS) and Roland Morris Disability Questionnaire (RMDQ) (Klepstad, Loge, Borchgrevink, Mendoza, Cleeland & Kaasa, 2002; Philip, Smith, Craft, & Lickiss, 1998; Tan, Jensen, Thornby, & Shanti, 2004).

A single question will be added to the end of the BPI to directly assess health satisfaction. This question will ask “How satisfied are you with your health?” Answers will be on a 5-point likert-type scale, with 1 = “very satisfied” and 5 = “not at all satisfied”. Hoge et al. (2007) used a similar question to measure overall health. Similarly, Shepherd et al. (2007) used a single question to rate an individual’s level of pain. Overall, research has supported the use of a single question to measure subjective perception of health.

**Beck Depression Inventory – II (BDI-II).**

The BDI-II is the most recent revision of the Beck Depression Inventory (See Appendix C for measure). The BDI-II was created to assess for major depressive disorder in individuals age 13 and over, using DSM-IV criteria. The BDI-II is a 21-item, self-report measure that assesses both the presence and severity of depression symptoms. It takes approximately 5 to 10 minutes to administer (Beck, Steer, & Brown, 1996). A 4-point (0 to 3) Likert-type scale is used. Each question has 4 options that increase in severity for the experienced symptom. The BDI is scored by summing all items to obtain a single score. Total scores between 0 and 13 reflect minimal depression; scores between 14 and 19 reflect mild depression; moderate depression is reflected by scores between 20
and 28, while severe depression is indicated by scores from 29 to 63 (Beck Depression Inventory – 2nd Edition, n.d.). The BDI-II has demonstrated good convergent validity, with values ranging from 0.56 (when correlated with the BDI-I) to 0.93 (when correlated with BDI-1A) (Beck Depression Inventory – 2nd Edition, n.d.; Osman, Downs, Barrios, Kopper, Gutierrez, & Chiros, 1997). In a sample of 230 college students, a coefficient alpha of 0.90 was obtained, and the corrected item-total correlation coefficients ranged from 0.44 to 0.65. This suggested that each item contributed to the overall BDI-II score (Osman et al., 1997).

**Medical checklist.**

A medical disorder checklist will be created for this study (See Appendix D for measure). Information about participants’ current medical conditions will be gathered through chart review. The checklist will consist of the following conditions: Acne, AIDS, allergies, Alzheimer’s disease, Arthritis/osteoarthritis, asthma, cancer, cognitive decline (e.g. dementia), COPD (pulmonary disease), diabetes, ear infections, emphysema, epilepsy/seizure, erectile dysfunction, heart burn, heart disease (e.g. coronary artery disease, enlarged heart, atrial fibrillation/arrhythmia, myocardial infarctions, etc.), hernia, high cholesterol, HIV, hypertension, incontinence, infertility, insomnia, irritable bowel syndrome, kidney disease (acute renal failure, renal insufficiency, high/low nephritis, etc.), liver disease (hepatitis A, B, C, cirrhosis), lupus, migraines/headaches, multiple sclerosis, obesity, osteoporosis, pain (lower back pain, midback pain, upper back pain, neck pain, lower leg pain, calf pain, upper thigh pain, hip pain, abdominal pain, side pain, arm pain, wrist pain, hand pain, foot pain, facial pain, chest pain, fibromyalgia), Parkinson’s disease, psoriasis, sleep apnea, stroke, and traumatic brain
injury. One point will be assigned for each condition present; points will be summed to create an overall index of medical impairment. As the study progresses and data has been collected, the researcher will examine the structure with factor analysis to see if the measure is capturing one core factor or several factors.

**Experience Physical Dysfunction (EPD).**

EPD will be captured by creating a composite variable, which will be the combination of the BPI and medical checklist scores. Prior to combining the two scores, BPI and Medical Checklist raw scores will be converted to standard (z) scores in order to control for scaling differences and to ensure that each measure is contributing equally to the composite variable.

**Demographic survey.**

A Demographic survey will be created for the purposes of this study (See Appendix E for measure). Items will include general demographic questions assessing sex, ethnicity, rank, branch of the military, era served, living situation, employment, relationship status, and rate of compensation by the military and will be completed by the examiner using chart review.

**Procedure**

Prior to study initiation, IRB approval will be obtained from Xavier University and the Cincinnati VAMC. All participants will complete the study measures along with routine intake procedures. The participants will be free to refuse to complete the measures and failure to comply with the assessment process will not affect their eligibility for treatment. Within 48 hours of completing the intake measures, the primary investigator will enter a chart note documenting the BPI results to assist with treatment
planning through chart review of current diagnoses. In keeping with the archival nature of
the study, the primary investigator will subsequently review participant’s medical charts
and complete the medical checklist and demographic survey.
Chapter 4

Proposed Analyses

The relationship between the severity of PTSD, Depression and health will be assessed using three sets of mediation analyses on three different outcome variables. The first set of analyses will focus on subjective health, operationally defined as the total BPI score; the second set will focus on objective health, operationally defined as total Medical Checklist (MC) score; the third set will focus on a combined health variable that includes both objective and subjective components, operationally defined as the EPD score. In this study, the following general hypotheses will be tested: the severity of depressive symptoms (e.g., BDI) will mediate the relationship between the severity of PTSD (e.g. CAPS score) and the severity of the three health outcome variables (e.g. BPI score; MC score and EPD) such that depression severity will account for the majority of the relationship between PTSD and health. In all cases, higher scores represent worse functioning. In order to test the general hypotheses, formal mediational analyses will be conducted.

Baron and Kenny (1986) outlined several criteria that need to be met in order to determine the presence of a mediator variable. First, changes in the predictor variable must account for changes in the mediator variable (labeled Path A). Second, changes in the criterion or outcome variable are accounted for by changes in the mediator (labeled Path B). Third changes in the predictor variable account for changes in the outcome variable (labeled Path C). Finally, the significant relationship between the predictor and outcome variables is no longer significant after paths A and B are controlled (labeled
Path C’). Further, the most complete demonstration of mediation occurs when Path C is zero.

Using this strategy, the following three mediational hypotheses will be tested:

(H1) Severity of depressive symptoms will mediate the relationship between the severity of PTSD (CAPS score) and the severity of subjective health (BPI score):

1. Path A (Baron & Kenny, 1986) will be tested with a simple linear regression by regressing the BDI-II score on the CAPS score. A positive relationship between the CAPS and BDI-II is expected.

2. Path B (Baron & Kenny, 1986) will be tested with a simple linear regression, where the BDI score will be regressed on the BPI score. A positive relationship is expected between BDI-II and BPI scores.

3. Path C (Baron & Kenny, 1986) will be tested with simple linear regression whereby the CAPS score will be regressed on the BPI score. A positive relationship between the CAPS and the BPI score is expected.

4. Path C’ (Baron & Kenny, 1986) will be tested using a multiple linear regression whereby the BPI score will be regressed on both the BDI score and CAPS score. The BDI and CAPS scores will be entered on the same step. It is predicted that the CAPS will no longer show a significant relationship with the BPI once the BDI is in the equation.

(H2) Severity of depressive symptoms will mediate the relationship between the severity of PTSD (e.g. CAPS score) and objective health (e.g. Sum of Medical Checklist).
1. Path A will be tested with a simple linear regression whereby the BDI-II score will be regressed on the CAPS score. A significant relationship between the CAPS score and the BDI-II score is expected.

2. Path B will be tested with a simple linear regression whereby the Medical Checklist score will be regressed on the BDI-II score. A significant positive relationship between the BDI-II score the Medical Checklist score is expected.

3. Path C will be tested with a simple linear regression whereby the Medical Checklist score will be regressed on the CAPS score. A significant relationship between the CAPS score and Medical Checklist score is expected.

4. Path C’ will be tested using a multiple linear regression whereby the Medical Checklist score will be regressed on both the BDI score and CAPS score. The BDI and CAPS scores will be entered on the same step. It is predicted that the CAPS will no longer show a significant relationship with the Medical Checklist Score once the BDI is in the equation.

(H3) Severity of depressive symptoms will mediate the relationship between the severity of PTSD (e.g. CAPS score) and EPD (e.g. sum of standardized BPI and Medical Checklist scores).

1) Path A will be tested with a simple linear regression whereby the BDI-II score will be regressed on the CAPS score. A significant relationship is expected.

2) Path B will be tested with a simple linear relationship, whereby the sum of the BPI and Medical Checklist score will be regressed on the BDI-II. A significant relationship is expected.
3) Path C will be tested through a simple linear regression whereby the sum of BPI and the Medical Checklist will be regressed on the CAPS score. A significant relationship is expected.

4) Path C' will be tested using a multiple linear regression whereby the sum of the BPI score and the Medical Checklist score will be regressed on both the BDI score and CAPS score. The BDI and CAPS scores will be entered on the same step. It is predicted that the CAPS will no longer show a significant relationship with the sum the of the BPI score and the Medical Checklist score once the BDI is in the equation.

Baron & Kenny's 1986 article provides the basis for this mediational design. However, additional analyses will be conducted for each hypothesis for the purposes of this study. Preacher & Hayes (2004) suggest that a bootstrapping method should be used in addition to the simple mediation model proposed by Baron & Kenny (1986). This allows for the testing of indirect predictor effects, does not assume that the predictor is normally distributed and reduces the likelihood making a Type I Error by minimizing the number of inferential tests. Point estimates and bias corrected confidence intervals are created when using this method. Preacher & Hayes' have created common domain macros for use with the Statistical Package for the Social Sciences (SPSS) which will be used in the current study.

Once the initial tests of the mediational model have been conducted, secondary analyses will be undertaken to investigate the robustness of the model when controlling for background and demographic factors. Factors such as education level, sex, age, medication type/use, service connection, and rank will be assessed at a univariate level
for their relation to outcome; variables that show a significant relation with outcome will then be entered into the mediational model prior to the study variables.

If the mediational analyses are not significant for Hypothesis 1, Hypothesis 2, and Hypothesis 3, investigation of possible moderating effects by depression on these relationships will be conducted. This will be done by using multiple regression. In the regression equation for each hypothesis, the severity of PTSD and depression will be entered on the first step; on the second step, a PTSD-depression interaction term will be entered. Moderation will be supported if a significant relationship between the interaction term and the outcome variable emerges.
References


Appendix A

Clinician Administered PTSD Scale (CAPS)

The Clinician Administered PTSD Scale is protected by copyright, and as such it is not reproduced in this document. However, it may be accessed through the publisher Western Psychological Services.
Appendix B

Brief Pain Inventory

The Brief Pain Inventory is protected by copyright, and as such it is not reproduced in this document. However, it may be accessed through University of Texas MD Anderson Cancer Center.
Appendix C

Beck Depression Inventory – II

The Beck Depression Inventory - II is protected by copyright, and as such it is not reproduced in this document. However, the document may be found with Pearson Education, Inc.
Appendix D

Medical Checklist
Medical Checklist

__ Acne
__ AIDS
__ Allergies
__ Alzheimer’s disease
__ Arthritis/osteoarthritis
__ Asthma
__ Bronchitis
__ Cancer
__ Cognitive decline (i.e. dementia)
__ COPD (pulmonary disease)
__ Diabetes
__ Ear infections
__ Emphysema
__ Epilepsy/seizure
__ Erectile dysfunction
__ Heart burn
__ Heart disease (e.g. coronary artery disease, enlarged heart, atrial fibrillation/arrhythmia, myocaridal infarctions, etc.)
__ Hernia
__ High cholesterol
__ HIV
__ Hypertension
__ Incontinence

__ Infertility
__ Insomnia
__ Irritable bowel syndrome
__ Kidney disease (acute renal failure, renal insufficiency, high/low nephritis, etc.)
__ Liver disease (hepatitis A, B, C, cirrhosis)
__ Lupus
__ Migraines/headaches
__ Multiple sclerosis
__ Obesity
__ Osteoporosis
__ Pain (lower back pain, midback pain, upper back pain, neck pain, lower leg pain, calf pain, upper thigh pain, hip pain, abdominal pain, side pain, arm pain, wrist pain, hand pain, foot pain, facial pain, chest pain, fibromyalgia)
__ Parkinson’s disease
__ Psoriasis
__ Sleep apnea
__ Stroke
__ Traumatic brain injury
__ Other _____________
Appendix E

Demographic Survey

1. Age: ________

2. Sex (circle one): M F

3. Ethnicity: African American Caucasian American Indian/Alaskan/Hawaiian/Pacific Islander Asian Hispanic Mixed Race Other: ________________

4. Branch of the Military: Army Marines Air Force Navy Reserves Coast Guard

5. Era served: World War II Korea Vietnam 1st Iraq War OEF/OIF

6. Rate of Compensation by the military in %: ____%

7. Rank in the military: __________________

7. Marital Status: Single Married Divorced Separated Widowed

9. Residence: Own Home Rent Live with friends/relatives Homeless Supervised Living

10. Work: Full-Time Part-Time Unemployed/unable to work Student
Chapter 5: Defense

Abstract

The primary focus of this study was to examine whether depression mediated the relationship between PTSD and three health-related outcome variables: subjective health (e.g., pain), objective health (e.g., diagnosed medical conditions), and a combination variable (e.g., experienced physical dysfunction). Participants in the study were 152 veterans from a residential treatment program for Post-Traumatic Stress Disorder. Results indicated that depression mediated the relationship between PTSD and pain. However, no mediation was discovered between PTSD and objective health indices, or between PTSD and experienced physical dysfunction. The results suggest that subjective aspects of health may be more related to psychological functioning than are physical elements.
Does Depression Act as a Mediating Variable Between PTSD
And Experienced Physical Dysfunction?

Since first identified as a distinct disorder, Post-Traumatic Stress Disorder (PTSD) has gone through a number of transformations. Its current incarnation requires exposure to a traumatic event and several core symptoms: persistent re-experiencing of the traumatic event; persistent avoidance of stimuli associated with the traumatic event; and a numbing of general responsiveness – all of a magnitude sufficient to cause significant impairment and distress to the individual (American Psychiatric Association, 2000). While most individuals who experience a traumatic event make a full recovery within a few months (Bryant, 2003; Ehring, Kleim, Clark, Foa, & Ehlers, 2007), certain populations, such as the military, are at greater risk of developing PTSD (Tanielian & Jaycox, 2008). For instance, in a recent study of returning combat soldiers from Operation Enduring Freedom and Operation Iraqi Freedom, it was found that approximately 300,000, or 14%, met criteria for PTSD (Tanielian & Jaycox, 2008).

**Relationship of PTSD and Health**

A growing body of research has documented that PTSD not only impacts psychological health but also has a significant effect on physical health. Substantial research has shown that PTSD is associated with neurological, cardiovascular, and somatic functioning. This association has been seen in both general population (Sledjeski, 2008) and military (Boscarino, 2008) samples. Using data from a national household survey \( n = 5692 \), Sledjeski (2008) found that those diagnosed with PTSD showed both increased incidence and severity of chronic medical conditions when compared to non-traumatized individuals; similarly, within the veteran population, individuals with a
PTSD diagnosis have shown 50% to 150% higher rates of many chronic diseases such as circulatory, nervous system, digestive, muscular, and respiratory disorders (Boscarino, 2008).

Returning Iraqi War veterans who carry a diagnosis of PTSD report poorer physical health compared to those without PTSD. According to a study of 2,863 veterans, being positive for PTSD was significantly related to lower levels of overall physical functioning, even when prior medical conditions were controlled (Hoge, Terhakopian, Castro, Messer, & Engel, 2007).

Some physical disorders, such as coronary heart disease, have shown particularly high associations with PTSD. Numerous general population studies have found that coronary heart disease develops as a result of repeated sympathoadrenal arousal, which in turn leads to increased risk of injury to the arteries. Boscarino and colleagues have studied this connection with various samples over a number of years. In an early study, Boscarino & Chang (1999a), documented that trauma was correlated with coronary heart disease. In this study, two groups of Vietnam veterans, approximately 7,924 “theatre” veterans -- those who were stationed in Vietnam -- and 8,789 “era” veterans -- those who were in the armed forces but never stationed in Vietnam-- were examined to determine if those with who met diagnostic criteria for current PTSD, anxiety, and depression experienced increased rates of coronary heart disease compared to those without the psychiatric conditions. The results indicated that those veterans with current PTSD, anxiety, or depression showed significantly more abnormal ECG findings and evidence of infarctions when compared with the controls. A recent study (Boscarino, 2008) found
that veterans diagnosed with PTSD were more likely to suffer from, and die from, cardiovascular diseases when compared to their non-PTSD diagnosed counterparts.

**PTSD and chronic pain.**

Subjective pain accompanies a host of medical conditions and is often comorbid with various mental health disorders (Asmundson, Wright, & Stein, 2004; Roy-Byrne, Smith, Goldberg, Afari, & Buchwald, 2004; Shipherd et al., 2007). Pain has long been understood to possess highly subjective qualities as individuals may perceive and experience pain differently (National Center for PTSD, n.d.). However, attempts at operationalizing pain have led to a consensus position that pain can be assessed through rating scales that examine tender points and overall diffuse discomfort (Roy-Byrne, Smith, Goldberg, Afari, & Buchwald, 2004). Studies using such an approach have demonstrated positive correlations between PTSD and self-reported pain in veterans, with the research indicating PTSD exacerbates pain (Asmundson, Wright, & Stein, 2004; Poundja et al., 2006; Roy-Byrne, Smith, Goldberg, Afari, & Buchwald, 2004; Shipherd et al., 2007). For example, Jakupcak et al. (2006) found significantly increased rates of somatic complaints among PTSD–positive veterans; Shipherd et al. (2007), found a high rate of comorbidity (e.g., 66%) between a PTSD diagnosis and chronic lower back pain and Beckham et al. (1997), found that 80% of a sample of PTSD-diagnosed outpatients reported high levels of pain at PTSD treatment onset -- levels that were significantly reduced following treatment.

The combination of PTSD and chronic pain may lead to both worse health and poorer psychological outcomes. Villano et al. (2007), studying a sample of 295 psychiatric patients from an urban outpatient mental health clinic, discovered that those
with both PTSD and chronic pain -- each condition assessed categorically-- had more severe medical conditions and psychiatric distress than those with only one condition or those without either condition. Furthermore, those with either PTSD or chronic pain were more likely to have greater psychological distress, more severe medical conditions, and more subjective stress in their life than those without either condition.

**PTSD and Depression**

PTSD is rarely a sole diagnosis. Using self-report measures, Hyer, Stanger, & Boudewyns (1999) found that approximately three-fourths of veterans who returned from Vietnam met criteria for at least one psychiatric diagnosis and most had multiple diagnoses. One of the most common comorbid disorders with PTSD is major depression, with comorbidity rates ranging from 24% to 50% across studies (Erickson, Wolfe, King, King, & Sharkansky, 2001; Gahm, Lucenko, Retzlaff, & Fukuda, 2007; Hyer et al., 1999; Lapierre, Schwagler, & Labauve, 2007).

In a recent study examining the rates of depression and PTSD in soldiers returning from Operation Iraqi Freedom (n=2,275) and Operation Enduring Freedom (n=1,814), Lapierre et al. (2007) used self-report questionnaires to examine depression severity, PTSD severity, and general life satisfaction. Their results indicated that 31% of soldiers returning from Operation Iraqi Freedom (OIF) and 30% of soldiers returning from Operation Enduring Freedom (OEF) were symptomatic for PTSD. In terms of depression, 37% of soldiers returning from OIF and 38% from OEF reported clinically significant levels of depression. Approximately 24% of soldiers from OIF and 24% from OEF reported clinically significant levels of both depression and PTSD. Those with a single condition (PTSD or depression), as well as those with comorbid conditions, were
more likely to report less satisfaction with life than those without a psychological condition.

One possible reason for the high comorbidity of these two diagnoses is symptom overlap. Symptoms, such as numbing and decreased activity, are trademarks of both major depression and PTSD (Hyer et al., 1999). Hyer et al. examined whether depression was an independent disorder or subsumed by PTSD using a sample of 139 elderly, combat veterans seeking treatment from psychiatric and medical clinics housed in a Veterans Affairs Medical Center. All of the participants were veterans from World War II or the Korean Conflict and at least 60 years old. Results suggested that depression was strongly correlated with combat trauma (Hyer et al., 1999). However, the results also indicated that while depression and PTSD may be related, they are not the same entity despite having many overlapping symptoms. Specifically, PTSD demonstrated greater influence on health status and adjustment, while depression exerted greater influence on social support and heart rate (Hyer et al., 1999).

Similar to the relationship between PTSD and physical health, depression has been shown to affect somatic functioning. Not only does depression cause the individual to feel sad, lose interest in many activities, and socially isolate, it also appears to complicate chronic illnesses (Salovey, Rothman, Detweiler, & Steward, 2000). Moreover, individuals’ perceptions of their physical health are often worse among patients with depression than among patients without depression (Salovey et al., 2000). The connection between depression and health -- in particular depression’s effect on bodily systems (i.e., cardiovascular, immune, etc.) -- has been well documented in the literature (Salovey et al., 2000).
Research has shown that when individuals experience a depression-spectrum disorder their overall quality of life -- including, but not limited to - their physical health - is affected (Musselman, Evans, & Nemeroff, 1998; Salovey et al., 2000). Carrying a depression diagnosis has been associated with increased risk for, and/or exacerbation of, certain health conditions such as diabetes and cardiovascular disease when compared to individuals who report and maintain euthymic and/or positive affect. Additionally, individuals with depression diagnoses have been shown to experience their health symptoms and conditions as being more intense and uncomfortable, and often believe that they cannot be helped (Salovey et al., 2000). The presence of depression in conjunction with physical disorders has been associated with increased rates of morbidity and mortality, as well as decreased quality of life (Eren, Erdi, & Sahin, 2008; Junge, 2009; Musselman et al., 1998)

**PTSD, Depression, Health**

As noted, a growing body of research has shown that PTSD, depression, and both subjective and objective measures of health are all positively correlated, that the combined presence of both PTSD and depression carries additional risk beyond either condition alone and negatively impacts overall health (Frayne et al., 2004; Jakupcak et al., 2006; Mollica, McInnes, & Sarajlic et al., 1999). Such findings have prompted efforts to better understand these relations and to identify causal mechanisms. Poundja, Fikretoglu, & Brunet (2006), have suggested that depression may act as a mediating variable between PTSD and one measure of health – subjective pain -- such that when depression is accounted for, the relationship between PTSD and pain is minimized or disappears. Poundja, et al., studied this question in a sample of male veterans (N=130)
seeking treatment for deployment-related PTSD. Participants were administered self-report measures for depression symptoms, pain, PTSD symptoms, and their deployment experiences. Overall, Poundja et al. found a moderate positive relationship between PTSD symptom severity and pain ($r=0.29$), but this relationship was completely mediated by depression severity.

**Experienced Physical Dysfunction**

Health has both objective and subjective components, with many diagnosed medical conditions influencing subjective perceptions of health. However, research has largely failed to look at subjective health perceptions and objective medical conditions as an integrated variable (Becker et al., 1997; Perrig-Chiello, Perrig, & Stahelin, 1999; Reyes-Gibby, Aday, & Cleeland, 2002; Schneider et al., 2004). Most research has looked at subjective components of health (e.g., pain) or objective aspects (e.g., chronic medical conditions) separately. For example, Schneider et al. (2004) examined how objective health-related variables may interfere with psychological health by examining the relationship between objective health related variables (e.g., instrumental activities of daily living) and psychological health and personality factors in explaining the self-perception of health in a sample of geriatric patients at a medical hospital. Becker et al. (1997) studied pain epidemiology and subjective quality of life in pain patients ($N=150$). In this study, the authors found that those with higher pain reported lower quality of life. Reyes-Gibby et al. (2002) studied the impact of pain on self-rated health in a sample of older adults ($N=8222$) and found that those who reported more pain were likely to perceive their health as poor. Again, this research focused strictly on one facet (e.g.,
subjective health) and no attempt was made to assess the additional impact of actual physical condition on self-rated health.

Other studies have examined objective and subjective health components in the same sample but not as an integrated variable. As such, each dimension has been conceptualized as a separate entity (Arnold, Ranchor, Koeter, de Jongste, Sanderman, 2005; Perrig-Chiello et al., 1999). For example, Arnold et al. (2005) investigated the relationship between objective health and an individual’s health perceptions. Specifically, they studied whether objective health parameters – such as pulmonary function in chronic obstructive pulmonary disease patients -- and subjective health perceptions were mediated by symptoms of dyspnoea and physical functioning in patients with pulmonary disease and heart failure. The authors discovered that the relationship between objective health parameters and subjective health was not mediated by symptoms of dyspnoea.

The current study seeks to investigate the relationship between depression severity, PTSD severity and experienced physical dysfunction. Specifically, this study hopes to add to the current research by capturing subjective perceptions of health (e.g., reported pain) and objective health (e.g., medical conditions) with a single construct -- experienced physical dysfunction. In keeping with prior research, it is predicted that the severity of depressive symptoms will act as a mediating variable in the relationship between severity of PTSD and subjective health (e.g., pain). Also, it is expected that the severity of depressive symptoms will act as a mediating variable in the relationship between severity of PTSD and objective health (e.g., current medical conditions). Finally, it is expected that depression will act as a mediating variable in the relationship between
severity of PTSD and experienced physical dysfunction — or the combined effects both subjective pain and objective health status.

**Method**

**Participants**

The participants were 152 participants from the Cincinnati Veterans’ Affairs Medical Center Post-Traumatic Stress Disorder and Anxiety Disorder’s Clinic in Fort Thomas, KY. Participants were recruited through the residential treatment program at the PTSD and Anxiety Disorders Clinic. Of the sample, 81.6% were men (n=124) and 18.4% were women (n=28). Table 1 contains detailed demographic information about the sample. Table 2 contains information about the types of trauma experienced and reported by study participants as measured by the CAPS.

**Measures**

**Clinician Administered PTSD Scale (CAPS).**

The CAPS was created in 1990 at the National Center for Post-Traumatic Stress Disorder. It is considered the gold standard of PTSD scales (Blake, Weathers et al., 1995; Weathers, Keane, & Davidson, 2001). The CAPS is a 30-item, individually administered, structured interview assessing DSM-IV criteria for PTSD. Scores on the CAPS can range from 0 to 79; 45 is the recommended threshold for PTSD classification (National Center for PTSD, n.d.). The CAPS requires participants to think of a target traumatic event and reference their responses to this experience. The interview takes approximately 45-60 minutes to administer. The measure assesses PTSD through the examination of three clusters: Cluster B — re-experiencing symptoms (e.g., “Recurrent and intrusive distressing recollections of the event, including images, thoughts, and
perceptions) Cluster C – avoidance symptoms (e.g., “Efforts to avoid thoughts, feelings, or conversations associated with the trauma”) and Cluster D – hyperarousal symptoms (e.g., “difficulty falling or staying asleep”). Each symptom is scored for frequency (e.g., “Have you ever tried to avoid thoughts or feelings about the event?...How often in the past month?”) and intensity (e.g., “How much effort did you make to avoid these thoughts or feelings...How much did that interfere with your life?”). For scoring purposes, a frequency of 1 and an intensity score of 2 or more, signify that a symptom is present (National Center for PTSD, n.d.). A diagnosis of PTSD is given when at least 1 symptom from Cluster B, 3 symptoms from Cluster C, and 2 symptoms from Cluster D have been endorsed (National Center for PTSD, n.d.).

Overall, the CAPS has shown excellent psychometric properties (Blake et al., 1995). Initial studies found that the CAPS’ test-retest reliabilities ranged from 0.77 to 0.96 for the 3 symptom clusters and 0.90 to 0.98 for all 17 items. Both severity and frequency ratings have shown good internal consistency, ranging from 0.85 to 0.87 respectively. When compared to the Structured Clinical Interview for DSM Disorders (SCID)--the standardized diagnostic interview most frequently used by researchers--the CAPS was found to have good sensitivity at 0.84, strong specificity at 0.95, and a kappa coefficient of 0.78.

**Brief Pain Inventory (BPI).**

The Brief Pain Inventory (BPI) is a 9-item self-report measure designed to assess the severity of chronic pain and its influence on daily functioning. The BPI is a self-report measure which assesses current and past-week functioning in terms of best and worst points (MD Anderson Cancer Center, n.d.). In order to calculate the total scores,
items 3 through 6 are used to capture overall pain severity. An example severity question from the BPI is “Please rate your pain by circling the one number that best describes your pain at its worst in the last 24 hours (0 to 10 scale; 0=no pain and 10=pain as bad as you can imagine).” The severity scores are then collapsed into a mean score which can range from 0 to 10. The total BPI severity score is used to determine pain level using the following values: 0 to 4 = mild pain; 5-6 = moderate pain and 7-10 = severe pain. The influence of pain on daily functioning – or pain interference – is assessed using 7 questions (Items 9A - 9G), which tap pain-related functional impairment. An example interference item is “Circle the number that describes how, during the past 24 hours, pain has interfered with your general activity (0-10 scale; 0=does not interfere and 10=completely interferes).” As with the severity score, the interference items are collapsed into a mean score which can range from 0 to 10, indicating the average rate of impairment due to their pain. Four questions, items 1-2 and 7-8, are not necessary to calculate the total scores for the BPI and are used as supplemental information. The BPI has been shown to have excellent validity and reliability across cultures and samples, with Cronbach’s alphas ranging from 0.77 to 0.91. In the current study, the BPI received a Cronbach’s Alpha of .589. Convergent validity analyses have demonstrated validity coefficients ranging from 0.40 to 0.62 when compared to the Edmonson Symptom Assessment System (ESAS) and Roland Morris Disability Questionnaire (RMDQ) (Klepstad, Loge, Borchgrevink, Mendoza, Cleeland & Kaasa, 2002; Philip, Smith, Craft, & Lickiss, 1998; Tan, Jensen, Thornby, & Shanti, 2004).

A single question was added to the end of the BPI to directly assess health satisfaction. This question asked “How satisfied are you with your health?” Answers
were on a 5-point likert-type scale with 1 = "very satisfied" and 5 = "not at all satisfied". Hoge et al. (2007) used a similar question to measure overall health.

Similarly, Shiperd et al. (2007) used a single question to rate an individual’s level of pain. Overall, research has supported the use of a single question to measure subjective perception of health.

**Beck Depression Inventory – II (BDI-II).**

The BDI-II is the most recent revision of the Beck Depression Inventory. The BDI-II was created to assess for major depressive disorder in individuals age 13 and over, using DSM-IV criteria. The BDI-II is a 21-item, self-report measure that assesses both the presence and severity of depression symptoms. It takes approximately 5 to 10 minutes to administer (Beck, Steer, & Brown, 1996). A 4-point (0 to 3) Likert-type scale is used. Each question has 4 options that increase in severity for the experienced symptom. The BDI is scored by summing all items to obtain a single score. Total scores between 0 and 13 reflect minimal depression; scores between 14 and 19 reflect mild depression; moderate depression is reflected by scores between 20 and 28, while severe depression is indicated by scores from 29 to 63 (Beck Depression Inventory -2nd edition, n.d.). The BDI-II has demonstrated good convergent validity, with values ranging from 0.56 (when correlated with the BDI-I) to 0.93 (when correlated with BDI-1A) (Beck Depression Inventory -2nd edition, n.d.; Osman, Downs, Barrios, Kopper, Gutierrez, & Chiros, 1997). In a sample of 230 college students, a coefficient alpha of 0.90 was obtained, and the corrected item-total correlation coefficients ranged from 0.44 to 0.65, suggesting that each item contributed to the overall BDI-II score (Osman et al., 1997).

**Medical checklist.**
A medical disorder checklist was created for this study. Information about participants' current medical conditions was gathered through chart review. The checklist consisted of the following conditions: Acne, AIDS, allergies, Alzheimer's disease, Arthritis/osteoarthritis, asthma, cancer, cognitive decline (e.g. dementia), COPD (pulmonary disease), diabetes, ear infections, emphysema, epilepsy/seizure, erectile dysfunction, heart burn, heart disease (e.g. coronary artery disease, enlarged heart, atrial fibrillation/arrhythmia, myocardial infarctions, etc.), hernia, high cholesterol, HIV, hypertension, incontinence, infertility, insomnia, irritable bowel syndrome, kidney disease (acute renal failure, renal insufficiency, high/low nephritis, etc.), liver disease (hepatitis A, B, C, cirrhosis), lupus, migraines/headaches, multiple sclerosis, obesity, osteoporosis, pain (lower back pain, midback pain, upper back pain, neck pain, lower leg pain, calf pain, upper thigh pain, hip pain, abdominal pain, side pain, arm pain, wrist pain, hand pain, foot pain, facial pain, chest pain, fibromyalgia), Parkinson's disease, psoriasis, sleep apnea, stroke, and traumatic brain injury.\(^1\) Reliability analyses of the MCL were conducted, resulting in a Cronbach's Alpha of .06 indicating that the MCL does not function holistically and the constituent items are largely unrelated.

**Experience Physical Dysfunction (EPD).**

EPD was captured by creating a composite variable composed of the BPI, single item health- satisfaction and medical checklist scores. Prior to combining the scores, all

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\(^1\) Initially it was planned to collapse the MCL into factor scores. However, as the MCL variables are dichotomous and not continuous in nature, factor analysis could not be reliably conducted.
measures were converted to standard (z) scores in order to control for scaling differences and to ensure that each measure contributed equally to the composite variable.

**Demographic survey.**

A demographic survey was created for the purposes of this study. Items included were general demographic questions assessing sex, ethnicity, rank, branch of the military, era served, living situation, employment, relationship status, and rate of compensation by the military and was completed by the examiner using chart review.

**Procedure**

Prior to study initiation, IRB approval was obtained from all participating institutions. All participants completed the study measures during routine intake procedures for the residential program and the information gathered was used for treatment planning purposes. As such, the data is archival in nature and informed consent was not obtained\(^2\). All results were entered into the Veterans’ digital medical charts within the first week of entering the residential program. In keeping with the archival nature of the study, the primary investigator subsequently reviewed participant’s medical charts and completed the medical checklist and demographic survey.

**Results**

**Analytic Strategy**

The following analytic strategy was used to test the primary hypotheses. It was hypothesized that experienced physical status, which included both subjective pain and

\(^2\) The study originally proposed including both residential and outpatient veterans. However, outpatient participants proved difficult to recruit and the target number of participants was reached through the residential program alone.
objective medical status, would be associated with higher levels of PTSD symptoms and that these relations could be explained by participants’ level of depression. As such, the overarching hypothesis specified a mediational model. The classical approach to mediation, as outlined by Baron & Kenny (1986), requires that the predictor variable(s) (PV) — in this case the PTSD severity variable— be significantly related to both the outcome variable (OV) — in this case the various health variables — and the hypothesized mediational variable (MV) — in this case level of depression; the mediational variable must also show a significant relationship with the outcome variable, after accounting for the influence of the predictor variable. Baron and Kenny’s mediational model tests four paths. In the current study, the first step involved assessing the relationship of each individual health/pain variable with baseline PTSD (labeled path c); the second step involved testing the relationship of the PTSD with depression (labeled path a); the third step involved testing the relationship of depression with the health variable(s) (labeled path b); the final step involved testing the relationship of each health variable with baseline PTSD, after accounting for the influence of depression (labeled path c’). Note that paths b and c’ are tested simultaneously to remove the influence of the predictor variable from the proposed mediator. See figure 1.

While Baron and Kenny’s classical approach reveals mediation, it has some limitations. As articulated by Preacher and Hayes (2008), Baron and Kenny’s method can miss indirect effects as it requires significant relations between the predictor, the mediator and the outcome variables. Additionally, it requires multiple individual tests and increases the risk of type I error. With these limitations in mind, Preacher and Hayes (2008) have developed an alternative approach based on bootstrapping. This allows for
assessment of indirect effects (i.e., $ab$), in addition to all the paths in Baron and Kenny’s method (i.e., $a, b, c, c’$) in a single step, reducing type I error. This approach yields point estimates (i.e., unstandardized regression coefficients) in addition to standard errors for each path. Bootstrapping enables a researcher to create an empirical representation of the indirect effects and yields point estimates and bias-corrected, accelerated (BCA) confidence intervals for each individual proposed indirect effect. Confidence intervals that do not include zero suggest significant mediation and that the indirect effects are different from zero.

The current study opted to test the primary hypotheses using Baron and Kenny’s classic mediation approach and to conduct follow-up analyses using Preacher and Hayes’ bootstrapping approach.

For all analyses, PTSD symptom severity was assessed using the pretreatment CAPS score, with higher scores being reflective of more severe PTSD; depression severity was assessed using the BDI-II, with higher scores reflecting greater depression. Objective and subjective physical health were assessed using a three-pronged approach: first, the level of subjective discomfort was assessed using the Brief Pain Inventory (BPI) and single-item health satisfaction score; second, the actual physical status of the individual was assessed using the Medical Checklist (MCL) score; finally, these measures were combined to form a summary variable, Experienced Physical Discomfort (EPD), that captured both subjective and objective elements of health functioning.

**Primary analyses.**

Prior to any analyses, all variables were examined for normalcy. No significant violations were noted. Table 3 contains the mean values for the variables of interest. As
can be seen, the average pain score from the BPI indicates that most participants reported moderate amounts of pain. In addition, the majority of participants reported high levels of depression and PTSD. In regards to the overall health question, the majority of participants indicated that they perceived their overall health quality to be in the medium range. Finally, most participants did not endorse the majority of the health conditions on the MCL.

The following specific hypotheses were tested:

(H1) Severity of depressive symptoms will mediate the relationship between the severity of PTSD symptoms and degree of subjective health. This hypothesis predicted that depression severity (as measured by the BDI-II score) would mediate the relationship between PTSD symptom severity (as measured by the CAPS total score) and subjective health (as measured by the BPI score).

Path b, the relationship of the proposed mediator and the outcome variable, was tested by regressing the BDI-II score on the BPI score, controlling for the effects of pretreatment CAPS. Results indicated a positive but non-significant relation ($B = .016, t = 1.8, p = .075$), indicating that depression was not reliably correlated with the presence of pain when taking into account baseline PTSD severity. Path a, the relationship of the predictor variable and the mediator, was tested by regressing the BDI-II score on the baseline CAPS score. Results revealed a significant relation between BDI-II and the CAPS ($B = .30, t = 5.68, p = .00$), indicating that depression severity was positively correlated with PTSD symptom severity. Path c, the relationship between subjective pain (the outcome variable) and PTSD intensity (the predictor variable), was tested by regressing the CAPS score onto the BPI score. A significant relationship between the
CAPS and BPI \( (B = .013, t = 2.36, p = .02) \) emerged, indicating that PTSD severity was positively correlated with the intensity of subjective pain. Finally, path c', the relationship between the predictor variable (PTSD) and the outcome variable (pain), after accounting for the effects of the proposed mediator (depression), was tested by using multiple linear regression. The model included two steps: the CAPS score was entered on Step 1 and the BDI-II was entered on step 2. As predicted, path c’ revealed a nonsignificant relationship \( (B = .01, t = 1.34, p = .18) \), indicating that mediation had occurred and that depression accounted for the observed relationship between subjective pain and PTSD. Consistent with this finding, bootstrapping analyses produced a point estimate of .0048 and a 95% BCA of .0001 to .0120, indicating the presence of mediation.

(H2) Severity of depressive symptoms will mediate the relationship between the severity of PTSD symptoms and objective health. This hypothesis predicted that depression severity (as measured by the BDI-II score) would mediate the relationship between PTSD symptom severity (as measured by the CAPS total score) and objective health (as measured by the standardized Medical Checklist total score).

Path b, was tested by regressing the BDI-II score on the standardized MCL score, controlling for the effects of the baseline CAPS score. Results showed a significant relation \( (B = -.017, t = -1.98.49, p = .05) \), indicating that the presence of depression was negatively correlated with objective health after accounting for the effects of baseline PTSD severity. Path a was tested by regressing the BDI-II score on the CAPS score. Results demonstrated a significant relation between BDI-II and the CAPS \( (B = .30, t = 5.06, p = .00) \), indicating that depression severity was positively correlated with PTSD
severity. Path c was tested by regressing the CAPS score onto the standardized MCL score. Results showed a significant relationship between the CAPS and MCL ($B = .015$, $t = 2.82$, $p = .01$), indicating that PTSD symptom severity was positively correlated with the number of diagnosed medical conditions. Finally, path c’, was tested using multiple linear regression whereby the CAPS was entered on Step 1 and the BDI-II was entered on Step 2. Results indicated a significant relationship for Path c’ ($B = .02$, $t = 3.44$, $p = .00$), indicating no mediation and that the observed relationship between PTSD symptom severity and number of diagnosed medical conditions could not be accounted for by depression severity. As shown, the converse of mediation was observed and the predictive power of PTSD symptom severity was increased once depression severity was added to the model. Examination of the model $r^2$ at each step indicated that adding depression symptom severity to PTSD symptom severity increased overall predictive power ($\Delta r^2 = .03$; $F = 3.92$; $p < .05$) and that depression severity functioned as a suppressor variable in the relationship between PTSD symptom severity and number of diagnosed medical conditions. While there was no evidence of direct mediation, tests of the total indirect effects (paths ab) showed a marginally significant effect ($z = -1.6$; $p = .06$) and bootstrapping analyses produced a point estimate of -.0052 and a 95% BCA of -.012 to -.001, indicating possible mediation by the total indirect effects had occurred.

(H3) Severity of depressive symptoms will mediate the relationship between the severity of PTSD symptoms and combined subjective and objective health status — experienced physical dysfunction (EPD).

Path b was tested by regressing the BDI-II score on the EPD score, controlling for the effects of baseline PTSD symptom severity. Results indicated no significant relation
(\(B = .02, t = 1.08, p = .29\)), suggesting that depression severity is unrelated to degree of experienced physical dysfunction. Path a was tested by regressing the BDI-II score on the CAPS score. Results showed a significant relation between BDI-II and CAPS (\(B = .31, t = 4.58, p < .01\)), indicating that depression severity was positively correlated with PTSD symptom severity. Path c was tested by regressing baseline CAPS onto the EPD score. Results revealed a significant relationship between the CAPS and EPD (\(B = .029, t = 2.66, p < .01\)), indicating that PTSD symptom severity is positively correlated with degree of experienced physical dysfunction. Finally, path c’ was tested using multiple linear regression, whereby the baseline CAPS was entered on Step 1 and the BDI-II was entered on step 2. Path c’ was not significant (\(B = .02, t = 1.90, p = .06\)), indicating that including depression severity in the model significantly reduced the association between PTSD symptom severity and degree of experienced physical dysfunction. However, bootstrapping analyses produced a point estimate of .0057 and a 95% BCA of -.0041 to .0224, indicating no detectable mediation had occurred.

**Secondary analyses.**

The robustness of the obtained mediational effects were assessed by retesting the model that showed significant mediation after controlling for demographic and background variables significantly related to the three outcome variables. This was done by first conducting a series of univariate tests of potential control variables and subjective physical dysfunction and retaining those that demonstrated significant relations. Table 4 contains these results. As can be seen, only non-narcotic medications, narcotic medications and officer status showed any independent association with outcome. These three variables were then used as control variables to test the robustness of hypothesis 1.
Results indicated that symptom severity remained a significant predictor of subjective physical dysfunction after controlling for officer status, use of non-narcotic medication and use of narcotic medication ($B = .01; t = 2.2; p = .03$). Although adding depression to the equation did not significantly increment the total explained variance ($\Delta r^2 = .01; p = .209$), once in the model the association between PTSD and subjective physical dysfunction did disappear ($B = .01; t = 1.43, p = .16$). However, examination of the full model indicated that the most potent predictor of subjective physical dysfunction was use of narcotic medication ($B = -.66; t = -3.19, p < .01$). Veterans who did not use narcotic medication were more likely to report subjective physical dysfunction (pain).

Given that only one of the three primary hypotheses was clearly supported, the moderating influence of depression on the relationship between PTSD and both objective health status and EPD was assessed. No significant interactions emerged for either outcome variable and depression severity did not function as a moderator.

**Discussion**

The purpose of this study was to examine the relations between PTSD symptom severity, depression severity and measures of both subjective (e.g., pain) and objective (diagnosed conditions) physical functioning. Specifically, the role of depression in mediating any observed association between PTSD symptom severity and physical functioning was tested. This study extended past work conducted by Poundja et al (2006), which found depression severity mediated a positive association between pain and PTSD symptom severity, by investigating objective physical measures in addition to subjective physical functioning. It was hypothesized that any relations observed between PTSD symptom severity and three physical outcomes – subjective physical functioning,
objective physical functioning and a combined index labeled Experienced Physical Dysfunction (EPD) – could be accounted for by the extent of depression present. The hypotheses were only partially supported. While depression did mediate the observed, positive relation between PTSD symptom severity and subjective physical status, it did not mediate the observed, positive relation between PTSD symptom severity and objective physical status or the observed relation between PTSD symptom severity and the holistic construct, EPD. As such, the current results indicate that distinct processes are accounting for the relations between PTSD and subjective and objective indicators of physical functioning. Of interest, is that while all three of the health-related outcomes showed significant, univariate, relations with both depression and PTSD, the interconnections between the constructs differed. When physical dysfunction was assessed on a psychological level (e.g., via pain) PTSD showed no independent association over and above depression; however, when physical dysfunction was assessed on a somatic level (e.g., via diagnosed medical conditions) depression and PTSD each showed unique associations and accounted for maximal variance when combined.

Consistent with past findings (Erickson, Wolfe, King, King, & Sharkansky, 2001; Gahm, Lucenko, Retzlaff, & Fukuda, 2007; Hyer, Stanger, & Boudewyns, 1999; Lapierre, Schwegler, & Labauve, 2007), the current sample of PTSD diagnosed Veterans reported high levels of depression symptoms, reflecting considerable comorbidity. In this study, the average level of depression was classified as severe (BDI-II; M = 36). While the current study focused on Veterans, the nature of their reported trauma varied; while approximately 48% were seeking treatment for combat trauma, over 25% of the sample indicated their index trauma was sexual assault and another 12% were seeking treatment
for the lasting effects of childhood trauma. This suggests that the current findings may generalize beyond the veteran population. Overall, the Veterans in this sample reported very high levels of active trauma symptoms, consistent with individuals seeking residential treatment for PTSD. Finally, the sample as a whole reported experiencing mild- to- moderate levels of pain at the point of study entry.

As indicated, the relations observed between the three constructs of interest were complex. As predicted, depression played a mediating role between PTSD and subjective pain. However, the strength of this association is difficult to determine as 24% of the sample reported being prescribed narcotic pain medication and the strongest predictor of subjective pain was use of narcotic pain medication; participants who were prescribed narcotic pain medication reported significantly less subjective pain. While the results indicated that PTSD symptom severity predicted subjective pain even when accounting for use of narcotic medication, the role of depression may have been attenuated by this class of medication. Two of the core constructs associated with PTSD (re-experiencing and avoidance) have cognitive and behavioral bases that may be less readily ameliorated by narcotic medication than are the emotional correlates of depression. Additionally, the physical discomfort and limitations associated with pain may give rise to depressive symptoms, such as helplessness and hopelessness, and reducing pain may have reduced reported levels of depression. As such, the current results may underestimate the role that depression plays in the relationship between PTSD and subjective pain.

Contrary to prediction, there was no evidence that depression mediated the association of PTSD and objective health. Rather, depression and PTSD each accounted for unique variance and considering both best predicted objective health. While contrary
to prediction, these results do align with prior research which found that either depression or PTSD symptom severity predicted lower physical functioning (e.g. cardiovascular disease, immune system) (Boscarino, 2008; Mollica et al., 1999).

In regards to the holistic measure of health -- Experienced Physical Dysfunction - depression played a less prominent role and did not account for any unique variance beyond PTSD symptom severity. While depression was significantly correlated with EPD on a univariate level (p = .04) its influence could be accounted for by PTSD symptom severity. As such, the premise that viewing health in an integrated or holistic manner would enhance understanding the interconnections between PTSD, depression and health was not supported. In fact, combining the objective and subjective health measures served to effectively obscure the relationships that emerged when each aspect was considered alone.

While the proposed hypotheses only garnered mixed support, the prominence of both health impairment and depression in a sample seeking treatment for PTSD was striking. This underscores the need for treatment providers (both medical and psychological) to remain attentive to a multiplicity of conditions and to recognize that individuals who present for PTSD treatment are likely to be symptomatic for other conditions – particularly depression --as well. While outside the scope of this study, which sought to document baseline relations and not assess treatment effects, the interconnected relations observed among PTSD, depression and health (both subjective and objective) suggest that targeted treatment aimed at one aspect may provide relief and improvement in the other two domains as well.
The current results should be considered within the context of several limitations. First, the operational definitions of the constructs were different than those used in past research (Schneider et al., 2004) and may have led to different outcomes. For example, the entire sample had been diagnosed with PTSD, and the PTSD symptom severity measure may have shown restriction of range for this reason. This approach is in contrast to prior research assessing the influence of PTSD on health using a comparison group not diagnosed with PTSD (Hoge et al., 2007). Similarly, the current sample was comprised of Veterans seeking residential treatment and may not be representative of the larger PTSD population.

In regards to the health variables, the current study defined subjective health in terms of pain. Given the high number of participants who were taking narcotic pain medication, a better measure might have been a subjective appraisal of health-related quality of life (e.g., Andreson & Meyers, 2000) as that may have been less directly influenced by pain medication. The physical health measure used also had limitations; it weighted all physical conditions equally and, as such, an individual who had multiple, minor conditions would show more “impairment” that a participant with fewer, but more serious concerns. Finally, a better holistic measure of health may have incorporated an assessment of functional activities and not just combined medical diagnoses and pain. For example, Mollica et al (1999) found that individuals with comorbid diagnoses of PTSD and depression showed higher rates of functional disability.

Other limitations concern the archival and correlational nature of the study. However, given that ethical considerations preclude manipulation of the constructs of interest, testing specified meditational hypotheses is the most appropriate approach to
uncover causal relationships and moves the findings beyond correlation per se. While the current findings may not generalize broadly, they are felt to be representative of Veterans seeking treatment for PTSD at a residential treatment program. Future research may consider analyzing the relations between PTSD, depression and health in settings other than a VA center specialized in treating PTSD and outside of the VA system more broadly.
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Table 1

Demographic Characteristics of Sample

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<th>Characteristics</th>
<th>Statistic</th>
<th>N</th>
<th>Percent (%)</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>(mean &amp; SD)</td>
<td>152</td>
<td>-</td>
<td>45.28(12.02)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>114</td>
<td></td>
<td>75.0</td>
<td>-</td>
</tr>
<tr>
<td>African-American</td>
<td>35</td>
<td></td>
<td>23.0</td>
<td>-</td>
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<td>Hispanic/Latino</td>
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<td></td>
<td>1.3</td>
<td>-</td>
</tr>
<tr>
<td>Native-American</td>
<td>1</td>
<td></td>
<td>.7</td>
<td>-</td>
</tr>
<tr>
<td>Education, years</td>
<td>(mean &amp; SD)</td>
<td>151</td>
<td>-</td>
<td>13.27 (1.93)</td>
</tr>
<tr>
<td>Marital Status</td>
<td>n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/Remarried</td>
<td>51</td>
<td></td>
<td>33.5</td>
<td>-</td>
</tr>
<tr>
<td>Widowed</td>
<td>2</td>
<td></td>
<td>1.3</td>
<td>-</td>
</tr>
<tr>
<td>Separated</td>
<td>7</td>
<td></td>
<td>4.6</td>
<td>-</td>
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<tr>
<td>Divorced</td>
<td>67</td>
<td></td>
<td>44.1</td>
<td>-</td>
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<tr>
<td>Never Married</td>
<td>25</td>
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<td>16.4</td>
<td>-</td>
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<tr>
<td>Living Situation</td>
<td>n (%)</td>
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<td></td>
<td></td>
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<tr>
<td>Own home</td>
<td>36</td>
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<td>33.3</td>
<td>-</td>
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<tr>
<td>Rent Apt/home</td>
<td>30</td>
<td></td>
<td>27.8</td>
<td>-</td>
</tr>
<tr>
<td>Live with Family/Friends</td>
<td>24</td>
<td></td>
<td>22.2</td>
<td>-</td>
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<tr>
<td>Homeless</td>
<td>12</td>
<td></td>
<td>11.1</td>
<td>-</td>
</tr>
<tr>
<td>Supervised Living</td>
<td>6</td>
<td></td>
<td>5.6</td>
<td>-</td>
</tr>
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<td>Branch of Military</td>
<td>n (%)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Army</td>
<td>69</td>
<td></td>
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<td>-</td>
</tr>
<tr>
<td>Navy</td>
<td>14</td>
<td></td>
<td>13.0</td>
<td>-</td>
</tr>
<tr>
<td>Coast Guard</td>
<td>1</td>
<td></td>
<td>.9</td>
<td>-</td>
</tr>
<tr>
<td>Service Era</td>
<td>n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Korean War</td>
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<td></td>
<td>.7</td>
<td>-</td>
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<td>Vietnam War</td>
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<td>24.3</td>
<td>-</td>
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<td></td>
<td>20.4</td>
<td>-</td>
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<td>-</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>1</td>
<td></td>
<td>.7</td>
<td>-</td>
</tr>
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<td>Iraq (OEF/OIF)</td>
<td>47</td>
<td></td>
<td>30.9</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td></td>
<td>2.0</td>
<td>-</td>
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<td>Employment Status</td>
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<td></td>
<td></td>
<td></td>
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<td>Full Time</td>
<td>15</td>
<td></td>
<td>9.9</td>
<td>-</td>
</tr>
<tr>
<td>Disabled</td>
<td>75</td>
<td></td>
<td>49.3</td>
<td>-</td>
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<tr>
<td>Unemployed</td>
<td>44</td>
<td></td>
<td>28.9</td>
<td>-</td>
</tr>
<tr>
<td>Retired</td>
<td>13</td>
<td></td>
<td>8.6</td>
<td>-</td>
</tr>
<tr>
<td>Student</td>
<td>2</td>
<td></td>
<td>1.3</td>
<td>-</td>
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Table 1, continued

<table>
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<th>Characteristics</th>
<th>Statistic</th>
<th>N</th>
<th>Percent (%)</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>N (%)</td>
<td>3</td>
<td>2.0</td>
<td>-</td>
</tr>
<tr>
<td>Officer Type</td>
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<td></td>
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<td>Commissioned</td>
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<td>12</td>
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<tr>
<td>Non-Commissioned</td>
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<td>93</td>
<td>86.1</td>
<td>-</td>
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<tr>
<td>Unknown</td>
<td></td>
<td>3</td>
<td>2.8</td>
<td>-</td>
</tr>
<tr>
<td>Svccxn</td>
<td>(mean &amp; SD)</td>
<td>152</td>
<td>-</td>
<td>26.97(34.14)</td>
</tr>
<tr>
<td>Svccen_Total</td>
<td>(mean &amp; SD)</td>
<td>108</td>
<td>-</td>
<td>35.09(36.77)</td>
</tr>
</tbody>
</table>

*Note.* Svccxn = Percent of Service Connection for PTSD. Svccen_Total = Total service connection.
Table 2

*Frequency Table for Index Traumas*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire or Explosion</td>
<td>6</td>
<td>4.0</td>
</tr>
<tr>
<td>Transportation Accident</td>
<td>6</td>
<td>4.0</td>
</tr>
<tr>
<td>Serious Accident</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>Physical Assault</td>
<td>4</td>
<td>2.6</td>
</tr>
<tr>
<td>Assault with Weapon</td>
<td>1</td>
<td>.7</td>
</tr>
<tr>
<td>Sexual Assault</td>
<td>39</td>
<td>25.8</td>
</tr>
<tr>
<td>Combat</td>
<td>72</td>
<td>47.7</td>
</tr>
<tr>
<td>Witness to Death</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Sudden Unexpected Death</td>
<td>1</td>
<td>.7</td>
</tr>
<tr>
<td>Childhood Sexual Abuse</td>
<td>8</td>
<td>5.3</td>
</tr>
<tr>
<td>Childhood Physical Abuse</td>
<td>4</td>
<td>2.6</td>
</tr>
<tr>
<td>Polytraumatic Exposure</td>
<td>5</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Table 3

*Means and Standard Deviations for CAPS, BPI, BDI-II, MCL, Overall Health*

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPI</td>
<td>108</td>
<td>3.38</td>
<td>2.66</td>
</tr>
<tr>
<td>BDI-II</td>
<td>151</td>
<td>35.69</td>
<td>12.03</td>
</tr>
<tr>
<td>CAPS</td>
<td>151</td>
<td>73.40</td>
<td>16.77</td>
</tr>
<tr>
<td>Overall Health Score</td>
<td>87</td>
<td>3.00</td>
<td>1.11</td>
</tr>
<tr>
<td>MCL</td>
<td>108</td>
<td>1.91</td>
<td>0.04</td>
</tr>
</tbody>
</table>

*Note.* N = number in sample. SD = Standard Deviation.
Table 4

*All Univariate Test Results for the BPI and Control Variables*

<table>
<thead>
<tr>
<th>Control Variable</th>
<th>B</th>
<th>t-value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education level</td>
<td>-.04</td>
<td>-.83</td>
<td>.41</td>
</tr>
<tr>
<td>Sex</td>
<td>-.20</td>
<td>-.86</td>
<td>.39</td>
</tr>
<tr>
<td>Age</td>
<td>-.003</td>
<td>-.38</td>
<td>.70</td>
</tr>
<tr>
<td>Use of medication</td>
<td>-.88</td>
<td>-4.01</td>
<td>.00*</td>
</tr>
<tr>
<td>Use of psychiatric medication</td>
<td>-.55</td>
<td>-1.50</td>
<td>.14</td>
</tr>
<tr>
<td>Use of Narcotic medication</td>
<td>-.66</td>
<td>-5.12</td>
<td>.00*</td>
</tr>
<tr>
<td>Total Service Connection</td>
<td>.002</td>
<td>.68</td>
<td>.50</td>
</tr>
<tr>
<td>Service Connection for PTSD</td>
<td>-5.86</td>
<td>.00</td>
<td>1.0</td>
</tr>
<tr>
<td>Officer type</td>
<td>.53</td>
<td>2.04</td>
<td>.04*</td>
</tr>
</tbody>
</table>

*Note. B*= Beta weight; * = Significant control variables used during secondary analyses.
A) Total Effect

```
X ——— C ——— Y
```

B) Mediational Pathway

```
X ——— a ——— M ——— b ——— Y
   
X ——— c’ ——— Y
```

Figure 1: The mediational model. A) Total effect or direct pathway. B) $b =$ the effect of the mediator on the outcome; $a =$ the effect of the predictor on the mediator; $c =$ the effect of the predictor on the outcome; $c’ =$ the effect of the predictor on the outcome when controlling for the mediator.
Appendix A

Institutional Review Boards Approval Letters
Summary

**Title:** Does Depression Act as a Mediating Variable Between PTSD and Experienced Physical Dysfunction?

**Introduction:** Research has documented associations between Post-Traumatic Stress Disorder, depression and health (Boscarino, 2008; Sledjeski, 2008). Specifically, it has been found that PTSD, depression and subjective and objective health measures are positively correlated and that the combined presence of both PTSD and depression carries additional risk for health beyond either condition alone (Jakupcak et al., 2006; Mollica et al., 1999). However, the underlying structure and causal mechanisms of these relations have been unclear. This study sought to test a specified meditational model for three health outcome variables. Building on prior research, it was hypothesized that the severity of depressive symptoms would act as a mediating variable between the severity of PTSD symptoms and subjective health indicators (e.g., pain). Also it was expected that the severity of depressive symptoms would act as a mediating variable between the severity of PTSD symptoms and objective health indicators (e.g., current medical conditions). Finally, it was expected that the severity of depressive symptoms would mediate the relationship between the severity of PTSD symptoms and experienced physical dysfunction – the combined effects of subjective pain and objective health status.

**Method:** Participants were 152 veterans seeking residential treatment for PTSD from a medium-sized midwestern city VA’s Post-Traumatic Stress Disorder and Anxiety Disorders Clinic. Upon admission, all participants were administered the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996), Brief Pain Inventory (BPI; MD Anderson Cancer Center, n.d.), Clinician Administered Posttraumatic Stress Scale (CAPS; Blake, Weathers et al., 1995; Weathers, Keane, & Davidson, 2001), and rated their overall health. In addition to the self-report measures, objective health information was obtained through chart review. Baron & Kenny’s (1986) model of mediation was used to determine if depression functioned as a mediator between PTSD symptom severity and both the objective and subjective health measures. Follow-up analyses of indirect effects were conducted using Preacher & Hayes (2008) bootstrapping method.

**Results:** The three hypotheses garnered mixed support. Results indicated that depression did mediate the relation between PTSD and subjective health (pain), generating a point estimate of .0048 and a 95% BCA of .0001 to .0120. However, subsequent analyses indicated that the most potent predictor of subjective health was the use of narcotic medication. Once entered into the model, all other relations became nonsignificant. The result for objective health (number of medical diagnoses) proved complex and the power of PTSD symptom severity to predict objective health indices increased once depression severity was added to the model. Finally, when health was assessed more holistically using the combination of subjective and objective indices, depression did not function as a mediator; point estimate = .0057; 95% BCA = -.0041 to .0224.
Implications: This study adds to the literature linking mental health and physical health. Specifically, the nature of the relations between PTSD symptom severity, depression symptom severity and health indices were investigated. The hypothesis that depression would mediate any relations observed between PTSD and health outcomes was only supported for subjective perceptions of health. However, strong univariate relations were found between all indices and the levels of health impairment and depression in a sample seeking treatment for PTSD were notable. The results suggest treatment providers need to be conscientious in recognizing the likelihood of multiple conditions, both psychological and physical, being present in individuals seeking treatment for PTSD.
MEDICAL INSTITUTIONAL REVIEW BOARD PROTOCOL APPROVAL NOTIFICATION FOR STUDIES GRANTED EXPEDITED APPROVAL

PRINCIPAL INVESTIGATOR: Erin Gallagher, MA

PROTOCOL: IRB #10-04-19-03EE - Does Depression Act as a Mediating Variable Between PTSD and General Physical Dysfunction in a Veteran Population

- Includes informed consent: Yes
- Includes advertising: No
- Informed consent requirement waived: No
- Survey materials constitute abbreviated consent: No
- Includes HIPAA Waiver: No

Sponsor: Investigator-Initiated

DATE: July 23, 2010

The approval for this research activity expires on: July 23, 2011

1. The federal regulations at 45 CFR 46.110 which allow for the expedited review procedure, require that the IRB adopt a method for keeping all members advised of research proposals which have been approved under this procedure. The full Board will be notified of the expedited approval status of your study at its next convened meeting. You will be notified in writing in the event the Board disagrees with this expedited approval decision.

2. For adverse event reporting requirements, please refer to UC Policy II.02.

3. The period of approval of this research project is stated above. In order for a project to continue with IRB approval beyond the expiration date, a progress report form must be filed with the Institutional Review Board on at least an annual basis, and sometimes more frequently at the discretion of the Board.

4. There may be no change or addition to the project, or changes of the investigators involved, without prior approval of the IRB.

5. You are required to modify this study, subject to IRB approval, if subsequent information regarding any drug, device or procedure utilized in the study is received from the manufacturer or any other reliable source that could reasonably increase or alter potential harm to subjects. The informed consent statement must be modified to include this new information or an addendum must be prepared as a means to assure subject notification. In cases where the subject has completed the study, the modification or addendum is only necessary if the additional information received could impact the subjects in the future.

Chairperson (or Designee), Institutional Review Board #1

*The attached consent is stamped with the period of IRB approval. Please copy this ICS document and use for all subjects entered into the study.

Statement regarding International Conference on Harmonisation and Good Clinical Practices
The University of Cincinnati Institutional Review Board is duly constituted (fulfilling FDA requirements for diversity), has written procedures for initial and continuing review of clinical trials: prepares written minutes of convened meetings, and retains records pertaining to the review and approval process; all in compliance with requirements defined in 21 CFR Parts 50, 56 and 312 Code of Federal Regulations. This institution is in compliance with the ICH GCP as they correspond to FDA/DHHS regulations.

University of Cincinnati Institutional Review Board Office
51 Goodman Dr. Suite 300, ML #0567, Cincinnati, Ohio 45267-0567
Telephone 513-558-5259, Fax 513-558-4111
Date: September 24, 2010

From: Chairperson, Subcommittee on Research Safety (151)

Subj: Bio-Safety Protocol

To: Erin Gallagher, M.A.

1. Your abbreviated form SRS# 10-09-24-01 entitled "Does Depression Act as a Mediating Variable Between PTSD and Experienced Physical Dysfunction?" was reviewed and approved. The decision will be presented to the Subcommittee on Research Safety at its October 5, 2010 meeting.

2. If there are changes in your research program that involve work with biological products other than those specified in the SRS Form, or if there are significant changes in procedures for the handling of tissues or agents, or if there is a change of location that utilizes VA research space, please file a complete SRS form. Approval will require continuing adherence to the procedures for bio-safety that you outline and will be subject to review or inspections by the Committee or designated officials, but it is the principal investigator's duty to insure adherence to the procedures.

3. If you have any questions regarding the above decision, please feel free to contact Benjamin Dillon in the Research Service at 861-3100, x5434.

Melanie T. Cushion, Ph.D.

Peter D. Walzer, M.D., MSc
ACOS/Research Service
November 23, 2010

Erin E. Gallagher
2501 Post Road Apt. 210
Fitchburg, WI 53713

Dear Ms. Gallagher:

The IRB has completed the review of your protocol #1029, “Does Depression Act as a mediating variable Between PTSD and Experienced Physical Dysfunction?” using expedited review procedures. We appreciate your thorough treatment of the issues raised. Your study is approved in the Expedited category under Federal Regulation 45CFR46. Approval expires November 23, 2011. A progress report, available at http://www.xavier.edu/irb/forms.cfm, is due by that date.

If you wish to modify your study, including any changes to the approved Informed Consent form, it will be necessary to obtain IRB approval prior to implementing the modification. If any adverse events occur, please notify the IRB immediately.

We wish you success with your research!

Sincerely,

[Signature]

Morell E. Mullins, Jr., Ph.D.
Chair, Institutional Review Board
Xavier University

MEM/sb

c: Susan Kenford-advisor