DISSERTATION

THREE ESSAYS ON THE ECONOMIC EFFECTS OF COMBAT RELATED POST-TRAUMATIC STRESS DISORDER ON U.S. VETERANS

Submitted by

Kelly M. Lee

Department of Economics

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Colorado State University

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Doctoral Committee:

Advisor: Anita Pena

Sammy Zahran
David Mushinski
Lorann Stallones

ABSTRACT

THREE ESSAYS ON THE ECONOMIC EFFECTS OF COMBAT-RELATED POST-TRAUMATIC STRESS DISORDER ON U.S. VETERANS

Since September 2001, approximately 2.77 million military service members have served on over 5.4 million deployments (Wenger, 2018) to Iraq and Afghanistan in support of Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND). Soldiers returning from these deployments are at risk of experiencing adverse mental health issues, to include post-traumatic stress disorder (PTSD) and depression. The first-stage of this study examines the relationship between exposure to combat and a diagnosis of PTSD and depression. Then, I explore the effects a diagnosis of PTSD and depression have on the employment and risk-taking behaviors of U.S. service members.

Chapter 1 focuses on active duty service members, veterans, and National Guardsmen and Reservists and estimates the effects of combat on their mental health outcomes. I then decompose the effects of combat and examine the effect of differing measures of combat on mental health. These measures include deployment length, exposure to enemy firefight, killing or wounding someone, and exposure to the death or injury of an ally, civilian, or enemy. I find that exposure to combat and several separate combat events leads to higher probabilities of adverse mental health outcomes for military members.

Chapter 2 explores the effect a diagnosis of PTSD has on several employment outcomes for U.S. veterans. First, using a standard probit model, I examine the effect of PTSD on four employment outcomes: the probability of employment, the number of hours worked per week

(on average), employment sector, and job satisfaction. I find that PTSD is associated with a decreased probability of employment and a decrease in the number of hours worked per week. However, if PTSD is endogenous, then these results will be biased. For example, veterans with PTSD may be perceived by potential employers as being dangerous or incompetent (Hipes & Gemoets, 2019), which could affect the probability of employment. To address this concern, I employ a two-stage estimation approach using exposure to combat as an instrument to minimize the bias in the estimated effect of PTSD on the probability of employment and the number of hours worker per week. I find no significant effect of PTSD on either outcome.

Chapter 3 focuses on the relationship between a diagnosis of PTSD and depression and the risk-taking behaviors of service members. Risk-taking behaviors are defined as intentional behaviors that have potential negative consequences or loss and have been found to be positively associated with PTSD. U.S. military personnel returning from deployments are experiencing adverse mental health issues which can lead to an increase in risk-taking behaviors. This increase in risk-taking behaviors can lead to worse economic outcomes for veterans, such as high unemployment rates and decreased earnings. I approach this question from two separate directions. First, I examine the effect a diagnosis of PTSD or depression has on the risk-taking behaviors of U.S. veterans. Second, I examined the association of exposure to combat on risk-taking behaviors using the combat events found to be significant to a diagnosis of PTSD or depression in Chapter 1. I find that PTSD is associated with an increase in the use of nicotine, alcohol, and other substances.

As stated above, the broad goal of this research is to improve our understanding of the long-term consequences a diagnosis of combat-related PTSD has on U.S. veterans. Chapter 1 allows me to explore the effect different combat experiences have on the probability of adverse

mental health outcomes. While Chapter 1 looks at the direct effects of combat exposure on mental health outcomes, Chapter 2 looks beyond the combat experience and examines the effect a diagnosis of combat-related PTSD has on the employment outcomes of U.S. veterans. Chapter 3 extends the work in the previous chapter by exploring one potential reason for the lower levels of employment found in U.S. veterans by examining the effect PTSD and depression have on the risk-taking behaviors of previously deployed service members.

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INTRODUCTORY OVERVIEW

Since September 2001, approximately 2.77 million military service members have served on over 5.4 million deployments (Wenger, 2018) to Iraq and Afghanistan in support of Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND). In general, a deployment is time away from a service member's assigned duty station and is typically outside of the United States. Even though each deployment can look differently depending on a service member's job, unit, branch of service, and deployment location, there are universal risks associated with combat deployments.

U.S. soldiers returning from Iraq and Afghanistan are experiencing adverse mental health issues. There have been a number of studies focused on post-traumatic stress disorder (PTSD) in soldiers returning from Iraq and Afghanistan (e.g. Hoge et al., 2004; Erbes et al., 2007; Rosenheck and Fontana, 2007; Seal et al, 2007; Hoge et al., 2008; Tanielian and Jaycox, 2008) and many agree that the incidence of PTSD is growing and of major concern. In the first chapter, I focus on three different samples of military service members and compare their mental health outcomes after being exposed to combat. This research examines how exposure to differing measures of combat affect the probability of a diagnosis of depression, PTSD, and the co-occurrence of PTSD and depression. These measures include assignment to a combat zone, exposure to enemy firefight, killing or wounding someone, and exposure to the death or injury of an ally, civilian, or enemy.

An understanding of the risks associated with combat deployment is important, not only so that the military can better prepare service members for combat, but also to ensure proper compensation is made to service members for their exposure to these risks and the necessary

amount of mental health services are provided to combat the effects of exposure to these risks. Chapter 1 focuses on identifying some of the risks associated with combat deployments and the effects that exposure to those risks have on mental health outcomes for service members.

While Chapter 1 explores how exposure to combat affects the probability of a diagnosis of PTSD and depression, Chapter 2 examines the effect a diagnosis of PTSD has on the employment outcomes of U.S. service members. Service members acquire skills and work habits, such as punctuality, discipline, teamwork, and communication, that are valuable and often transferable to the civilian labor market. While veterans are often thought of as a desirable group from which to hire employees, PTSD is a disability which often has a negative connotation because of preconceived assumptions and misperceptions (Rudstam *et al.*, 2012; Hipes & Gemoets, 2019). PTSD appears to be a significant predictor of unemployment (Savoca & Rosenheck, 2000) with the probability of unemployment increasing as symptom severity increases (Smith, Schnurr, & Rosenheck, 2005).

In Chapter 3, I explore one possible explanation for the decreased levels of employment found in Chapter 2, risk-taking behaviors. I examine the relationship between a diagnosis of PTSD and depression and the risky behaviors of U.S. veterans. Some of the outcomes I explore include tobacco, alcohol, and substance use and interactions with the criminal justice system. Combat experiences can be emotionally and psychologically difficult for service members. Combat veterans suffering with adverse mental health can sometimes lash out if they are not receiving proper care or they are undiagnosed by a medical professional.

An economic evaluation of the causes of PTSD and its effects on veterans is important at both the micro and macro level. From a macro perspective, as the prevalence of PTSD increases, resources available to treat and offset the costs associated with PTSD may become more scarce,

leading to the consideration of alternative uses for those resources or an increase in resources for PTSD at the expense of other programs. At the micro level, it is important to understand the impact to individuals suffering from PTSD so that resources may be used in the most efficient way to achieve the best possible outcomes. This research will focus on the micro level, individual effects of combat-related PTSD.

CHAPTER 1 – THE UNSEEN SCARS OF WAR: AN EXAMINATION OF THE RISKS ASSOCIATED WITH COMBAT EXPOSURE AND THEIR EFFECTS ON THE MENTAL HEALTH OUTCOMES OF U.S. MILITARY MEMBERS

Introduction

On September 11, 2001, the world watched as four commercial airliners, hijacked by Al-Qaeda operatives, crashed into the World Trade Center, the Pentagon, and a field in Pennsylvania. Seven days later, President George W. Bush signed into law a joint resolution authorizing the use of force against those responsible. This was the beginning of the longest war in U.S. history. While still fighting the War in Afghanistan, President Bush began a military operation into Iraq in March 2003, vowing to end the authoritarian rule of Saddam Hussein and destroy Iraqi weapons of mass destruction. In December 2011, President Barack Obama pulled the last U.S. troops out of Iraq, ending a nearly nine-year long military campaign. After nearly two decades of fighting the War in Afghanistan, President Joseph R. Biden Jr. withdrew the last U.S. military forces on August 30, 2021.

Since September 2001, approximately 2.77 million military service members have served on over 5.4 million deployments (Wenger, 2018) to Iraq and Afghanistan in support of Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND). In general, a deployment is time away from a service member's assigned duty station and is usually outside of the United States (known as OCONUS). Even though each deployment can look differently depending on a service member's job, unit, branch of service, and deployment location, there are universal risks associated with combat deployments.

Gulf War Era-II[1] U.S. soldiers returning from Iraq and Afghanistan are experiencing adverse mental health issues. There have been a number of studies focused on post-traumatic stress disorder (PTSD) in soldiers returning from Iraq and Afghanistan (Hoge et al., 2004; Erbes et al., 2007; Rosenheck and Fontana, 2007; Seal et al, 2007; Hoge et al., 2008; Tanielian and Jaycox, 2008) and many agree that the incidence of PTSD is growing and of major concern. However, many of these studies do not have an appropriate counterfactual control group. Often, they compare deployed soldiers with non-deployed soldiers and find that deployed personnel have a higher incidence of adverse mental health. Yet, non-deployers may not be an appropriate control group for those deployed to a combat zone. As argued in Cesur *et al.* (2013), soldiers who have extended periods of time with no deployments may be non-deployable due to physical or mental health reasons. Earlier studies also have compared the mental health outcomes of soldiers with those of civilians. This also may not be an appropriate control group. The characteristics of an individual in the military can often be quite different from those of a civilian.

This paper focuses on three different samples of military service members and compares their mental health outcomes after being exposed to combat. This research examines how exposure to differing measures of combat affect the probability of a diagnosis of depression and PTSD. These measures include assignment to a combat zone, exposure to enemy firefight, killing or wounding someone, and exposure to the death or injury of an ally, civilian, or enemy. The results from this research rely on the assumption that deployment to a combat zone does not depend on individual traits of the soldiers. Rather, military units are chosen to deploy based on

[1] Gulf War-era I is service from August 1990 – August 2001. Gulf War-era II is service from September 2001 – present.

their assigned mission and individual military members are randomly assigned to units based on the needs of their chosen branch of service.

An understanding of the risks associated with combat deployment is important, not only so the military can better prepare service members for combat, but also to ensure proper compensation is made to service members for their exposure to these risks and the necessary amount of mental health services are provided to help mitigate the effects of exposure to these risks. Following the method from Cesur *et al.* (2013), this paper focuses on identifying some of the risks associated with combat deployment and the effects that exposure to those risks have on the mental health outcomes for service members.

This research contributes to the existing literature in three ways. First, while it follows a similar structure to Cesur *et al.* (2013), this chapter uses data from the most current wave of the National Longitudinal Study of Adolescent Health (Wave V). This allows me to examine the mental health outcomes of service members over a longer period of time. I also examine the effects of combat across three distinct samples, allowing me to examine the effects of combat relative to different control groups. Lastly, I include National Guard and Reserve military members in all samples. Much of the previous literature focused primarily on active duty members or National Guardsmen and Reservists as separate groups. This comes from the assumption that they differ in individual characteristics. This research explores the possibility that there is not as much of a difference between the two as is believed.

Background

Post-Traumatic Stress Disorder

PTSD is a mental health disorder that is caused by experiencing or witnessing a disturbing event or events. It often has a wide range of symptoms with subtle indicators. Some

of these symptoms include intrusive memories, avoidance, negative changes in thinking and mood, and changes in emotional reactions (Mayo Clinic, 2021). PTSD was first acknowledged in combat veterans and rape victims, but exposure to any traumatic event can cause PTSD symptoms (Williams, Cahill, & Foa, 2010). PTSD changes one's perception of them self, others, and their overall safety. The National Comorbidity Survey-Replication (NCS-R) indicates that an individual suffering from PTSD has a higher risk of teenage pregnancy, unemployment, high school and college failure and marital instability (Brunello, *et al*., 2001).

The Diagnostic and Statistical Manual of Mental Health Disorders (DSM) is used by U.S. mental healthcare providers to make mental health diagnoses. The third edition (DSM-III) saw the addition of PTSD in 1980 (APA, 1980) and was classified as an Anxiety Disorder. Initially, a traumatic event was defined as a catastrophic stressor outside the scope of usual human experience. The DSM was later revised in 1987, 1994, 2000 and then 2013.

It was not until 2013, when the most current edition (DSM-5) was released, that a number of important revisions to PTSD were made. By this time, it was clear to medical professionals that PTSD was not just a fear-based anxiety disorder and the definition was extended to include anhedonic and dysphoric symptoms[2]. PTSD is also now categorized as a Trauma and Stressor Related Disorder and no longer classified as only an Anxiety Disorder (Pai, Suris, & North, 2017). See Appendix A for the criteria for a diagnosis of PTSD as per the DSM-5.

While serving in the military, service members may see combat and be exposed to horrific and/or life-threatening situations. Exposure to these experiences can lead to PTSD. According to the U.S. Department of Veterans Affairs, between 11%-20% of veterans who served in OIF and/or OEF have PTSD in a given year. Approximately 12% of Desert Storm

[2] Anhedonic refers to a loss of interest in common activities and are characterized by a lack of feelings. Dysphoric refers to feelings of depression.

veterans have PTSD in a given year and around 30% of Vietnam veterans are estimated to have PTSD in their lifetime. (VA, 2018)

Depression

Major Depressive Disorder, also known as clinical depression, major depression, or simply just depression, has a long history with the earliest known accounts appearing in ancient Mesopotamian texts in the second millennium B.C. Depression, initially known as melancholia, was often attributed to demonic possession and treated by priests. Common methods of treatment included beatings, physical restraint, and starvation in an attempt to drive the demons out of an afflicted person's body. While demonic depression was believed to be the most common cause, there were some ancient Greek and Roman doctors who believed melancholia was a biological and psychological illness treatable with therapeutic methods such as massage, music, and baths. (Schimelpfening, 2020; Nemade, n.d.)

Depression is a complex disorder and our understanding of it has evolved over the years. The modern concept of depression views the disorder as a clinical syndrome. The name, Major Depressive Disorder (MDD), was first used during the 1970s in the United States and was added to the DSM-III in 1980. Contemporary views believe depression can occur from a combination of multiple factors, including social, biological, and psychological components. (Schimelpfening, 2020; Paykel, 2008)

According to the National Institute of Mental Health (NIMH), depression is one of the most common mental health disorders in the United States (NIMH, 2018). The 2017 National Survey on Drug Use and Health (DHHS, 2018) shows that an estimated 7.1% of all U.S. adults had at least one major depressive episode in 2017. The VA estimated that among veterans visiting primary care clinics, 1 in 3 had some symptoms of depression, 1 in 5 had serious

symptoms that required further evaluation for major depression, and 1 in 8 to 10 had major depression requiring treatment with psychotherapy and/or antidepressants (VA, 2021).

Literature Review

There is a growing body of literature that has examined the effects of combat on various outcomes including violence, physical health, mental health, education, employment, and family dynamics (Lyle, 2006; Engel *et al*., 2010; Cesur *et al.*, 2013; Negrusa *et al*., 2014; Armey & Lipow, 2016; Cesur & Sabia, 2016; & Armey *et al*. 2018). Previous research has established a strong relationship between combat and adverse mental health outcomes. Kang *et al.* (2003) show that Gulf War veterans deployed between 1990-1991 had a higher prevalence of PTSD at 10.1% when compared to non-Gulf War veterans at 4.2%. They also show that rates of PTSD increased monotonically across six indicators of the intensity of stress, from 3.3% in the least stressful situation to 22.6% in the most stressful situation.

Hoge *et al.* (2004) found that exposure to combat was significantly greater among service members deployed to Iraq than those deployed to Afghanistan. They also found that service members meeting the criteria for major depression, generalized anxiety, and PTSD were significantly higher after service in Iraq, between 15.6%-17.1%, when compared to 9.3% before service in Iraq and 11.2% after service in Afghanistan. Smith *et al.* (2008) found a threefold increase in new onset self-reported PTSD symptoms or diagnosis among deployed military members exposed to combat. 7.6%-8.7% of deployed members who reported exposure to combat saw new onset symptoms or a diagnosis of PTSD, compared to 1.4%-2.1% of deployed members with no reported exposure to combat and 2.3%-3.0% of non-deployed military members.

Cesur *et al.* (2013) exploit the exogenous variation in overseas deployment assignment location to estimate the effect of combat exposure during the wars in Iraq and Afghanistan on three mental health outcomes: PTSD, depression, and suicidal ideation. They find that Armed Forces members deployed outside the United States to a combat zone are more likely to suffer from adverse mental health that those deployed outside the U.S. to a non-combat zone. They also examined the effect of several types of exposure to combat on mental health outcomes and found that, of those deployed to a combat zone, soldiers exposed to enemy firefights and those that witnessed the death of an ally or civilian were at a greater risk of PTSD and suicidal ideation than those soldiers deployed to a combat zone without exposure to these types of combat.

Theoretical Background and Identification

Earlier research compared the mental health outcomes of military members in combat with the mental health outcomes of civilians (Card, 1987; Jordan *et al*., 1991; & Price *et al*., 2004). However, later research (Dobkin & Shabani, 2009; Cesur *et al.*, 2013) has suggested civilians are not an appropriate control group.

One reason civilians are not an appropriate control group is that individual characteristics and family background of active-duty military members differ from those of civilians. Some of these traits are related to psychological well-being. One example of this is socioeconomic status. If, as Segal *et al*. (1998), Miech *et al*., 1999, Bachman *et al*. (2000), and Kleykamp (2006) point out, socioeconomic status is negatively associated with the probability of joining the military and positively associated to mental health, then soldiers may already be more likely to have mental health problems, which can lead to overestimated effects of combat. However, it is also argued that those who serve in the military may be in better physical and mental health than their

civilian counterparts due to the rigorous health screening each soldier goes through before they can join the service (Cesur *et al.*, 2013). This could lead to smaller estimated effects of combat.

Research focused on combat service during World War II, the Korean War, and the Vietnam War (Hearst *et al.*, 1986; Dobkin & Shabani, 2009; Angrist *et al.*, 2010) were able to use the draft lottery as an instrument to address the endogeneity of military service. However, in the absence of a draft in the post-Vietnam era, random selection of a civilian for military service is not a feasible identification strategy. Some of the research focused on the wars in Iraq and Afghanistan have used non-deployed service members as a control group (Shen *et al.*, 2010; Wells *et al.*, 2010), but there is still debate on whether this is an appropriate control group since some believe there may be differences in the individual characteristics of non-deployed National Guardsmen or Reservists and non-deployed active duty members.

Lyle (2006) and Engel *et al.* (2010) argue that deployment assignment is exogeneous to an individual soldier's preferences, welfare, and family background characteristics based on the military's deployment assignment procedures. Individuals have little control over which unit they are assigned to and are reassigned, on average, every three to four years. It is also extremely rare that an individual is deployed. Rather, units are deployed based on operational need in a specific theatre and unit readiness and availability, not on individual soldiers' characteristics.

While their research is examining the effect of parental absence due to military deployment on children's academic achievement, they include two empirical tests to support their assumption of exogeneous deployment assignment. The first empirical test was to instrument individual deployment with unit deployment. Their findings show similar results when treating individual deployment as exogeneous as opposed to instrumenting for individual

deployment. The second test used administrative data available to Army Human Resources Command, the agency responsible for soldier assignments in the Army. This data included rank, occupation, age, race, Armed Forces Qualification Test[3] (AFQT) score, and educational attainment. They found that controlling for these individual characteristics had little effect on their estimates of the effect of deployment. Both empirical tests suggest that deployment assignment is exogeneous to individual and family characteristics.

Data

The data for this research comes from the National Longitudinal Study of Adolescent Health (Add Health), a study which followed adolescents into their early adulthoods. The study consists of panel data collected from five in-home interviews, categorized as Wave I, II, III, IV and V, with the earliest in 1994 and the most recent in 2016-2018. It is a nationally representative longitudinal study conducted by the Carolina Population Center at the University of North Carolina at Chapel Hill and has been used in previous studies to examine military populations (Cesur *et al.*, 2013; Orak *et al.*, 2021).

Measures

The data allows me to control for military service exclusively in the U.S., service overseas in a non-combat zone, and service overseas in a combat zone. The data also includes several types of exposure to combat. These include the number of times the service member engaged in enemy firefight, if the service member killed (or believed they killed) someone, if the service member was wounded during combat, and if the service member saw an ally, civilian or enemy wounded or killed. All of the above-mentioned measures are used to examine the

[3] The AFQT score is used to determine your eligibility for enlistment into the Armed Forces. It is comprised of four subtests from the Armed Services Vocational Aptitude Battery (ASVAB): arithmetic reasoning, mathematics knowledge, paragraph comprehension, and word knowledge. All parts are used for classification into different jobs (Today's military, 2021)

relationship between combat exposure and different mental health outcomes. Military service is measured based on the respondents' report of military service and deployment assignment in Wave IV[4].

The mental health outcomes are measured based on the respondents' answers to questions from Wave V. The first mental health outcome of interest is *Depression*. Respondents were asked if they had ever been diagnosed with depression by a medical professional. *Depression* is a binary variable coded 1 if respondents answered yes and 0 otherwise. Since this measurement requires an official diagnosis by a medical professional, there may be individuals in the sample that meet the diagnosis criteria for depression but have not been diagnosed.

The second mental health outcome of interest is *PTSD*. Respondents were asked if they had ever been diagnosed by a medical professional as having PTSD. *PTSD* is a binary variable coded 1 if they answered yes and 0 otherwise. Just as with depression, since *PTSD* requires a medical diagnosis, there may be undiagnosed individuals in the sample who actually have PTSD but are unaware. Therefore, this identification strategy may not capture the true incidence of PTSD. I also include a third outcome of interest. It is a binary variable equal to 1 if respondents reported both a diagnosis of PTSD and depression.

Samples

For this chapter I use three military samples. The first is the *Full Military* sample. This sample includes all non-deployed military members, those deployed to a combat zone, and those deployed to a non-combat zone. Including those members deployed to a non-combat zone acknowledges that deployment in an area designated as non-combat does not mean there is a zero risk of combat, only a decreased likelihood. The *Full Military* sample is comprised of all

[4] Due to the small number of respondents and given that none were deployed to a combat location, members of the Coast Guard were excluded from the sample.

military members currently serving on active duty during Wave V, all prior service members, and includes all National Guard and Reservists[5].

The second sample of interest is the *Veterans* sample. This sample includes only those members who served in the military in prior waves, but had separated from the service by Wave V. As in the *Full Military* sample, the *Veterans* sample also includes all nondeployed members, those deployed to a combat zone, and those deployed to a non-combat zone. The third sample, the *Combat Veterans* sample, is comprised of only those who had separated from the military by Wave V and were deployed to a combat zone.

Across all the samples of interest, I make the unusual decision to include National Guardsmen and Reservists with active duty personnel. National Guardsmen and Reservists are often treated as separate from active duty because it is assumed they differ in individual and family characteristics. Prior to September 11, 2001, National Guardsmen and Reservists were considered to be "weekend warriors". One weekend a month they would report to their unit for training. This was to ensure the soldiers were mission ready in case they were needed. The rest of the month, they were considered civilians. It was uncommon for them to be called upon except in the case of a national disaster.

Post 9/11, the National Guard and Reserves took on a much more active role. With active duty deployed to multiple regions in support of numerous operations, they were unable to meet mission needs. The National Guard and Reserves were needed to augment the active forces. Approximately 28% of the total deployed forces were National Guardsmen and Reservists (Shea et al. 2013).

[5] This is the only sample where we are able to observe members currently still serving on active duty during Wave V. The sample size becomes too small when only looking at those currently serving on active duty during Wave V.

In Table B1 in Appendix B, I examine the relationship between joining the National Guard/Reserves or active duty and individual characteristics and family background. I use ordinary least squares to estimate the following model:

$$ActiveDuty_{it} = \alpha + \beta_1 X'_{it} + \varepsilon_{it} \quad (1.1)$$

where X'_{it} is the vector of individual and family controls. I find that of all the right-hand side variables, none are significant. The joint significance tests also show no group of variables is significant. These findings suggest that individual characteristics and family background are not related to the decision of whether one joins active duty or the National Guard/Reserves.

Table 1.1 shows the means and standard deviations of the mental health outcomes of interest during Wave IV and Wave V. The data suggests that, overall, individuals who served in the military have a higher incidence of depression and PTSD than their civilian counterparts. From Wave IV to Wave V (2008-2018), the incidence of depression and PTSD increased across all groups. The increase for all outcomes was greater in the three military samples than the civilian sample, with larger increases for those deployed to a combat zone.

Table 1.1
Summary Statistics of Mental Health Outcomes

Sample	Wave IV			Wave V		
	Depression	PTSD	PTSD & Depression	Depression	PTSD	PTSD & Depression
Full Military	0.125	0.0808	0.0446	0.279	0.201	0.134
	(0.331)	(0.273)	(0.206)	(0.449)	(0.401)	(0.341)
Observations	718	718	718	716	713	718
Veterans	0.134	0.0860	0.0478	0.297	0.213	0.145
	(0.341)	(0.281)	(0.213)	(0.457)	(0.410)	(0.352)
Observations	628	628	628	627	624	628
Combat Veterans	0.144	0.166	0.0830	0.346	0.339	0.227
	(0.352)	(0.373)	(0.276)	(0.477)	(0.474)	(0.420)
Observations	229	229	229	228	227	229
Civilian	0.157	0.0229	0.0163	0.250	0.0555	0.0442
	(0.364)	(0.149)	(0.126)	(0.433)	(0.229)	(0.206)
Observations	10,150	10,150	10,150	10,107	10,105	10,150

Standard deviations are in parentheses. Means are generated using Waves IV and V of the National Longitudinal Study of Adolescent Health.

The number of respondents diagnosed with PTSD or depression significantly increases between Wave IV and Wave V. There are a couple of explanations for this trend. First, this trend may better represent the lifetime risk. The occupational risk of exposure to potentially traumatic combat experiences puts military members at an increased risk of developing PTSD and depression, along with other psychiatric outcomes (Reger *et al.*, 2019). The diagnosis criteria for PTSD also changed drastically between Wave IV and Wave V. In the DSM-5, PTSD was now categorized as a Trauma and Stressor Related Disorder and no longer just an Anxiety Disorder (Pai, Suris, & North, 2017).

Lastly, the incentives of active-duty military members are different from those of veterans when it comes to self-reporting possible symptoms of PTSD and depression. While still serving on active-duty, receiving a diagnosis of PTSD can have potentially negative impacts on service members. A member may no longer be eligible for deployment or may face the possibility of a medical discharge. However, for veterans who have already separated from active-duty, there is an incentive to report symptoms in order to be eligible for disability payments.

Estimating the Effect of Combat on Mental Health

To examine the effects of combat on the mental health outcomes of interest, I estimate the following probit model:

$$P(Mental\ Health\ Outcome_{i5} | Combat_{i4}, X_{i5}, P_{i1}, M_{i4}) = \Phi(\alpha_0 + \beta_1 Combat_{i4} + \beta_2 X_{i5} + \beta_3 P_{i1} + \beta_4 M_{i4}) \quad (1.2)$$

This conditional probability is estimated based on a binary dependent variable for the mental health outcome ($Mental\ Health\ Outcome_{i5}$) for individual *i* during Wave V. The independent variable, $Combat_{i4}$, is a binary measure of deployment to a combat zone for individual *i* during

Wave IV. X_{i5} is a vector of individual controls for individual *i* from Wave V. P_{i1} is a vector of parental controls from Wave I and M_{i4} is a vector of military controls from Wave IV (See Table B2 in Appendix B for the means of each of the control variables).

I begin by first examining the effect of being deployed to a combat zone on mental health. As shown in Table 1.2 below, deployment to a combat zone greatly increases the probability of adverse mental health for soldiers when compared to soldiers not deployed to a combat zone. Table B3 in Appendix B shows the stability of these estimates with the addition of the vectors of controls.

Table 1.2
Estimates of the Relationship Between Combat and Mental Health

	Full Military Sample			Veterans Sample		
	Depression	PTSD	PTSD & Depression	Depression	PTSD	PTSD & Depression
Combat	0.105**	0.167***	0.103***	0.137**	0.182***	0.117***
	(0.0498)	(0.0407)	(0.0342)	(0.0559)	(0.0475)	(0.0398)
Observations	698	686	691	615	606	610
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Parental Controls	Yes	Yes	Yes	Yes	Yes	Yes
Military Controls	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses.
**** p<0.01, ** p<0.05, * p<0.1*

In an effort to better understand the effects of combat on mental health, I examine the difference in outcomes by sex and race. As shown in Table 1.3A, women deployed to a combat zone are at a significantly higher risk of depression, PTSD, and the co-occurrence of PTSD and Depression than their male counterparts. Men deployed to a combat zone are at an increased risk of PTSD by 15.5-18 percentage points when compared to men not deployed to a combat zone. For women deployed to a combat zone, the risk of depression increases between 48-69 percentage points and the risk of PTSD increases by 35-43 percentage points relative to women

not deployed to a combat zone. The risk of the co-occurrence of PTSD and depression is even greater.

Table 1.3A

Estimates of the Relationship Between Combat and Mental Health by Sex

	Full Military Sample			Veterans Sample		
	Depression	PTSD	PTSD & Depression	Depression	PTSD	PTSD & Depression
Male	0.0578	0.155***	0.0865**	0.0924*	0.180***	0.110***
	(0.0502)	(0.0441)	(0.0345)	(0.0561)	(0.0520)	(0.0404)
Observations	539	530	533	469	462	465
Female	0.488**	0.351**	0.796***	0.694***	0.432**	0.907***
	(0.215)	(0.141)	(0.243)	(0.213)	(0.173)	(0.272)
Observations	150	147	115	140	138	108

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Women make up approximately 10.4% (563,000) of all deployed military personnel (Wenger, 2018). However, as can be seen in Table 1.3A, women deployed to a combat zone are at significantly higher risk of depression and PTSD than their male counterparts. One explanation for this difference could be Military Sexual Trauma (MST). MST is the term used to describe forms of sexual harassment and sexual assault sustained in military service. Kimerling *et al.* (2007) found a 3% annual incidence of sexual assault among active duty women and a 1% incidence among active duty men. They also found that for female service members, sexual coercion occurred at an annual rate of 8% and unwanted sexual attention occurred at an annual rate of 27%, compared to annual rates of 1% and 5% respectively among male service members. They also found that MST was associated with a 2 to 3 times greater likelihood of a mental health diagnosis and this association was stronger among female members than male members.

When looking at the differences in outcomes based on race, Table 1.3B shows the risk of depression for black soldiers increases by 39.6-48.9 percentage points and for PTSD by 17.8-39.7 percentage points. For white soldiers, there is an increased risk of PTSD by 17-18.8

percentage points. Due to some limitations with the sample size, I was unable to look directly at the effects of combat for respondents of other races or Hispanic descent. Instead, I was able to capture some of the effects for them in the racial group non-whites. The probability of a diagnosis of depression for non-whites increases by 14.4-17.6 percentage points and by approximately 7 percentage points for PTSD. In general, people of color are at a higher overall risk for PTSD and depression, but at a lower risk of the co-occurrence of PTSD and depression.

Table 1.3B
Estimates of the Relationship Between Combat and Mental Health by Race

	Full Military Sample			Veterans Sample		
	Depression	PTSD	PTSD & Depression	Depression	PTSD	PTSD & Depression
Black	0.396***	0.178**		0.489***	0.397***	
	(0.123)	(0.0815)		(0.150)	(0.0947)	
Observations	148	112		132	100	
White	0.0669	0.170***	0.102**	0.0897	0.188***	0.117**
	(0.0716)	(0.0563)	(0.0500)	(0.0811)	(0.0644)	(0.0565)
Observations	438	429	430	391	385	386
Non-white	0.144*	0.0737***	0.0291**	0.176*	0.0791**	0.0293*
	(0.0761)	(0.0278)	(0.0119)	(0.0955)	(0.0378)	(0.0178)
Observations	241	234	219	207	202	186

Robust standard errors are in parentheses. Sample size becomes too small for adequate results for those within the Black population diagnosed with both PTSD and depression.
*** p<0.01, ** p<0.05, * p<0.1

Disaggregating the Effects of Combat on Mental Health

Deployment Length

Next, I attempt to disaggregate the effects of combat by examining the effects of deployment length and specific combat events. See Table B4 in Appendix B for the means of the combat variables. First, I examine the effect of the length of time (in months) in a combat zone on mental health using the following probit model:

$$P(Mental\ Health\ Outcome_{i5}|CombatMonths_{i4}, X_{i5}, P_{i1}, M_{i4})$$
$$= \Phi(\alpha_0 + \beta_1 CombatMonths_{i4} + \beta_2 X_{i5} + \beta_3 P_{i1} + \beta_4 M_{i4}) \quad (1.3)$$

where $CombatMonths_{i4}$ is the total time spent in a combat zone (in months). As shown in Panel A of Table 1.4, for each additional month in a combat zone, the likelihood of PTSD increases across all samples and the likelihood of depression and the co-occurrence of PTSD and depression increases in the veterans sample. While it is important to look at the total time spent in a combat zone, there is variation in the length of a single deployment across branches. The typical deployment in the Army is approximately 12 months, whereas other deployments in other branches are around 5 to seven months (Wenger, 2018). Very short deployments also exist and can last up to 3 months in length. Even though respondents may have the same amount of total time deployed, the impacts of those deployments could be different depending on how that total time was accumulated.

Panel B of Table 1.4 shows that when compared to deployments 0-6 months in length, deployments that are 7-12 months in length are at an increased risk of PTSD by 17.8-20.5 percentage points. This risk increases to 30.3-47.4 percentage points for deployments longer than 12 months. The risk of a diagnosis of depression also increases to 14.9-20.5 percentage points for deployments longer than 12 months. The co-occurrence of PTSD and depression is associated with a 13.6-14.3 percentage point increase for deployments 7-12 months in length and a 16.1-22.5 percentage point increase for deployments longer than 12 months. These results suggest that deployments should not be longer than 6 months at a time in order to decrease the likelihood of adverse mental health.

Exposure to Enemy Firefights

The next way I attempt to decompose the effects of combat is to examine the effects exposure to enemy firefight has on mental health in two separate ways using the following probit model:

Table 1.4

Estimated Effects of Combat Deployment Length on Mental Health

	Full Military Sample			Veterans Sample			Combat Veterans Sample		
	Depression	PTSD	PTSD & Depression	Depression	PTSD	PTSD & Depression	Depression	PTSD	PTSD & Depression
Panel A: Total Time Deployed									
Total Months in Combat	0.00142	0.00326**	0.00104	0.00460*	0.00856***	0.00300**	0.00239	0.0113***	0.00201
	(0.00133)	(0.00161)	(0.000781)	(0.00245)	(0.00236)	(0.00139)	(0.00307)	(0.00359)	(0.00230)
Observations	698	686	691	615	606	610	223	216	214
Panel B: Deployment Bundles									
Deployment Length: 7 - 12 months	0.114*	0.178***	0.136**	0.127	0.180***	0.143**	0.0604	0.205*	0.125
	(0.0688)	(0.0612)	(0.0529)	(0.0781)	(0.0681)	(0.0595)	(0.105)	(0.118)	(0.0905)
Observations	698	686	691	615	606	610	223	216	214
Deployment Length: more than 12 months	0.149**	0.303***	0.161***	0.205***	0.380***	0.214***	0.149	0.474***	0.225***
	(0.0625)	(0.0548)	(0.0445)	(0.0714)	(0.0636)	(0.0530)	(0.0959)	(0.118)	(0.0832)
Observations	698	686	691	615	606	610	223	216	214
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parental Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Military Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

$$P(Mental\ Health\ Outcome_{i5}|EFF_{i4}, X_{i5}, P_{i1}, M_{i4})$$

$$= \Phi(\alpha_0 + \beta_1 EFF_{i4} + \beta_2 X_{i5} + \beta_3 P_{i1} + \beta_4 M_{i4}) \quad (1.4)$$

I first look at if respondents were ever engaged in enemy firefight. This is a binary variable coded 1 if yes, 0 otherwise. As shown in Table 1.5, I find that engaging in any enemy firefight increases the probability of a diagnosis of PTSD by 17.9-20.6 percentage points and increases the risk of the co-occurrence of PTSD and depression by 9.4-11.6 percentage points.

Next, I examine the number of enemy firefights a respondent has engaged in and find that greater exposure to firefights has larger effects on mental health outcomes than less exposure[6]. These results, combined with the results of the effect of deployment length, suggest that longer deployments can lead to an increased likelihood of exposure to more firefights, leading to an increased likelihood of adverse mental health.

Exposure to Injuries and Death

The last method used to disaggregate the effects of combat on mental health is to examine the effects of exposure to death and injuries using the following probit model:

$$P(Mental\ Health\ Outcome_{i5}|CombatEvent_{i4}, X_{i5}, P_{i1}, M_{i4})$$

$$= \Phi(\alpha_0 + \beta_1 CombatEvent_{i4} + \beta_2 X_{i5} + \beta_3 P_{i1} + \beta_4 M_{i4}) \quad (1.5)$$

As can be seen in Table 1.6, exposure to injuries and death increases the probability of a diagnosis of depression and PTSD across all samples.

A respondent being wounded or injured significantly increases their probability of depression by 25.5-30 percentage points and their probability of a diagnosis of PTSD by 43-54.7 percentage points. Soldiers that killed, or believed they killed, someone increases the likelihood

[6] These categories were chosen by dividing the distribution of firefights into thirds. The sensitivity of these categories was explored by dividing the sample in alternative ways with similar results.

Table 1.5

Estimates of the Effects of Exposure to Enemy Firefights on Mental Health

	Full Military Sample			Veterans Sample			Combat Veterans Sample		
	Depression	PTSD	PTSD & Depression	Depression	PTSD	PTSD & Depression	Depression	PTSD	PTSD & Depression
Ever Engaged in Enemy Firefight	0.0902	0.179***	0.0945**	0.0946	0.206***	0.116***	0.0133	0.183**	0.0466
	(0.0559)	(0.0496)	(0.0382)	(0.0625)	(0.0572)	(0.0447)	(0.0868)	(0.0910)	(0.0681)
Observations	698	686	691	615	606	610	223	216	214
Number of Enemy Firefights:									
1 to 3	0.0504	0.103	0.0178	0.0398	0.0988	0.0254	-0.0484	0.0524	-0.0741
	(0.0774)	(0.0686)	(0.0511)	(0.0843)	(0.0749)	(0.0575)	(0.104)	(0.117)	(0.0785)
4 to 11	0.0280	0.0315	0.0140	-0.0175	0.0412	0.00627	-0.184	-0.0576	-0.0833
	(0.0991)	(0.0829)	(0.0627)	(0.109)	(0.0988)	(0.0737)	(0.125)	(0.149)	(0.101)
12 Plus	0.181**	0.411***	0.254***	0.226**	0.503***	0.322***	0.259**	0.553***	0.324***
	(0.0846)	(0.0824)	(0.0664)	(0.0972)	(0.0951)	(0.0789)	(0.129)	(0.123)	(0.104)
Observations	698	686	691	615	606	610	223	216	214

Robust standard errors are in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

Table 1.6
Estimates of the Effects of Combat Exposure to Injuries and Death

	Full Military Sample			Veterans Sample			Combat Veterans Sample		
	Depression	PTSD	PTSD & Depression	Depression	PTSD	PTSD & Depression	Depression	PTSD	PTSD & Depression
Wounded or Injured	0.274***	0.430***	0.341***	0.255**	0.436***	0.336***	0.300**	0.547***	0.487***
	(0.100)	(0.0951)	(0.0785)	(0.107)	(0.101)	(0.0836)	(0.122)	(0.124)	(0.112)
Killed (or believed killed another)	0.133**	0.230***	0.143***	0.180**	0.301***	0.179***	0.205**	0.373***	0.192***
	(0.0631)	(0.0555)	(0.0440)	(0.0716)	(0.0653)	(0.0524)	(0.0917)	(0.0971)	(0.0707)
Saw Alley, Enemy, or Civilian wounded, killed, or dead	0.0727	0.246***	0.138***	0.0902	0.277***	0.153***	-0.0739	0.285***	0.106*
	(0.0496)	(0.0438)	(0.0342)	(0.0573)	(0.0507)	(0.0394)	(0.0842)	(0.0844)	(0.0551)
Saw Ally wounded, killed, or dead	0.119**	0.194***	0.148***	0.166***	0.227***	0.184***	0.124	0.187**	0.191***
	(0.0526)	(0.0456)	(0.0375)	(0.0613)	(0.0528)	(0.0435)	(0.0775)	(0.0815)	(0.0594)
Saw Enemy wounded, killed, or dead	0.0839	0.191***	0.108***	0.0854	0.210***	0.124***	-0.00261	0.152*	0.0601
	(0.0565)	(0.0500)	(0.0389)	(0.0632)	(0.0574)	(0.0445)	(0.0801)	(0.0821)	(0.0624)
Saw Civilian wounded, killed, or dead	0.140**	0.167***	0.129***	0.164**	0.186***	0.154***	0.109	0.167*	0.124*
	(0.0616)	(0.0525)	(0.0436)	(0.0706)	(0.0605)	(0.0505)	(0.0886)	(0.0868)	(0.0704)
Observations	698	686	691	615	606	610	223	216	214

Robust standard errors are in parentheses.
**** p<0.01, ** p<0.05, * p<0.1*

of depression by 13.3-20.5 percentage points and PTSD by 23-37.3 percentage points. I also find that seeing an ally, enemy, or civilian wounded, killed, or dead increases the probability of PTSD across all samples. However, only seeing an ally or civilian wounded, killed, or dead increases the probability of a diagnosis of depression in the *Full Military* and *Veterans* samples.

The results for PTSD also seem to follow a gradient in the intimacy of the violence. The more intimate the exposure event, the higher the risk of a diagnosis of PTSD. Previous research has also found this to be true. The intensity of traumatic exposure has been found to affect psychiatric outcomes (Reger *et al.*, 2019). Higher rates of PTSD have been associated with combat trauma that involves close contact with the enemy when compared to those with less intense exposure (Rona *et al.*, 2009; Hoge *et al.*, 2004). Each type of exposure poses their own unique level of risk of a diagnosis of PTSD.

While this research looks at each of these types of exposure to combat individually, it is important to keep in mind that military members may face numerous traumatic events during combat deployments. In addition to the type of traumatic event, the number of traumatic exposures is also relevant when exploring the association between trauma and risk of PTSD or depression (Reger *et al.*, 2019). Stretch *et al.*, 1998 found that the intensity of PTSD symptoms was associated with the number of lifetime traumatic events an individual was exposed to. Future research in this area could focus on the differences in mental health outcomes among individuals with different types of exposure to combat as well as the number of exposure events.

Compensating Wage Differentials

This section focuses on a discussion of the *ex ante* compensation paid to service members while deployed and the *ex post* compensation paid after they receive a diagnosis of PTSD and disability rating. The compensating wage differential paid while service members are deployed

is meant to compensate for their exposure to an environment with an increased risk of potential mental and physical harm and/or death. There are many different types of compensation in the military, however, only two are exclusive to combat and combat support operations: Imminent Danger Pay/Hostile Fire Pay (IDP/HFP) and the Combat Zone Tax Exclusion (CZTE; DoD, 2012(a); DFAS, 2021).

Imminent Danger Pay/Hostile Fire Pay

The first type of compensation is Imminent Danger Pay/Hostile Fire Pay. Service members are eligible to receive IDP when they are serving on official duty within an area that has been designated an IDP area (See Appendix C for IDP qualifying areas). The monthly rate for IDP is $225 and prior to December 31, 2011, if a service member was eligible for IDP, they were paid the full monthly stipend for any full or partial month served in a qualifying area. The 2012 National Defense Authorization Act modified IDP payments to a prorated rate of $7.50 per day up to a maximum of $225 for one month (DFAS, 2021). Service members exposed to or in close proximity to a hostile fire event or hostile mine explosion event are eligible to receive HFP. HFP is a monthly, non-prorated amount of $225. Members are either eligible for IDP or HFP, but not both at the same time (DFAS, 2021). The cost to the Department of Defense in 2009 for IDP/HFP was $789 million (DoD, 2012(b)).

Combat Zone Tax Exclusion

The second type of combat-specific compensation is the Combat Zone Tax Exclusion. The CZTE allows for service members, while serving in a designated combat zone (See Appendix D for designated combat zones), to be excluded from the federal income tax. The Internal Revenue Service (IRS) guidelines detail six types of income that are eligible for CZTE: basic pay, reenlistment or continuation bonuses, school loan repayments, IDP/HFP, leave

benefits, and awards and other financial incentives (IRS, 2020). All pay for enlisted members and warrant officers is excluded, whereas exclusion for officer's pay is limited up to the highest level of enlisted pay plus IDP/HFP. To be eligible for the CZTE, a service member must not only be serving in a designated combat zone, but also be receiving IDP/HFP (DFAS, 2021). In 2009, the cost of the CZTE to the Treasury was $3.6 billion (DoD, 2012(b)).

Disability Compensation for Veterans

Once a service member returns home from deployment and is diagnosed with any permanent injury, then that member is assigned a disability rating by the Department of Veterans Affairs (VA). Based on their disability rating, they are entitled to receive disability pay meant to compensate them for the loss in earnings due to an injury sustained during their period of service (See Appendix E for the 2022 Veterans disability compensation rates). Disability compensation for veterans is a monthly, tax-free payment through the VA. These benefits are for veterans who got sick or injured while serving in the military or who's previously existing conditions were made worse while serving. VA disability benefits are for physical and mental health conditions. In order to be eligible, veterans must have served on active duty, active duty for training, or inactive duty training and have a disability rating for their service-connected condition (VA, 2021).

The VA will assign a disability rating based on the severity of the condition(s) and that rating is then used to determine the amount of compensation received each month. If a veteran suffers from multiple conditions, each condition is given an individual rating, disability is calculated using a combined disability rating. The disability rating is expressed as a percentage and represents how much the disability decreases overall health and ability to function (VA, 2021).

While there is a growing body of literature on the effects of combat deployment on numerous outcomes, little attention is paid to the costs of those risks associated with combat. Armey *et al.* (2018) explore the effect of combat deployments to Iraq and Afghanistan on service member causalities. They find disproportionately higher rates of casualties among four groups: enlisted personnel, less educated personnel, those in combat type jobs, and young, white, males. Using their findings, they calculate a compensating wage differential of $808 per month would be more appropriate to compensate for the risk of death when deployed to a combat location than the current $225 per month received as IDP/HFP.

For future research, I would like to attempt some back of the envelope calculations to determine the true compensating wage differential for the risk of combat and disability compensation for PTSD. This is not possible with the current data given some of its limitations. First, this data set does not capture all the possible types of combat exposure. Second, any calculations would only be a partial calculation since this research is focused only on the mental health effects and would not take into consideration the physical risks of combat. However, any future calculations of compensating wage differentials, even if only partial, would still contribute to the growing body of literature exploring the negative effects of combat.

Conclusions

The U.S. military was engaged in two separate wars in Afghanistan and Iraq over nearly 20 years, deploying approximately 2.77 million military service members on over 5.4 million deployments. Once service members have returned home, they are confronted with the possibility of adverse mental health due to exposure to combat events. In this study, I examined the effects of exposure to several different combat events on the mental health outcomes for U.S. service members.

My results contribute to the growing body of literature that combat service is associated with adverse psychological outcomes for service members. In particular, I find that long deployments, exposure to enemy firefights, being wounded or injured, and seeing an ally, enemy, or civilian wounded, dead, or killed is associated with an increased risk of a diagnosis of depression and PTSD.

An economic evaluation of the causes of PTSD and its effects on veterans is important at both the micro and macro level. From a macro perspective, as the prevalence of PTSD increases, resources available to treat and offset the costs associated with PTSD may become more scarce, leading to the consideration of alternative uses for those resources or an increase in resources for PTSD at the expense of other programs. At the micro level, it is important to understand the impact to individuals suffering from PTSD so that resources may be used in the most efficient way to achieve the best possible outcomes. This chapter focused on identifying some of the risks associated with deployment and the effects that exposure to those risks have on the likelihood of depression and PTSD for service members.

The results of this study suggest that adverse mental health, especially PTSD, is a major concern for deployed service members returning home from deployment. This suggests a need for the U.S. Armed Forces to reevaluate their pre- and post-deployment screening practices. In addition, military leadership may need to rethink the way the U.S. military currently deploys. Shorter deployments can lead to a decreased risk of exposure to combat events, which can lead to a decreased likelihood of depression and PTSD.

CHAPTER 2 – AFTER WAR: POST-TRAUMATIC STRESS DISORDER AND ITS EFFECTS ON THE EMPLOYMENT OUTCOMES OF U.S. VETERANS

Introduction

With over 2.7 million U.S. service men and women deployed to Iraq and Afghanistan since 2001 (Wenger, 2018), the prevalence of PTSD in U.S. veterans has significantly increased. While pre-deployment estimates of PTSD for veterans range between 5%-9% (Hoge, et al., 2008; Schneiderman, Braver, & Kang, 2008), post-deployment estimates range between 11%-20% for Iraq/Afghanistan veterans in a given year, 12% for Desert Storm veterans in a given year, and approximately 30% of Vietnam veterans have been diagnosed with PTSD in their lifetime (Department of Veteran's Affairs, 2020). The physical and psychological effects of warfare can have a negative impact on a service member's ability to re-acclimate to civilian life.

Finding employment has been more difficult for OEF/OIF veterans when compared with veterans of previous conflicts (Cohen, Suri, Amick, & Yan, 2013). PTSD is a significant predictor of unemployment (Savoca & Rosenheck, 2000) with the probability of unemployment increasing as symptom severity increases (Smith, Schnurr, & Rosenheck, 2005). Additionally, most veterans returning from Iraq and Afghanistan are more sensitive to the negative effects from unemployment since they are still in their prime earning years (Cohen, Suri, Amick, & Yan, 2013).

According to the Bureau of Labor Statistics (BLS; 2019), there were 18.8 million veterans, accounting for approximately 8% of the civilian noninstitutional population age 18 and over. The BLS defines a veteran as, "men and women who have previously served on active duty in the U.S. Armed Forces and who are civilians at the time these data were collected." It is

important to note that active duty service members, currently still serving, are not classified as veterans. However, reservists and National Guardsmen are classified as veterans only if they had ever served on active duty. Approximately 38% of all veterans in 2019 were veterans who served during World War II, the Korean War, and the Vietnam era, 16% served during the Gulf War-era I, 23% served during the Gulf War-era II[7], and 22% were veterans who served outside of a designated wartime period.

The labor force participation rate of veterans in 2019 was 49.2%, significantly lower when compared to 65.7% for nonveterans. The unemployment rate for all veterans was 3.1%, slightly below the unemployment rate of 3.6% for nonveterans. The unemployment rate for veterans with a service-connected disability was 4.8%. When broken down by age, approximately 5% of the 284,000 unemployed veterans were between ages 18-24, 56% were ages 25-54, and 39% were age 55 and over (BLS, 2019).

In this chapter, I explore the effect a diagnosis of Post-Traumatic Stress Disorder (PTSD) has on the employment outcomes for U.S. veterans. I test the assumption that a diagnosis of PTSD can lead to a lower probability of employment, less overall time spent working, lower levels of job satisfaction, and affect which sector veterans seek employment. Service members acquire skills and work habits, such as punctuality, discipline, teamwork, and communication, that are valuable and often transferable to the civilian labor market. While veterans are often thought of as a desirable group from which to hire employees, PTSD is a disability which often has a negative connotation because of preconceived assumptions and misperceptions (Rudstam *et al.*, 2012; Hipes & Gemoets, 2019).

[7] Gulf War-era I is service from August 1990 – August 2001. Gulf War-era II is service from September 2001 – present.

Literature Review and Conceptual Framework

PTSD is an increasingly common problem for military personnel (Savoca & Rosenheck, 2000; Zatzick *et al.*, 2008; Schneiderman *et al.*, 2008). In addition to PTSD's physical and psychological impact, it may hamper a veteran's ability to find and maintain employment, which can affect their income level and socioeconomic status. Some of the skills military members learn and acquire during their service are valuable and often transferable to the civilian labor market (Anderson & Mitchell, 1992). These skills are an asset to firms in the form of not only job specific training, but also valuable work habits such as punctuality, discipline, and communication skills.

Previous research shows a diagnosis of PTSD is strongly associated with poor employment outcomes. Early research and research focused on veterans of previous conflicts (excluding the Gulf War and the Global War on Terror) showed that military experience had a negative association with both mental health and employment outcomes. Savoca and Rosenheck (2000) found that Vietnam veterans with a lifetime diagnosis of PTSD were 8.5 percentage points less likely to be employed than veterans without PTSD. Combat-related PTSD was the most significant determinant of the probability of employment for veterans. They also found that veterans who were working and diagnosed with PTSD were more likely to earn a lower wage than working veterans without PTSD, on average $3.61 (in 1999 dollars) less per hour.

Anderson and Mitchell (1992) showed than Vietnam veterans are at a higher risk for alcoholism and drug abuse than nonveterans, Korean War veterans, and World War II veterans, and this was associated with worse employment outcomes. They also found that it was the negative effects of mental health disorders that indirectly affected the propensity to work, and

that Vietnam veterans and Korean War veterans had significantly higher probabilities of developing DSM diagnoses.

When looking at PTSD, Smith *et al.* (2011) found that Vietnam veterans with more severe symptoms were more likely to work only part-time or not work at all when compared to veterans with less severe symptoms. Autor *et al.* (2011) show that in 2010, Vietnam veterans were 5.9 percentage points less likely to participate in the labor force than nonveterans of the same cohort and an increase of 3.5 percentage points in the receipt of disability compensation for veterans between 2000 and 2010.

The wars in Iraq and Afghanistan differ from previous wars and conflicts in numerous ways. A study by Fontana and Rosenheck (2008) examined the differences in characteristics between Vietnam, Persian Gulf, and Iraq/Afghanistan veterans and found that veterans of Iraq and Afghanistan are generally much younger than those from previous conflicts and a much larger proportion served in National Guard and Reserve units. There was also a larger number of women and Latino veterans in the Iraq/Afghanistan and Persian Gulf cohorts than in the Vietnam cohorts. This study is one example of why it is important to control for age, sex, and race in military populations. When compared across cohorts, Persian Gulf veterans reported lowers rates of exposure to hostile or friendly fire while Vietnam veterans reported higher rates of exposure to participating in or witnessing atrocities. PTSD rates were lower and less likely to be service connected for Persian Gulf veterans when compared to Vietnam veterans and Iraq/Afghanistan veterans. However, the severity of PTSD symptoms varied across all the cohorts.

Estimates of PTSD for Iraq/Afghanistan veterans range between 11%-20% in any given year (U.S. Department of Veterans Affairs, 2020). Previous research has shown that PTSD can

triple the odds of unemployment (Zatzick *et al*., 2008; Schneiderman *et al.*, 2008) and when depression co-occurs with PTSD, the risk of unemployment is 5 to 6 times higher (Zatzick, 1997). According to a study by Cohen *et al.* (2013), obtaining employment has been a greater challenge for Iraq/Afghanistan veterans compared to veterans of previous conflicts. While they did not find that PTSD was a significant indicator of employment status, they did show that, of the 169 Iraq/Afghanistan veterans in their sample, the veterans with more severe self-reported depression had a higher prevalence of unemployment. This suggests that it is important to examine the relationship of PTSD and depression on employment separately.

Mild traumatic brain injury (mTBI) has been called the "signature wound" of the wars in Iraq and Afghanistan. Among veterans of the wars in Iraq and Afghanistan, mTBI has emerged as a common deployment-related condition, with prevalence rates much higher than previous conflicts (Amick et al., 2018). Amick et al. (2018) explore the effect of mTBI, PTSD, and depression in isolation and in combination on the employment status of Iraq/Afghanistan veterans. When compared with veterans with no diagnoses, veterans with only mTBI are least likely to be unemployed while veterans suffering from a mTBI, PTSD, and depression and veterans suffering from PTSD and depression had the greatest likelihood of unemployment.

One of the reasons we may see lower levels of employment in combat veterans is because of the challenges veterans face adjusting back to a sense of normalcy after returning home from a deployment. Elbogen *et al.* (2012) examine the link between financial well-being and post-deployment adjustment problems in Iraq/Afghanistan veterans and find a strong association between the two. They show that veterans with PTSD, major depressive disorder (MDD), or traumatic brain injuries (TBI) have lower levels of employment and income than veterans without these diagnoses. They also found that regardless of having or not having one of these

diagnoses, veterans who lacked the income needed to meet their basic needs were more likely to be arrested, homeless, abuse alcohol and drugs, had higher suicidal ideation, and displayed more aggression post-deployment than veterans able to meet their basic needs. Veterans with a median annual income below $50,000 with poor money management skills were at a higher risk of post-deployment adjustments problems while those with a median annual income greater than $50,000 and good money management skills reported fewer problems with post-deployment adjustment.

The negative social stigma that is usually attached with a diagnosis of PTSD in veterans can also have adverse effects on a veteran's ability to find or maintain employment. Rudstam *et al.* (2012) surveyed 1,083 human resource professionals to examine employer readiness when it came to hiring veterans with disabilities. They looked at three areas: knowledge, beliefs/willingness, and actions/practices. Their research focused on veterans with PTSD and traumatic brain injury (TBI). They found that overall, employers were willing to hire veterans with disabilities, however, employers had knowledge gaps when it came to accommodating workers with PTSD and TBI and around disclosure issues. While employers believed veterans with disabilities would benefit the company, they also believed employing a veteran with a disability would involve more costs and take more of a manager's time. They were also unsure if workers with PTSD would be more violent.

A case study by Hipes and Gemoets (2019) demonstrated that in the workplace, veterans with PTSD were perceived as dangerous and incompetent, which led to them being socially excluded by their co-workers. A 2012 survey conducted by the Society for Human Resource Management on military employment showed that 42% of employers who hired veterans reported PTSD and other mental health issues were challenges when hiring veterans.

Approximately 64% of organizations had hired veterans within the past 36 months and larger organizations (100+ employees) were more likely to hire veterans than smaller organizations (1-99 employees). However, only 3%-4% were familiar with and used the Department of Labor's Disabled Veterans' Outreach Program and/or the Local Veterans' Employment Representative.

Previous literature has offered multiple factors that could be causing poor employment outcomes for U.S. Veterans. A diagnosis of PTSD is one of the most common explanations. However, PTSD has been treated as exogenous in previous research. In this chapter, I hypothesize that PTSD should be treated as endogenous because of the possibility that an unobservable factor could be correlated with a diagnosis of PTSD and employment. One example is the perceived riskiness of combat veterans, proposed by Hipes and Gemoets (2019). I use this insight from the literature in what follows to propose using exposure to combat as an instrument to better explore the unbiased effects of PTSD on employment.

Data

The data for this research comes from the National Longitudinal Study of Adolescent Health (Add Health), a study which followed adolescents into their early adulthoods. The study consists of panel data collected from five in-home interviews, categorized as Wave I, II, III, IV and V, with the earliest in 1994 and the most recent in 2016-18. It is a nationally representative longitudinal study conducted by the Carolina Population Center at the University of North Carolina at Chapel Hill.

In this chapter, I examine the effect of a diagnosis of PTSD on four employment outcomes: the probability of employment, hours worked per week, employment sector, and job satisfaction. Employment is a binary variable where respondents were asked if they were currently working for pay in Wave V and was coded 1 if yes and 0 otherwise. Hours worked per

week is the total number of hours each week a respondent typically spends at their job. Employment sector is comprised of three binary variables to denote if a respondent works in the public sector, the private sector, or is self-employed. Job satisfaction is also comprised of three binary variables to designate if a respondent is satisfied, neutral, or dissatisfied with their current job.

For this chapter, I focus on the employment outcomes for the *Veterans* sample. This sample includes only those military members who served in the military in prior waves, but had separated from the service by Wave V. I am excluding the *Full Military* sample since it includes those members still on active duty during Wave V and may bias any results on the estimates of the effects of PTSD on employment since active duty military members are naturally employed.

Table 2.1 shows the means and standard deviations of the employment measures during Wave V. Veterans have a similar rate of employment as their civilian counterparts. However, veterans tend to work approximately 3 additional hours per week compared to their civilian counterparts. This holds true even when taking out those veterans who work zero hours. 31.7% of working veterans in this sample report working in the public sector, 61.3% in the private sector, and 5.5% are self-employed. 75.9% of working veterans report they are satisfied with their current employment, 12.5% are neutral, and 11.6% report they are dissatisfied.

Estimating the Effect of PTSD on Employment

As mentioned earlier, previous research has shown that veterans diagnosed with PTSD tend to have worse employment outcomes than veterans without PTSD. As a first step in examining the association between PTSD and the employment outcomes, I estimate the following probit model (Equation 2.1) for the probability of employment, employment sector,

Table 2.1
Summary Statistics of Employment Outcomes

	Currently Employed	Hours Working per Week	Hours Working per Week (no Zeroes)	Public Sector	Private Sector	Self Employed	Satisfied	Neutral	Dissatisfied
Veterans Sample	0.839	38.65	46.06	0.317	0.613	0.0550	0.759	0.125	0.116
	(0.368)	(20.36)	(12.34)	(0.466)	(0.488)	(0.228)	(0.428)	(0.331)	(0.320)
Observations	628	628	527	527	527	527	527	527	527
Civilian Sample	0.836	35.59	42.61	0.182	0.707	0.0952	0.780	0.143	0.0739
	(0.371)	(19.41)	(12.33)	(0.385)	(0.455)	(0.294)	(0.414)	(0.351)	(0.262)
Observations	10,150	10,132	8,462	8,483	8,483	8,483	8,483	8,483	8,483

Standard deviations are in parentheses. Means are generated using Wave V of the National Longitudinal Study of Adolescent Health. Sample for employment sector and job satisfaction was reduced to only those respondents who reported they were currently working in Wave V. 8 respondents in the Veterans sample and 135 in the Civilian sample did not report employment sector. 25 respondents in the Civilian sample did not report job satisfaction.

and job satisfaction.

$$P(EmploymentOutcome_{i5}|PTSD_{i5}, X_{i5}, P_{i1}, M_{i4})$$
$$= \Phi(\alpha_0 + \beta_1 PTSD_{i5} + \beta_2 X_{i5} + \beta_3 P_{i1} + \beta_4 M_{i4}) \quad (2.1)$$

Separately, I also run the following ordinary least squares model for the number of hours worked per week (Equation 2.2):

$$Hours_{i5} = \omega_0 + \delta_1 PTSD_{i5} + \delta_2 X_{i5} + \delta_3 P_{i1} + \delta_4 M_{i4} + \varepsilon_i \quad (2.2)$$

X_{i5} is a vector of individual controls for individual *i* from Wave V. P_{i1} is a vector of parental controls from Wave I and M_{i4} is a vector of military controls from Wave IV (See Table B2 in Appendix B for the means of each of the control variables). For employment sector and job satisfaction, the sample is reduced to only those employed.

The results in Table 2.2 show that a diagnosis of PTSD is associated with a decrease in the probability of employment by 16.2 percentage points. PTSD is also associated with a decrease in the numbers of hours worked per week by approximately 5.2 hours. Results were insignificant for employment sector and job satisfaction in the *Veterans* sample. In the *Civilian* sample, PTSD is associated with a decrease in job satisfaction.

These initial results suggest that military members with PTSD might be more resilient to the negative impacts of PTSD in the labor market than their civilian counterparts. Traditionally, job search methods are categorized into either "formal" or "informal" channels (Laschever, 2005; Ioannides and Loury, 2004). Jobs found through friends, acquaintances, or relatives are considered informal channels and their importance has been well documented (Bewley, 1999; Ioannides and Loury, 2004). These informal networks can often decrease the search frictions traditionally found in the labor market (Laschever, 2005). Connections among workers,

Table 2.2
Estimates of the Effect of PTSD on Employment

	Employment	Hours Worked per Week (OLS)	Public Sector Employment	Private Sector Employment	Self-Employed	Satisfied	Neutral	Dissatisfied
Veterans Sample	-0.162***	-5.206**	0.0263	-0.0486	0.0271	-0.0172	-0.0135	0.0156
	(0.0371)	(2.526)	(0.0557)	(0.0608)	(0.0183)	(0.0500)	(0.0329)	(0.0296)
Observations	598	623	520	520	446	520	486	514
Civilian Sample	-0.174***	-8.885***	0.0166	-0.0406	0.0235	-0.0542**	0.0109	0.0374***
	(0.0168)	(0.929)	(0.0212)	(0.0254)	(0.0153)	(0.0228)	(0.0189)	(0.0141)
Observations	10,081	10,065	8,438	8,438	8,412	8,434	8,434	8,434
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parental Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Military Controls*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Robust Standard errors are in parentheses. Sample for employment sector and job satisfaction was reduced to only those respondents who reported they were currently working in Wave V. *Military controls are excluded in civilian sample*

**** p<0.01, ** p<0.05, * p<0.1*

including common military service, can lead to information sharing within that network, which can lead to similar labor market outcomes (Hellerstein, Kutzbach, and Neumark, 2014).

While these results are significant and meaningful, results will be biased if PTSD is endogenous to the model. Endogeneity concerns are relevant if there are unobserved variables that are correlated with PTSD diagnoses and also are determinants of employment outcomes. Some examples include PTSD symptom severity (Smith *et al,* 2011), challenges veterans face readjusting to civilian life (Elbogen *et al,* 2012), employer knowledge gaps in accommodating workers with PTSD (Rudstam *et al.*, 2012), or that veterans with PTSD are perceived by potential employers as dangerous or incompetent (Hipes & Gemoets, 2019). All of these factors are unobserved within the Add Health dataset.

I propose using exposure to combat as an instrument to minimize bias in the estimated effect of PTSD on the employment outcomes. There are two reasons why I believe combat may be a good instrument for predicting these effects. First, in Chapter 1, I found that exposure to combat was a significant predictor of a diagnosis of PTSD, supporting the relevance of combat as an instrument. Second, as seen in the first two columns of Table 2.3, when I estimate Equation 2.3, I find support that exposure to combat is exogenous to employment and hours worked per week, given that it is an insignificant predictor of both.

$$P(Employment_{i5}|Combat_{i4}, X_{i5}, P_{i1}, M_{i4})$$
$$= \Phi(\alpha_0 + \beta_1 Combat_{i4} + \beta_2 X_{i5} + \beta_3 P_{i1} + \beta_4 M_{i4}) \qquad (2.3)$$

Equation 2.3 is a slightly different version of Equation 2.1 where I replace PTSD with those combat events found to be significant predictors of PTSD. While I show that exposure to combat is exogenous to employment and hours worked per week, I cannot make the same assumption for employment sector and job satisfaction. Veterans, especially veterans with a

Table 2.3
Estimates of Combat Events on Employment

	Veterans Sample							
	Employment	Hours Worked per Week	Public Sector Employment	Private Sector Employment	Self-Employed	Satisfied	Neutral	Dissatisfied
Panel A: Combat								
Combat	0.00511	1.017	0.0238	-0.0450	0.0449***	0.0711	-0.0174	-0.0321
	(0.0374)	(2.334)	(0.0493)	(0.0583)	(0.0163)	(0.0564)	(0.0287)	(0.0254)
Panel B: Deployment Length								
Time in Combat (months)	-8.05e-05	0.0196	0.00445**	-0.00531*	0.000250	-0.000308	-0.00177	0.000910
	(0.00156)	(0.100)	(0.00207)	(0.00281)	(0.000435)	(0.00250)	(0.00133)	(0.00129)
Deployment Length:								
7 to 12 months	-0.0150	-0.290	0.0692	-0.0573	-0.0155	-0.00168	-0.0182	-0.00231
	(0.0521)	(3.186)	(0.0654)	(0.0748)	(0.0124)	(0.0752)	(0.0373)	(0.0343)
More than 12 months	-0.0348	-0.358	0.0711	-0.106	0.0130	0.00989	0.00344	-0.0350
	(0.0478)	(2.810)	(0.0627)	(0.0716)	(0.0177)	(0.0673)	(0.0357)	(0.0286)
Panel C: Enemy Firefights								
Ever engaged in enemy firefight	-0.0435	-1.023	-0.0931*	-0.00710	0.0698***	0.0943	0.0153	-0.0813***
	(0.0448)	(2.636)	(0.0496)	(0.0648)	(0.0249)	(0.0597)	(0.0345)	(0.0190)
Enemy Firefights:								
1 to 3	0.0217	2.146	-0.112	0.164*	0.0183	0.173**	0.0237	
	(0.0562)	(3.082)	(0.0683)	(0.0888)	(0.0242)	(0.0792)	(0.0465)	
4 to 11	-0.0462	-6.035	-0.0983	-0.0849	0.0708*	0.0334	0.0671	-0.0701**
	(0.0827)	(5.091)	(0.0843)	(0.119)	(0.0384)	(0.114)	(0.0674)	(0.0333)
12 or more	-0.125	-1.024	-0.0422	-0.164	0.237***	0.0646	-0.0502	-0.0582*
	(0.0790)	(4.716)	(0.0773)	(0.0997)	(0.0659)	(0.0907)	(0.0452)	(0.0319)
Panel D: Exposure to Injury and Death								
Wounded	-0.101	-4.894	-0.0454	-0.121	0.190***	-0.0962	0.0123	-0.0320
	(0.0736)	(4.326)	(0.0848)	(0.109)	(0.0637)	(0.104)	(0.0567)	(0.0417)
Killed (or believed killed) someone	-0.0323	0.417	-0.112**	0.0173	0.0955***	0.0307	0.0102	-0.0497*
	(0.0508)	(3.205)	(0.0543)	(0.0752)	(0.0307)	(0.0697)	(0.0402)	(0.0275)
Saw an ally, enemy, or civilian wounded, dead, or killed	-0.0297	-1.240	-0.0369	-0.0385	0.0611***	-0.0164	0.0552	-0.0465**
	(0.0403)	(2.381)	(0.0481)	(0.0601)	(0.0226)	(0.0582)	(0.0342)	(0.0234)
Observations	602	627	627	623	538	627	581	617

Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

service-connected disability, are given special hiring preferences by the federal government (Winters, 2018). Therefore, veterans are more likely than nonveterans to be employed in the public sector. Vanderschuere and Birdsall (2019) also explore how veteran status affects job satisfaction. They hypothesize that because veterans are given special hiring advantages with the federal government, nonveterans may show resentment towards those with veteran status, leading to lower levels of job satisfaction. Their results show that across all demographics, veterans reported lower job satisfaction than nonveterans. As seen in the remaining columns of Table 2.3, I show that exposure to combat affects respondent's decisions on which sector to enter for employment and their level of job satisfaction. For this reason, I focus on the probability of employment and hours worked per week for the remainder of this chapter.

To estimate the effects a diagnosis of PTSD has on the probability of employment, I employ a two-stage least squares model of the following form:

$$Employment_{i5} = \delta_0 + \delta_1 PTSD_{i5} + \delta_2 X_{i5} + \delta_3 P_{i1} + \delta_4 M_{i4} + u_i \quad (2.4)$$

$$PTSD_{i5} = \beta_0 + \beta_1 Combat_{i4} + \beta_2 X_{i5} + \beta_3 P_{i1} + \beta_4 M_{i4} + v_i \quad (2.5)$$

The results of the two-stage estimation for employment are reported in Table 2.4. The first-stage estimates of PTSD are reported in the first column and the results of the second-stage estimation of PTSD on employment are reported in the second column. While exposure to combat was found to be significant on receiving a diagnosis of PTSD in the first-stage, PTSD was not found to be a significant predictor of employment in the second stage.

The results of the two-stage estimation for hours worked per week are reported in Table 2.5. The first-stage estimates of PTSD are reported in the first column and the results of the second-stage estimation of PTSD on hours worked per week are reported in the second column. Again, I find that exposure to combat is a significant predictor of receiving a diagnosis of PTSD

Table 2.4

Two-Stage Least Squares Regression of PTSD on Employment

	PTSD (First-stage,β_1)	Employment (Second-stage, δ_1)
Combat	0.186***	0.0747
	(0.046)	(0.215)
Time in Combat (Months)	0.011***	-0.000808
	(0.002)	(0.155)
Ever engages in enemy firefight	0.221***	-0.113
	(0.051)	(0.193)
Wounded	0.447***	-0.178
	(0.083)	(0.157)
Killed (or believed killed) someone	0.273***	-0.0456
	(0.057)	(0.178)
Saw an ally, enemy, or civilian wounded, dead, or killed	0.267***	-0.0743
	(0.047)	(0.148)
Observations	623	623

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 2.5

Two-Stage Least Squares Regression of PTSD on Hours Worked per Week

	PTSD (First-stage, β_1)	Hours per Week (Second stage, δ_1)
Combat	0.186***	7.197
	(0.046)	(11.99)
Time in Combat (Months)	0.011***	2.338
	(0.002)	(8.633)
Ever engages in enemy firefight	0.221***	-2.054
	(0.051)	(10.77)
Wounded	0.447***	-7.840
	(0.083)	(8.747)
Killed (or believed killed) someone	0.273***	4.532
	(0.057)	(10.06)
Saw an ally, enemy, or civilian wounded, dead, or killed	0.267***	-2.878
	(0.047)	(8.248)
Observations	623	623

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

in the first-stage, PTSD was not found to be a significant predictor on the number of hours worked per week in the second stage.

Empirical Specification Tests

First, I examine the strength of combat as an instrument for PTSD. Weak instruments can produce biased instrumental-variable estimators (Stock and Yogo, 2002). Stock and Yogo argue that for two-stage least squares, a weak instrument can be characterized in terms of the minimum eigenvalue based on the Cragg-Donald (1993) statistic. When there is a single endogenous regressor, this statistic is the first-stage F-statistic. Staiger and Stock (1997) suggest that when there is only one endogenous regressor, instruments can be classified as weak if the first-stage F-statistic is less than 10. The first-stage F-statistic is 16.186, suggesting that combat is a strong instrument for PTSD.

To test for the endogeneity of PTSD, I run the Durbin and Wu-Hausman test to determine if PTSD can be treated as endogenous or exogenous. The null hypothesis of these tests is that PTSD can be treated as exogenous. The Durbin test returned a statistic of 1.174 and p-value of 0.2786 and the Wu-Hausman test returned a statistic of 1.084 and a p-value of 0.2983. With these results, I am unable to reject the null hypothesis that PTSD is exogenous. If the endogenous regressor is in fact exogenous, then the probit estimator is more efficient.

Discussion and Conclusions

With over 5.4 million military deployments conducted since September 11, 2001, the prevalence of PTSD in service members returning home has become a growing concern. Finding and maintaining employment after separating from the service has been more difficult for OEF/OIF veterans, especially those diagnosed with PTSD. In this chapter, I examined the

effect a diagnosis of PTSD has on the employment outcomes of U.S. veterans using two separate methods.

In the first approach, I used a standard probit model to examine the effect of PTSD on four outcomes: the probability of employment, the number of hours worked per week (on average), employment sector, and job satisfaction. Consistent with previous research, I found that PTSD was associated with a decreased probability of employment and a decrease in the number of hours worked per week by approximately 5 hours. PTSD also was associated with a decrease in the likelihood of employment in the private sector and lower levels of job satisfaction.

While the results from the probit regression were significant and meaningful, the results would be biased if PTSD was endogenous to the model. Based on my results from Chapter 1, I proposed using exposure to combat as an instrument to try and get a less biased effect of PTSD on the employment outcomes. Because of the limitations of combat as an instrument as discussed earlier, I was only able to examine the effects of PTSD on the probability of employment and the number of hours worked per week. Using a two-stage estimation approach, I found no significant effect of PTSD on either employment outcome. However, based on the Durbin and Wu-Hausman tests for endogeneity, my initial assumption that PTSD was endogenous to the model may have been incorrect. I was unable to reject the null hypothesis that PTSD is exogenous.

One explanation for the lack of significant findings using a two-stage approach could be that having a diagnosis of PTSD does not lead to worse employment outcomes for veterans, consistent with the findings by Cohen *et al.* (2013). Another possibility, however, is that the instrumental variable approach in this chapter remains misspecified due to limitations in the data

source and instrument, and/or underpowered due to the small sample size. Regardless, the results of this study suggest a diagnosis of PTSD itself may not be what is important to employment differences or public policy directed at supporting veterans. Rather, other factors, such as the negative effects of mental health disorders, could be influencing an individual's propensity to work (Anderson & Mitchell, 1992; Smith *et al.*, 2011).

Public policies should focus on better addressing the employment concerns of veterans suffering with PTSD, while increasing the mental health services currently available to veterans, both within the VA and outside the VA. This could help veterans better manage the negative effects of their PTSD and better their employment outcomes. The VA and other governmental agencies could also focus on educating employers in the private sector to close knowledge gaps and increase employer readiness when it comes to hiring and accommodating veterans with PTSD.

My results contribute to the growing body of literature that PTSD is associated with worse employment outcomes for U.S. veterans. The lack of significant results in the two-stage estimation approach suggests that a diagnosis of PTSD alone may not contribute to decreased levels of employment. Instead, it may be the case that it is the symptoms and symptom severity that is causing worse employment outcomes. Other causes could include employer knowledge gaps in accommodating workers with PTSD, the perceived riskiness of veterans with PTSD by potential employers, or challenges veterans face readjusting to civilian life.

CHAPTER 3 – AFTER COMBAT: MENTAL HEALTH AND ITS EFFECTS ON THE RISKY BEHAVIORS OF U.S. MILITARY MEMBERS

Introduction

The choices an individual makes throughout their lifetime seldom have outcomes that can be predicted perfectly. Karlsson Linnér *et al.* (2019) define risk as the degree of variability in possible outcomes. Risk includes a chance of loss with a probability greater than zero. Risk, and the uncertainty that comes from risk, is a significant part of most economic decisions. Part of understanding and predicting economic behavior requires an understanding of individual attitudes towards risk. The willingness to take risks, or risk tolerance, varies significantly between individuals.

Risk-taking behaviors are defined as intentional behaviors that have potential negative consequences or loss and previous research has shown PTSD to be a determining factor in risky behaviors (Ben-Zur and Zeidner, 2009). Over 2.7 million service members have been deployed to Iraq and Afghanistan since 2001 (Wenger, 2018) and the prevalence of PTSD in U.S. veterans has been growing. As shown in Chapter 1 and previous research, U.S. military personnel returning from deployments are experiencing adverse mental health issues (Kang *et al.*, 2003; Hoge *et al*., 2004; Smith *et al.*, 2008; Cesur *et al.*,2013). In this chapter, I hypothesize PTSD or depression can lead to an increase in the risk-taking behaviors of U.S. veterans. A 2011 study conducted by the Pew Research Center found that 44% of post 9/11 veterans had a difficult time readjusting to civilian life. This increased to 51% among those who served in combat.

Veterans struggling with PTSD and depression have been shown to have worse employment outcomes (Anderson and Mitchell, 1992; Savoca and Rosenheck, 2000; Autor *et al.*,

2011; Cohen *et al.* 2013). One factor that could be contributing to lower levels of employment for veterans is an increase in risky or criminal behaviors post-deployment. This increase in risk-taking behaviors can lead to worse economic outcomes for veterans, such as high unemployment rates and decreased earnings.

Given the importance of better understanding these connections, I explore associations between a diagnosis of PTSD and depression and the risk-taking behaviors of U.S. military members using sample data in this chapter. A formal diagnosis of PTSD or depression may not capture all true cases within this sample. There may be individuals who meet the diagnosis criteria for a formal diagnosis, but have not sought medical help and, therefore, will not have a formal diagnosis. However, since this dataset does not have information on symptoms or symptom severity, a formal diagnosis is the best measure of PTSD and depression in this sample.

Literature Review

PTSD and depression are prevalent, and often chronic, mental health conditions that many veterans face after deployment. Previous research has established a relationship between deployments and increased risky behavior. Some examples include substance use disorders (Brown, Stout, & Gannon-Rowley, 1998; Stewart *et al.*, 1998), interpersonal violence (Beckham *et al.*, 1997), and weapon possession and weapons related aggressive behavior (Strom *et al.*, 2012; Freeman, Roca, & Kimbrell, 2003). Behavioral mechanisms have been shown to be a key factor in morbidity and premature mortality, with risk-taking behaviors representing one such mechanism (Strom *et al.*, 2012).

One theory for understanding the relationship between PTSD and substance abuse is based on a self-medication hypothesis (Brown & Wolfe, 1994). Under this hypothesis, it is assumed individuals first develop PTSD and then use substances as a means of relieving their

symptoms. It also suggests that the type of substances used is dependent on the type of symptoms (Beckham *et al,* 1997). Individuals suffering from PTSD and/or depression may use drugs and/or alcohol as an avoidant strategy with the goal of alleviating their symptoms (Boden *et al.*, 2014). Numerous studies have shown that individuals diagnosed with PTSD tend to manage their trauma with coping mechanisms that can make their symptoms worse (Badour *et al.*, 2012; Gutner *et al.*, 2006; Krause *et al.*, 2008; Pineles *et al.*, 2011). Without the necessary resources or skills to manage symptoms through other means, the use of substances as a coping mechanism can increase the risk of developing a substance use disorder (Boden *et al.*, 2014).

Among veterans with PTSD, rates of comorbid alcohol abuse range between 64%-84% and rates of comorbid substance use are between 40%-44% (Stewart *et al.*, 1998). In a study to examine the smoking patterns in Vietnam veterans diagnosed with PTSD relative to those without PTSD, Beckham *et al.* (1997) found that combat veterans with PTSD reported higher rates of heavy smoking than combat veterans without PTSD, 48% versus 28%. Thomsen *et al.* (2011) also found that around 25% of returning service members engaged in risky recreation and 7% engaged in illegal drug use at rates higher than those not deployed.

Killgore *et al.* (2008) found that following combat deployments to Iraq and Afghanistan, approximately 47% of individuals lost their temper and 15% destroyed things out of anger. A study by James, Strom, and Leskela (2014) examined the relationships between PTSD and mild traumatic brain injuries (mTBI). They found PTSD was the main contributing factor to increased impulsivity and risk-taking behaviors in a sample of 234 veterans.

Cesur *et al.* (2020) show that deployment to a combat zone significantly increased criminal tendencies among Iraq/Afghanistan veterans. They found that exposure to combat increased property and violent crimes among veterans and increased the likelihood of negative

interactions with military and civilian police, arrest, and punishment under the Uniform Code of Military Justice (UCMJ). They estimated the cost of combat exposure-induced crime was approximately $315 million for property crimes and $26.4 billion for violent crimes. Jakupcak *et al.* (2007) examines the link between the symptoms of PTSD and anger, hostility, and aggression in Iraq/Afghanistan veterans. They found that veterans diagnosed with PTSD reported higher levels of anger, hostility, and aggression than veterans without PTSD. The more severe the symptoms of PTSD, the higher the level of reported anger, hostility, and aggression.

This research contributes to the growing body of literature focused on the effects of military combat service on the risk-taking behaviors of U.S. veterans. I approach this question from two directions. First, I examine the effect a diagnosis of PTSD or depression has on the risk-taking behaviors of U.S. soldiers. However, as mentioned earlier, since this approach relies on individuals with PTSD or depression having a formal diagnosis from a medical professional, there may be individuals within the sample that meet the diagnosis criteria but have not been diagnosed. In the second approach, I use exposure to combat as a mechanism to explore to effect of combat on the risk-taking behaviors of veterans.

Data and Theoretical Model

The data for this research comes from the National Longitudinal Study of Adolescent Health (Add Health), a study which followed adolescents into their early adulthoods. The study consists of panel data collected from five in-home interviews, categorized as Wave I, II, III, IV and V, with the earliest in 1994 and the most recent in 2016-18. It is a nationally representative longitudinal study conducted by the Carolina Population Center at the University of North Carolina at Chapel Hill.

Measures

To measure risk tolerance, respondents were asked if they Strongly agree, Agree, Neither agree nor disagree, Disagree, or Strongly disagree with the statement, "I like to take risks." Respondents were coded as *Risk Loving* if they replied with Strongly agreed or Agreed, as *Risk Neutral* if they replied with Neither agree nor disagree, and as *Risk Averse* if they replied with Disagree or Strongly disagree. Dohmen *et al.* (2011) found that risk attitudes were strongly correlated across several contexts and that the best all-round explanatory variable that predicted all behaviors was a general risk question. As seen in Table 3.1, military members tend to have a higher risk tolerance than their civilian counterparts. Over time, you can see a decrease in individuals reporting to be *Risk Loving* and an increase in *Risk Neutral* and *Risk Averse* across all groups. See Table B5 in Appendix B for summary statistics by sex. Risk tolerance in Wave V is included in all models as an individual control.

Table 3.1
Summary Statistics of Risk Tolerance

	Wave IV			Wave V		
	Full Military Sample	Veterans	Civilians	Full Military Sample	Veterans	Civilians
Risk Loving	0.440	0.435	0.329	0.365	0.357	0.268
	(0.497)	(0.496)	(0.470)	(0.482)	(0.479)	(0.443)
Risk Neutral	0.302	0.307	0.284	0.322	0.320	0.318
	(0.460)	(0.462)	(0.451)	(0.467)	(0.467)	(0.466)
Risk Averse	0.258	0.258	0.385	0.302	0.312	0.394
	(0.438)	(0.438)	(0.487)	(0.460)	(0.464)	(0.489)
Observations	718	628	10,150	718	628	10,150

Standard deviations are in parentheses. Means are generated using Wave IV and Wave V of the National Longitudinal Study of Adolescent Health

This dataset also includes observations on tobacco, alcohol, and substance use and involvement with the criminal justice system. Variables for interactions with the criminal justice system include if respondents have ever been arrested, ever spent time in a correctional facility,

or gotten into a serious physical fight within the past 12 months. Variables for substance use include if respondents have ever been a smoker, if respondents consume 1 or more alcoholic drinks per day, if respondents are a heavy drinker (consumes more than 5 drinks per day in the last 12 months), and if respondents had used marijuana or other drugs in the last 30 days. Other drugs include the use of cocaine, methamphetamines, and prescription drugs. Table 3.2 below shows the summary statistics for each of the measured risky behaviors in Waves IV and V.

Table 3.2
Summary Statistics of Risky Behaviors in Wave IV and Wave V

	Wave IV			Wave V		
	Full Military Sample	Veterans Sample	Civilians	Full Military Sample	Veterans Sample	Civilians
Ever been arrested	0.333	0.339	0.242	0.371	0.390	0.288
	(0.472)	(0.474)	(0.428)	(0.483)	(0.488)	(0.453)
Reported arrest in either wave*				0.422	0.436	0.317
				(0.494)	(0.496)	(0.465)
Ever spent time in a correctional facility	0.170	0.178	0.123	0.156	0.169	0.117
	(0.376)	(0.383)	(0.328)	(0.364)	(0.375)	(0.321)
Reported spent time in a correctional facility*				0.230	0.242	0.163
				(0.421)	(0.429)	(0.369)
Fighting	0.0571	0.0621	0.0422	0.0296	0.0322	0.0199
	(0.232)	(0.242)	(0.201)	(0.170)	(0.177)	(0.140)
Smoker	0.181	0.183	0.149	0.279	0.299	0.237
	(0.385)	(0.387)	(0.356)	(0.449)	(0.458)	(0.426)
Drinker	0.797	0.795	0.730	0.781	0.780	0.725
	(0.403)	(0.404)	(0.444)	(0.414)	(0.414)	(0.446)
Heavy Drinker	0.163	0.177	0.120	0.106	0.115	0.0792
	(0.370)	(0.382)	(0.325)	(0.308)	(0.319)	(0.270)
Used marijuana	0.522	0.533	0.535	0.624	0.646	0.620
	(0.500)	(0.499)	(0.499)	(0.485)	(0.479)	(0.485)
Used other drugs	0.327	0.341	0.317	0.104	0.111	0.133
	(0.470)	(0.474)	(0.465)	(0.306)	(0.315)	(0.339)
Observations	718	628	10,150	718	628	10,150

**Binary variable =1 if reported in Wave IV and/or Wave V. Standard deviations are in parentheses. Means are generated using Wave IV and Wave V of the National Longitudinal Study of Adolescent Health.*

Ideally, I would exploit the panel aspect of this dataset by examining differences in reported behaviors across survey waves. Unfortunately, there are only small numbers of

switchers between behavioral categories across Waves IV and V and there are some data nuances which suggest measurement error in some responses. For example, based on cross-tabulations of risky behaviors reported in Wave IV and Wave V (See Table B6.A and B6.B in Appendix B), there was a significant number of unintuitive switchers between waves on the questions of if respondents had ever been arrested and ever spent time in a correctional facility. For example, 39 respondents in the *Full Military* sample and 30 respondents in the *Veterans* sample reported they had been arrested in Wave IV but also reported they never had been arrested in Wave V. This could be indicative of reporting bias within the dataset. Due to the small sample size, this could bias the results. To address this issue, I also created a binary variable if respondents ever reported being arrested in either wave and a binary variable if respondents ever reported spending time in a correctional facility in either wave. The means and standard deviations of these measures are also reported in Table 3.2 under the Wave V column.

Another reason I was unable to exploit the panel aspect is because not all questions regarding risk-taking behaviors were asked in the same manner across waves. For example, in Wave IV respondents were asked if they had ever used marijuana or other drugs and in Wave V they were asked if they had used marijuana or other drugs in the last 30 days.

Samples

For this chapter, I am examining the effect of PTSD and depression, measured via their respective diagnoses, on two separate samples. The first is the *Full Military* sample. It is comprised of all service members currently serving on active duty in Wave V, those service members with active-duty service in Wave IV, and includes all National Guard and Reservists. The second sample of interest is the *Veterans* sample. This sample includes only those service members who served in the military in prior waves, but had separated from service in Wave V.

Empirical Model

To explore the relationship between PTSD and depression and risky behaviors, I initially proposed using an instrumental variable approach. I hypothesized that receiving a diagnosis of PTSD or depression would be endogenous, but that it could be instrumented through exposure to combat using the following model:

$$P(Risky\ Behavior_{i5}) = \Phi(\alpha_0 + \alpha_1 MentalHealth_{i5} + \alpha_2 Risk\ Tolerance_i + \alpha_3 X_{i1,4,5}) \quad (3.1)$$

$$P(Mental\ Health_{i5}) = \Phi(\beta_0 + \beta_1 Combat_{i4} + \beta_2 X_{i1,4,5}) \quad (3.2)$$

where $X_{i1,4,5}$ is a vector of individual, parental, and military controls from Waves I, IV, and V. I believed that receiving a diagnosis of PTSD or depression was also dependent on an individual's risk tolerance level. However, when looking at the Wald Test of Exogeneity across all specifications, I was unable to reject the null hypothesis that PTSD or depression was exogenous. Therefore, the probit model would be more efficient.

Estimating the Effect of PTSD and Depression on Risk-Taking Behaviors

In this study, I am interested in the risk-taking behaviors of individuals in Wave IV and Wave V. I first run a regression for the risky behavior in Wave IV, the same time period that the exposure to combat is reported. Then I run a separate regression for the risky behavior in Wave V, the time period after combat is reported. I estimate the relationship between PTSD and depression and risky behaviors using the following standard probit model:

$$P(Risky\ Behavior_{it} | MentalHealth_{i5}, X_{i5}, P_{i1}, M_{i4})$$
$$= \Phi(\alpha_0 + \beta_1 MentalHealth_{i5} + \beta_2 X_{i5} + \beta_3 P_{i1} + \beta_4 M_{i4}) \quad (3.3)$$

$MentalHealth_{i5}$ is a binary variable equal to 1 if the respondent has an official diagnosis of PTSD or Depression from a medical professional in Wave V and 0 otherwise. X_{i5} is a vector of

individual controls for individual *i* from Wave V and includes a measure for risk tolerance. P_{i1} is a vector of parental controls from Wave I and M_{i4} is a vector of military controls from Wave IV. $P(Risky\ Behavior_{it})$ is the risky behavior for individual *i* with *t* referring to either Wave IV or Wave V.

Interactions with the Criminal Justice System

First, I examine the effect a diagnosis of PTSD or depression has on interactions with the criminal justice system in Wave IV. As seen in Table 3.3, individuals with a diagnosis of depression are an increased risk of spending time in a correctional facility in the same time period that exposure to combat is reported. Individuals diagnosed with PTSD are also at an increased risk of getting into a physical fight.

Table 3.3
Estimates of PTSD and Depression on Interactions with the Criminal Justice System in Wave IV

	PTSD		Depression	
	Full Military	Veterans	Full Military	Veterans
Ever been arrested	0.0432	0.0644	0.0406	0.0503
	(0.0465)	(0.0493)	(0.0427)	(0.0454)
Observations	712	623	715	626
Ever spent time in a correctional facility	0.0295	0.0314	0.0671**	0.0654**
	(0.0330)	(0.0346)	(0.0305)	(0.0329)
Observations	712	623	715	626
Fighting	0.0473***	0.0467***	0.00454	0.00621
	(0.0146)	(0.0152)	(0.0104)	(0.0115)
Observations	712	623	715	626

Robust standard errors are in parentheses. Dependent variables of interest are listed in the rows and regressor is listed in the columns.
*** p<0.01, ** p<0.05, * p<0.1

Next, I examine the effect a diagnosis of PTSD or depression has on interactions with the criminal justice system in Wave V. The results, shown below in Table 3.4, show that in the time period after the reported exposure to combat, individuals diagnosed with depression or PTSD are

at an increased risk of spending time in a correctional facility. This significance holds when looking at the alternative binary measure if an individual ever reported spending time in a correctional facility. Individuals diagnosed with PTSD are also at an increased risk of being arrested and getting into physical fights. However, the significance and magnitude noticeably drop when looking at the alternative measure if an individual ever reported being arrested.

Table 3.4

Estimates of PTSD and Depression on Interactions with the Criminal Justice System in Wave V

	PTSD		Depression	
	Full Military	Veterans	Full Military	Veterans
Ever been arrested	0.107**	0.121**	0.0455	0.0639
	(0.0488)	(0.0521)	(0.0454)	(0.0487)
Observations	701	615	704	618
Reported Arrested	0.0724	0.0947*	0.0323	0.0395
	(0.0492)	(0.0520)	(0.0457)	(0.0484)
Observations	712	623	715	626
Ever spent time in a correctional facility	0.0819**	0.0932**	0.0675**	0.0857**
	(0.0334)	(0.0365)	(0.0300)	(0.0337)
Observations	710	607	713	610
Reported Facility	0.0861**	0.0961**	0.0774**	0.0802**
	(0.0399)	(0.0426)	(0.0363)	(0.0392)
Observations	712	623	715	626
Fighting	0.00554*	0.00520*	-0.000442	-0.000800
	(0.00283)	(0.00283)	(0.00222)	(0.00219)
Observations	660	584	663	587

Robust Standard errors are in parentheses. Dependent variables of interest are listed in the rows and regressor is listed in the columns.

**** p<0.01, ** p<0.05, * p<0.1*

When examining the differences in outcomes between Wave IV and Wave V, there appears to be a noticeable decrease in the likelihood of getting into a physical fight for those soldiers diagnosed with PTSD. In Wave IV the probability of getting increases between 4.6-4.7 percentage points while in Wave IV this decreases to approximately 0.5 percentage points. As seen in Table B6.A and B6.B in Appendix B, the number of individuals who reported getting

into a physical fight decreased by 19 in the *Veterans* sample and 20 in the *Full Military* sample between Wave IV and Wave V.

Substance Use

Next, I explore the relationship between PTSD and depression and substance use in Wave IV. As seen in Table 3.5, a diagnosis of depression is associated with an increase in the probability of being a drinker by 7.5-7.9 percentage points, while a diagnosis of PTSD is associated with an increase in the probability of being a heavy drinker by 5.9-6.3 percentage points. Both PTSD and depression are associated with an increase in the use of marijuana and other drugs.

Table 3.5
Estimates of PTSD and Depression on Substance Use in Wave IV

	PTSD		Depression	
	Full Military	Veterans	Full Military	Veterans
Smoker	0.0354	0.0372	0.00481	-0.00287
	(0.0360)	(0.0376)	(0.0312)	(0.0326)
Observations	712	623	715	626
Drinker	0.0267	0.0136	0.0751**	0.0793**
	(0.0371)	(0.0396)	(0.0336)	(0.0356)
Observations	712	623	715	626
Heavy Drinker	0.0594*	0.0638*	0.000292	-0.00909
	(0.0310)	(0.0352)	(0.0275)	(0.0314)
Observations	712	623	715	626
Used marijuana	0.108**	0.116**	0.112**	0.0969**
	(0.0499)	(0.0522)	(0.0461)	(0.0486)
Observations	712	623	715	626
Used other drugs	0.180***	0.178***	0.182***	0.186***
	(0.0499)	(0.0536)	(0.0446)	(0.0479)
Observations	712	623	715	626

Robust Standard errors are in parentheses. Dependent variables of interest are listed in the rows and regressor is listed in the columns.
**** p<0.01, ** p<0.05, * p<0.1*

Next, I examine the relationship between PTSD and depression on substance use reported in Wave V. Consistent with previous research, the results reported in Table 3.6 show that a diagnosis of PTSD or depression increases the probability of substance use, with the largest

increases in the use of nicotine and marijuana. PTSD is associated with a 13.2-14.8 percentage point increase in the probability of being a smoker while depression is associated with a 16.6-17.8 percentage point increase.

Table 3.6
Estimates of PTSD and Depression on Substance Use in Wave V

	PTSD		Depression	
	Full Military	Veterans	Full Military	Veterans
Smoker	0.132***	0.148***	0.178***	0.166***
	(0.0446)	(0.0481)	(0.0411)	(0.0443)
Observations	712	623	715	626
Drinker	-0.0416	-0.0620	-0.0468	-0.0568
	(0.0402)	(0.0423)	(0.0365)	(0.0384)
Observations	712	623	715	626
Heavy Drinker	-0.0350	-0.0212	-0.0128	-0.0145
	(0.0228)	(0.0141)	(0.0224)	(0.0135)
Observations	696	608	699	611
Used marijuana	0.130***	0.129***	0.147***	0.125***
	(0.0473)	(0.0487)	(0.0438)	(0.0453)
Observations	709	622	712	625
Used other drugs	0.0567**	0.0641**	0.0515**	0.0564**
	(0.0282)	(0.0299)	(0.0247)	(0.0261)
Observations	696	608	699	611

Robust Standard errors are in parentheses. Dependent variables of interest are listed in the rows and regressor is listed in the columns.
**** p<0.01, ** p<0.05, * p<0.1*

Recall that under the self-medication hypothesis (Brown & Wolfe, 1994), it is suggested that those suffering with PTSD use chemical substances as a means of relieving their symptoms. Smoking cigarettes is one such substance that can be used to relieve certain PTSD symptoms, such as hyperarousal or reexperiencing traumatic memories (Beckham *et al.*, 1997). Smoking is a significant risk factor in numerous chronic diseases, including heart disease and cancer. A study by Mshigeni *et al.* (2021) found that three out of ten veterans use tobacco, a significantly higher rate than non-veterans. They also found that tobacco use was higher among veterans experiencing serious psychological distress, such as experiencing symptoms of PTSD. Tobacco use in the military has been linked with poor training performance and premature discharge for

service members (Hermes *et al.*, 2011). This, along with my results, suggest a need for better smoking cessation programs through the VA and other public health agencies.

When examining the differences in outcomes of substance use between Waves IV and V, the likelihood of reporting marijuana use and being a smoker increased significantly while the likelihood of being a heavy drinker and using other drugs decreased. This suggests there may be a substitution effect between alcohol and drugs. However, it is important to remember that in Wave IV respondents were asked to report if they had ever used marijuana or other drugs and in Wave V they were asked to report usage in the last 30 days. When looking at the cross-tabulations in Tables B6.A and B6.B, the number of respondents reporting to be heavy drinkers decreased significantly. As marijuana becomes legal in more states, individuals suffering with symptoms of PTSD or depression could be substituting alcohol with marijuana.

Estimating the Effect of Combat on Risk-Taking Behaviors

One of the unique aspects of the Add Health dataset is that it provides individual-level data on combat events. This provides a potential mechanism through which I can examine the effects of certain combat events on the risk-taking behaviors military members may engage in after returning from deployment. In Chapter 1, certain combat events were associated with an increased probability of receiving a diagnosis of PTSD or depression. These events include deployment to a combat zone, deployment length, exposure to enemy firefight, killing or wounding someone, and exposure to the death or injury of an ally, civilian, or enemy.

To examine the relationship between these combat events and risky behaviors, I estimate to following probit model:

$$P(Risky\ Behavior_{i5}|Combat_{i4}, X_{i5}, P_{i1}, M_{i4}) = \Phi(\alpha_0 + \beta_1 Combat_{i4} + \beta_2 X_{i5} + \beta_3 P_{i1} + \beta_4 M_{i4}) \quad (3.4)$$

The independent variable, $Combat_{i4}$, is a measure for each of the combat events for individual i during Wave IV.

As seen in the abbreviated Table 3.7 (see Tables B7.A and B7.B in Appendix B for full results), exposure to some combat events can increase the likelihood of substance use.

Table 3.7 (Abbreviated)
Estimates of Combat Events on Risky Behaviors in Wave V

	Full Military			Veterans		
	Smoker	Heavy Drinker	Used Marijuana	Smoker	Heavy Drinker	Used Marijuana
Panel A: Combat						
Combat	0.0155	-0.0236	0.00310	0.0509	-0.0118	0.0258
	(0.0467)	(0.0247)	(0.0513)	(0.0532)	(0.0155)	(0.0551)
Panel B: Deployment Length						
Time in Combat (months)	-0.000482	-0.000466	-0.000432	0.00126	0.000115	-0.000599
	(0.00148)	(0.000998)	(0.00164)	(0.00249)	(0.000805)	(0.00250)
Deployment Length:						
7 to 12 months	-0.0319	-0.0277	-0.0639	-0.00654	-0.0185	0.00673
	(0.0590)	(0.0296)	(0.0655)	(0.0677)	(0.0179)	(0.0692)
More than 12 months	0.0612	-0.0299	-0.0694	0.0998	-0.0116	-0.0372
	(0.0566)	(0.0282)	(0.0613)	(0.0659)	(0.0192)	(0.0667)
Panel C: Enemy Firefights						
Ever engaged in enemy firefight	0.0653	0.0104	0.0648	0.0735	0.00954	0.0593
	(0.0520)	(0.0291)	(0.0553)	(0.0593)	(0.0194)	(0.0594)
Enemy Firefights:						
1 to 3	0.0341	-0.00658	0.0959	0.0136	-0.000214	0.0667
	(0.0724)	(0.0392)	(0.0764)	(0.0795)	(0.0256)	(0.0813)
4 to 11	0.137	0.198***	0.137	0.163	0.159**	0.0831
	(0.101)	(0.0758)	(0.0979)	(0.116)	(0.0651)	(0.108)
12 or more	0.0615	-0.0459	0.0560	0.0891	-0.0247	0.0974
	(0.0794)	(0.0323)	(0.0815)	(0.0916)	(0.0206)	(0.0867)
Panel D: Exposure to Injury and Death						
Wounded	0.0249	-0.0274	0.172*	0.0225	-0.0188	0.138
	(0.0829)	(0.0403)	(0.0956)	(0.0869)	(0.0242)	(0.0967)
Killed (or believed killed) someone	0.0772	0.0208	0.0536	0.0926	0.0151	0.0457
	(0.0584)	(0.0332)	(0.0612)	(0.0667)	(0.0221)	(0.0666)
Saw an ally, enemy, or civilian wounded, dead, or killed	0.120**	0.0118	0.118**	0.157***	0.00414	0.0919*
	(0.0499)	(0.0278)	(0.0512)	(0.0569)	(0.0179)	(0.0557)
Observations	717	701	714	627	612	626

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Being exposed to 4-11 enemy firefights is associated with a 15.9-19.8 percentage point increase in the probability of being a heavy drinker. Being wounded is associated with a 17.2 percentage

point increase in the probability of using marijuana in the *Full Military* sample. Seeing an ally, enemy, or civilian wounded, killed or dead is associated with a 12.0-15.7 percentage point increase in the likelihood of being a smoker and a 9.1-11.8 percentage point increase in the probability of using marijuana.

When examining the relationship between combat and risk-taking behavior, it is important to keep a few things in mind. First, the U.S. military is an all-volunteer force. All-volunteer forces can be drawn from more disadvantaged populations compared to a conscripted force (Elder *et al.*, 2010; Laich & Wilkerson, 2017). This may lead to larger adverse effects of combat service. However, if military members of an all-volunteer force are better matched to specific jobs within the military, relative to conscripted members, then the private costs associated with combat may be lower and lead to smaller adverse effects (Cesur *et al.*, 2020).

Second, casualty rates in modern conflicts are significantly lower than in draft-era conflicts and the type of injuries among survivors has changed as well (Cesur *et al.*, 2020). Traumatic brain injury (TBI) has been called the "signature wound" of the wars in Iraq and Afghanistan. Among veterans of the wars in Iraq and Afghanistan, TBI has emerged as a common deployment-related condition, with prevalence rates much higher than previous conflicts (Amick et al., 2018). TBI is associated with a decrease in cognitive skills and social interactions, which can lead to an increase in risk-taking behaviors (Lash, 2015; The National Academies, 2009, Cesur *et al.*, 2020).

Lastly, the benefits programs for veterans could affect combat veterans' propensity for crime (Cesur *et al.*, 2020). Large entitlement programs provide a stronger social safety net, which could lead to a reduced incentive to engage in risky behaviors. However, these programs

may also create a disincentive to work for combat veterans, which could lead to an increase in risk-taking behaviors because of social isolation.

Discussion on Risk Tolerance

Previous research has shown that risk preferences can vary with gender, age, and cognitive ability. Falk *et al* (2015) found that women are relatively more risk averse than men and that younger individuals are willing to take more risks than older individuals. They also show that while there are some universal biological or psychological mechanisms that link preferences to age, gender, and cognitive ability, there is also a significant amount of variation in magnitude and direction of relationships across individuals. A study by Sahm (2008) focused on the systematic changes in risk preferences and found a modest decline in risk tolerance with age and an increase in risk tolerance when there was an improvement in macroeconomic conditions. Sahm also found that changes in income and wealth or a diagnosis of a serious health condition did not affect or alter an individual's willingness to take risk, a finding consistent with constant relative risk aversion utility.

While standard economic models typically assume that individuals have a stable risk tolerance level, some psychology literature argues that personal experiences have a significant impact on the personal decisions an individual makes (Nisbet and Ross, 1980; Weber *et al.*, 1993; Hertwig *et al.*, 2004). An important implication of the experience hypothesis is that individual differences in risk tolerance should be correlated with differences in life experiences (Malmendier and Nagel, 2011). For example, military service members who were exposed to serious injury and/or casualties while deployed to Iraq were more likely to support the war effort in Iraq, and were therefore willing to accept more risk, than service members with no personal exposure to serious injury or casualties, 48% versus 36% (Pew Research Center, 2011).

To test if my sample follows the trends of previous research on risk tolerance, I model my measure of *Risk Loving*, denoted as ρ^*, with a random-effects ordered probit model following the method of Beauchamp, Cesarini, and Johannesson (2017). I assume ρ^* depends on the vector of covariates x in the following way:

$$\rho^* = x\beta + \varepsilon^* \tag{3.5}$$

where ε^* is the error term and includes part of an individual's permanent risk attitude. ε^* is orthogonal to the covariates x and is assumed to be normally distributed with mean zero. As can be seen in Table 3.8 below, my results are consistent with previous research showing that women are relatively more risk averse than men and individuals become less risk tolerant as they get older.

Table 3.8
Estimates of Individual, Parental, and Military Controls on Risk Loving

	Full Military	Veterans	Civilians
Risk Loving			
Female	-0.526***	-0.515***	-0.407***
	(0.126)	(0.134)	(0.0281)
Age	0.0150	-0.495	-0.921***
	(0.884)	(0.940)	(0.239)
Age2	-0.000469	0.00642	0.0121***
	(0.0116)	(0.0124)	(0.00315)
Observations	717	627	10,120

Robust standard errors are in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Conclusions

Risk, and the uncertainty that comes from risk, plays a key role in important economic decisions. Because the U.S. military is an all-volunteer force, individuals who choose to join are self-selecting into a career with high levels of risk from combat deployments. For this reason, military service members tend to have a higher risk tolerance than their civilian counterparts. As a consequence of these high-risk deployments, military personnel are at an increased risk of

adverse mental health outcomes once they return. Difficulty adjusting back to a civilian lifestyle can lead to an increase in risk-taking behaviors and substance use.

In Chapter 2, I found that a diagnosis of PTSD in veterans can lead to lower levels of employment and decreased the number of hours worked per week. In this chapter I explored one possible explanation for these results, that veterans suffering with PTSD or depression were engaging in risky behaviors. I approached this question from two directions. First, I examined the effect a diagnosis of PTSD or depression had on the risk-taking behaviors of U.S. veterans. Second, I examined the association of combat on risk-taking behaviors using the combat events found to be significant to a diagnosis of PTSD or depression in Chapter 1. This provided additional intuition regarding the mechanisms between the diagnoses and behavior correlations identified in this chapter.

The findings of this research have important implications for policies aimed at helping veterans who are struggling readjusting back to civilian life after combat deployments. The military could adjust their current post-deployment screening process to better recognize individuals who may be suffering with adverse mental health. Earlier detection could lead to earlier intervention and better outcomes in the long-run. The VA could increase the number of programs focused on substance use and other risky behaviors. Targeted intervention programs could be more beneficial to veterans than a more generalized approach. The VA could also focus on increasing the access to VA health benefits for eligible veterans. A 2016 study by the RAND Corporation (Farmer, Hosek, & Adamson) showed that under the VA's current policy, approximately 60% of U.S. veterans were eligible for VA care. However, they found that fewer than half of those eligible used their VA health benefits.

Results of this study contribute to the body of literature on veterans and risk-taking behaviors. The present study evaluated associations between PTSD, depression, and exposure to combat on a wide range of risky behaviors. Consistent with previous findings, my results indicate that veterans diagnosed with PTSD or depression demonstrated more risk-taking behaviors and higher rates of substance use than those without PTSD or depression.

CONCLUDING REMARKS

The U.S. military was engaged in two separate wars in Afghanistan and Iraq over nearly 20 years, deploying approximately 2.77 million military service members on over 5.4 million deployments. Once service members have returned home, they are confronted with the possibility of adverse mental health from exposure to numerous combat events. An economic evaluation of the causes of depression and PTSD and its effects on veterans is important at both the micro and macro level. From a macro perspective, as the prevalence of depression and PTSD increases, resources available to treat and offset the costs associated with these diagnoses may become more scarce, leading to the consideration of alternative uses for those resources or an increase in resources for depression and PTSD at the expense of other programs. At the micro level, it is important to understand the impact to individuals suffering from depression and PTSD so that resources may be used in the most efficient way to achieve the best possible outcomes.

Chapter 1 focused on identifying some of the risks associated with combat deployments and the effects that exposure to those risks have on the likelihood of depression and PTSD for service members. The results of this study suggest that adverse mental health, especially PTSD, is a major concern for military members returning home from deployment. This suggests a need for the U.S. Armed Forces to reevaluate their pre- and post-deployment screening practices and for military leadership to rethink the way the U.S. military currently deploys. Shorter deployments could lead to a decreased risk of exposure to combat events, which can lead to a decreased likelihood of depression and PTSD.

Chapter 2 focused on exploring the effect a diagnosis of PTSD has on the employment outcomes of U.S. veterans using two separate methods: a probit model and a two-stage

estimation approach. While the results from the probit regression were significant and meaningful, I believed the results may have been biased because PTSD was endogenous to the model. However, based on the Durbin and Wu-Hausman tests for endogeneity, my initial assumption that PTSD was endogenous to the model may have been incorrect. I was unable to reject the null hypothesis that PTSD is exogenous. My results contribute to the growing body of literature that PTSD is associated with worse employment outcomes for U.S. veterans. The lack of significant results in the two-stage estimation approach suggests that a diagnosis of PTSD alone may not contribute to decreased levels of employment. Instead, it may be the case that it is the symptoms and symptom severity that is causing worse employment outcomes. Other causes could include employer knowledge gaps in accommodating workers with PTSD, the perceived riskiness of veterans with PTSD by potential employers, or challenges veterans face readjusting to civilian life.

Chapter 3 focused on one possible explanation for the employment results found in Chapter 2, that veterans suffering with depression or PTSD were engaging in risk-taking behaviors. I approached this question from two directions. First, I examined the effect a diagnosis of PTSD or depression had on the risk-taking behaviors of U.S. veterans. Second, I examined the relationship between exposure to combat and risk-taking behaviors using the combat events found to be significant to a diagnosis of PTSD or depression in Chapter 1. Results of this study contribute to the body of literature on veterans and risk-taking behaviors. Chapter 3 evaluated associations between PTSD, depression, and exposure to combat on a wide range of risky behaviors. Consistent with previous findings, my results indicate that veterans diagnosed with PTSD or depression demonstrated more risk-taking behaviors and higher rates of substance use than those without PTSD or depression.

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APPENDIX A

DSM-5 Criteria for Post-Traumatic Stress Disorder

Criterion A: stressor

The person was exposed to: death, threatened death, actual or threatened serious injury, or actual or threatened sexual violence, as follows: (one required)

1. Direct exposure.
2. Witnessing, in person.
3. Indirectly, by learning that a close relative or close friend was exposed to trauma. If the event involved actual or threatened death, it must have been violent or accidental.
4. Repeated or extreme indirect exposure to aversive details of the event(s), usually in the course of professional duties (e.g., first responders, collecting body parts; professionals repeatedly exposed to details of child abuse). This does not include indirect non-professional exposure through electronic media, television, movies, or pictures.

Criterion B: intrusion symptoms

The traumatic event is persistently re-experienced in the following way(s): (one required)

1. Recurrent, involuntary, and intrusive memories. Note: Children older than six may express this symptom in repetitive play.
2. Traumatic nightmares. Note: Children may have frightening dreams without content related to the trauma(s).
3. Dissociative reactions (e.g., flashbacks) which may occur on a continuum from brief episodes to complete loss of consciousness. Note: Children may reenact the event in play.
4. Intense or prolonged distress after exposure to traumatic reminders.

5. Marked physiologic reactivity after exposure to trauma-related stimuli.

Criterion C: avoidance

Persistent effortful avoidance of distressing trauma-related stimuli after the event: (one required)

1. Trauma-related thoughts or feelings.
2. Trauma-related external reminders (e.g., people, places, conversations, activities, objects, or situations).

Criterion D: negative alterations in cognitions and mood

Negative alterations in cognitions and mood that began or worsened after the traumatic event: (two required)

1. Inability to recall key features of the traumatic event (usually dissociative amnesia; not due to head injury, alcohol, or drugs).
2. Persistent (and often distorted) negative beliefs and expectations about oneself or the world (e.g., "I am bad," "The world is completely dangerous").
3. Persistent distorted blame of self or others for causing the traumatic event or for resulting consequences.
4. Persistent negative trauma-related emotions (e.g., fear, horror, anger, guilt, or shame).
5. Markedly diminished interest in (pre-traumatic) significant activities.
6. Feeling alienated from others (e.g., detachment or estrangement).
7. Constricted affect: persistent inability to experience positive emotions.

Criterion E: alterations in arousal and reactivity

Trauma-related alterations in arousal and reactivity that began or worsened after the traumatic event: (two required)

1. Irritable or aggressive behavior

2. Self-destructive or reckless behavior
3. Hypervigilance
4. Exaggerated startle response
5. Problems in concentration
6. Sleep disturbance

Criterion F: duration

Persistence of symptoms (in Criteria B, C, D, and E) for more than one month.

Criterion G: functional significance

Significant symptom-related distress or functional impairment (e.g., social, occupational).

Criterion H: exclusion

Disturbance is not due to medication, substance use, or other illness.

Specify if: With dissociative symptoms.

In addition to meeting criteria for diagnosis, an individual experiences high levels of either of the following in reaction to trauma-related stimuli:

1. Depersonalization: experience of being an outside observer of or detached from oneself (e.g., feeling as if "this is not happening to me" or one were in a dream).
2. Derealization: experience of unreality, distance, or distortion (e.g., "things are not real").

Specify if: With delayed expression.

Full diagnosis is not met until at least six months after the trauma(s), although onset of symptoms may occur immediately.

Source: American Psychiatric Association. 2013. *Diagnostic and Statistical Manual of Mental Disorders,* 5e. Washington D.C.

APPENDIX B

Table B1

OLS Estimates of the Relationship Between Individual and Family Characteristics and the Probability of Active Duty

Variables	
Female	0.000173
	(0.0402)
Black	0.00678
	(0.0346)
Hispanic	0.0134
	(0.0403)
Other Race	0.0385
	(0.0374)
F-Test on joint significance of race	0.38
P-value	0.7698
Age 34	-0.115
	(0.120)
Age 35	3.05e-05
	(0.106)
Age 36	-0.0486
	(0.0986)
Age 37	-0.0212
	(0.1000)
Age 38	0.0117
	(0.0959)
Age 39	-0.00210
	(0.0982)
Age 40	-0.0716
	(0.0988)
Age 41	-0.0359
	(0.104)
Weight	-0.000124
	(0.000377)
Height	0.000688
	(0.00445)
Married	0.0201
	(0.0365)
Separated/Widowed/Divorced	0.00435
	(0.0472)
F-Test on joint significance of marital status	0.22
P-value	0.8059
High School or GED	-0.0593
	(0.0805)
Some College	-0.0164
	(0.0726)
Associate/Vocational/Technical School	-0.0539

	(0.0752)
Bachelor's Degree	-0.0603
	(0.0779)
Some Graduate School	0.0640
	(0.0874)
Master's Degree	-0.127
	(0.0903)
Beyond Master's	-0.00809
	(0.0932)
F-Test on joint significance of own education	1.43
P-value	0.1898
Protestant	-0.0448
	(0.0400)
Catholic	0.0227
	(0.0417)
Other Christian	-0.0215
	(0.0401)
Other Religion	0.0382
	(0.0566)
F-Test on joint significance of own religion	0.84
P-value	0.4993
Parents Single	-0.304
	(0.247)
Parents Married	-0.213
	(0.231)
Parents Separated/Divorced/Widowed	-0.194
	(0.235)
F-Test on joint significance of parents marital status	0.84
P-value	0.4702
Mother: Less than High School	0.0416
	(0.0546)
Mother: High School or GED	0.0135
	(0.0461)
Mother: Some College	-0.0339
	(0.0500)
Mother: Bachelor's Degree	-5.20e-05
	(0.0494)
Mother: Beyond Bachelor's	-0.0149
	(0.0629)
F-Test on joint significance of mother's education	0.54
P-value	0.748
Parents: None, Atheist, or Agnostic	0.170
	(0.240)
Parents: Protestant	0.214
	(0.230)
Parents: Catholic	0.227
	(0.231)
Parents: Other Christian	0.255

	(0.233)
Parents: Other Religion	0.364
	(0.242)
F-Test on joint significance of parent's religion	1.16
P-value	0.3264
Observations	710
R-squared	0.384
F-Test all	1.06
P-value	0.3775

Robust standard errors are in parentheses.
**** p<0.01, ** p<0.05, * p<0.1*

Table B2
Summary Statistics for All Controls

	Civilian	Full Military	Veterans	Combat Veterans
Individual Controls				
Male	0.399	0.774	0.763	0.860
	(0.490)	(0.418)	(0.426)	(0.347)
Female	0.601	0.226	0.237	0.140
	(0.490)	(0.418)	(0.426)	(0.347)
White	0.634	0.626	0.633	0.638
	(0.482)	(0.484)	(0.482)	(0.482)
Black	0.206	0.236	0.234	0.205
	(0.405)	(0.425)	(0.424)	(0.405)
Hispanic	0.138	0.132	0.139	0.148
	(0.345)	(0.339)	(0.346)	(0.356)
Other Race	0.0983	0.104	0.0971	0.105
	(0.298)	(0.306)	(0.296)	(0.307)
Age	37.93	38.02	38.04	38.07
	(1.895)	(1.915)	(1.905)	(1.878)
Age 33	0.000296	0	0	0
	(0.0172)	(0)	(0)	(0)
Age 34	0.0290	0.0334	0.0350	0.0349
	(0.168)	(0.180)	(0.184)	(0.184)
Age 35	0.0853	0.0724	0.0621	0.0655
	(0.279)	(0.259)	(0.242)	(0.248)
Age 36	0.133	0.131	0.131	0.100
	(0.339)	(0.338)	(0.337)	(0.301)
Age 37	0.163	0.155	0.161	0.179
	(0.369)	(0.362)	(0.368)	(0.384)
Age 38	0.186	0.182	0.186	0.201
	(0.389)	(0.386)	(0.390)	(0.402)
Age 39	0.180	0.188	0.185	0.179
	(0.384)	(0.391)	(0.388)	(0.384)

Age 40	0.140	0.138	0.139	0.135
	(0.347)	(0.345)	(0.346)	(0.343)
Age 41	0.0647	0.0780	0.0780	0.0873
	(0.246)	(0.268)	(0.268)	(0.283)
Age 42	0.0153	0.0223	0.0239	0.0175
	(0.123)	(0.148)	(0.153)	(0.131)
Age 43	0.00315	0	0	0
	(0.0561)	(0)	(0)	(0)
Age 44	0.000493	0	0	0
	(0.0222)	(0)	(0)	(0)
Weight (lbs)	191.1	200.6	202.8	202.9
	(53.28)	(42.26)	(43.46)	(39.40)
Height (in)	66.99	69.24	69.28	69.72
	(4.111)	(3.979)	(4.088)	(3.801)
Health Insurance	0.907	0.936	0.928	0.956
	(0.291)	(0.245)	(0.258)	(0.205)
Single	0.273	0.178	0.186	0.175
	(0.446)	(0.383)	(0.390)	(0.381)
Married	0.580	0.632	0.613	0.624
	(0.494)	(0.483)	(0.487)	(0.485)
Separated/Widowed/Divorced	0.145	0.187	0.197	0.197
	(0.352)	(0.390)	(0.398)	(0.398)
Less than Highschool	0.0433	0.00139	0.00159	0.00437
	(0.203)	(0.0373)	(0.0399)	(0.0661)
High School or GED	0.146	0.116	0.126	0.0873
	(0.353)	(0.320)	(0.332)	(0.283)
Some College	0.235	0.298	0.301	0.323
	(0.424)	(0.458)	(0.459)	(0.469)
Associate/Vocational/Technical School	0.158	0.223	0.226	0.223
	(0.365)	(0.416)	(0.419)	(0.417)
Bachelor's Degree	0.215	0.171	0.172	0.175
	(0.411)	(0.377)	(0.378)	(0.381)
Some Graduate School	0.0339	0.0543	0.0525	0.0742
	(0.181)	(0.227)	(0.223)	(0.263)
Master's Degree	0.0980	0.0905	0.0796	0.0742
	(0.297)	(0.287)	(0.271)	(0.263)
Beyond Master's	0.0694	0.0432	0.0382	0.0393
	(0.254)	(0.203)	(0.192)	(0.195)
None, Atheist, or Agnostic	0.207	0.251	0.258	0.288
	(0.405)	(0.434)	(0.438)	(0.454)
Protestant	0.275	0.299	0.296	0.275
	(0.447)	(0.458)	(0.457)	(0.448)
Catholic	0.172	0.148	0.139	0.166
	(0.377)	(0.355)	(0.346)	(0.373)
Other Christian	0.231	0.217	0.217	0.201
	(0.421)	(0.413)	(0.412)	(0.402)
Other Religion	0.0922	0.0669	0.0732	0.0480
	(0.289)	(0.250)	(0.261)	(0.214)
Parental Controls				
Single	0.0442	0.0362	0.0398	0.0480
	(0.206)	(0.187)	(0.196)	(0.214)
Married	0.634	0.635	0.631	0.642

	(0.482)	(0.482)	(0.483)	(0.480)
Separated/Widowed/Divorced	0.193	0.202	0.207	0.183
	(0.394)	(0.402)	(0.405)	(0.388)
Mother: Less than High School	0.142	0.116	0.121	0.109
	(0.349)	(0.320)	(0.326)	(0.313)
Mother: High School or GED	0.311	0.312	0.325	0.349
	(0.463)	(0.464)	(0.469)	(0.478)
Mother: Some College	0.183	0.220	0.213	0.214
	(0.386)	(0.415)	(0.410)	(0.411)
Mother: Bachelor's Degree	0.189	0.189	0.180	0.157
	(0.392)	(0.392)	(0.384)	(0.365)
Mother: Beyond Bachelor's	0.0833	0.0641	0.0541	0.0611
	(0.276)	(0.245)	(0.226)	(0.240)
None, Atheist, or Agnostic	0.0553	0.0404	0.0382	0.0568
	(0.229)	(0.197)	(0.192)	(0.232)
Protestant	0.455	0.490	0.505	0.476
	(0.498)	(0.500)	(0.500)	(0.501)
Catholic	0.251	0.230	0.221	0.262
	(0.434)	(0.421)	(0.415)	(0.441)
Other Christian	0.0729	0.0780	0.0780	0.0655
	(0.260)	(0.268)	(0.268)	(0.248)
Other Religion	0.0347	0.0292	0.0303	0.0131
	(0.183)	(0.169)	(0.171)	(0.114)
Military Controls				
Service Area: CONUS		0.405	0.438	0.100
		(0.491)	(0.497)	(0.301)
Service Area: OCONUS		0.0223	0.0239	0.0480
		(0.148)	(0.153)	(0.214)
Service Area: Both		0.514	0.484	0.852
		(0.500)	(0.500)	(0.356)
Army		0.433	0.444	0.454
		(0.496)	(0.497)	(0.499)
Air Force		0.169	0.154	0.188
		(0.375)	(0.362)	(0.391)
Marines		0.164	0.169	0.170
		(0.371)	(0.375)	(0.377)
Navy		0.198	0.201	0.231
		(0.399)	(0.401)	(0.423)
Active Duty		0.792	0.783	1
		(0.406)	(0.412)	(0)
National Guard		0.124	0.129	0.0961
		(0.330)	(0.335)	(0.295)
Reserves		0.185	0.193	0.162
		(0.389)	(0.395)	(0.369)
Rank: E1		0.0292	0.0334	0
		(0.169)	(0.180)	(0)
Rank: E2		0.0348	0.0398	0
		(0.183)	(0.196)	(0)
Rank:E3		0.128	0.145	0.0437
		(0.334)	(0.352)	(0.205)
Rank:E4		0.318	0.349	0.367
		(0.466)	(0.477)	(0.483)

Rank:E5		0.263	0.252	0.376
		(0.441)	(0.434)	(0.485)
Rank:E6		0.0891	0.0732	0.140
		(0.285)	(0.261)	(0.347)
Rank:E7		0.0111	0.00637	0.0175
		(0.105)	(0.0796)	(0.131)
Rank:E8		0.00139	0	0
		(0.0373)	(0)	(0)
Rank:O1		0.0125	0.00955	0
		(0.111)	(0.0974)	(0)
Rank:O1E		0.00418	0.00159	0
		(0.0645)	(0.0399)	(0)
Rank:O2		0.00696	0.00637	0
		(0.0832)	(0.0796)	(0)
Rank:O2E		0	0	0
		(0)	(0)	(0)
Rank:O3		0.0390	0.0271	0.0480
		(0.194)	(0.162)	(0.214)
Rank:O3E		0.00279	0.00318	0.00873
		(0.0527)	(0.0564)	(0.0932)
Rank:W1		0.00139	0	0
		(0.0373)	(0)	(0)
RankW2		0	0	0
		(0)	(0)	(0)
Observations	10,150	718	628	229

Means are obtained from Waves I, IV, and V of the National Longitudinal Study of Adolescent Health. Standard deviations are in parentheses.

Table B3

Stability of the Estimates of the Relationship Between Combat and Mental Health with Controls

	Depression			PTSD			PTSD & Depression		
Full Military									
Combat	0.103***	0.109***	0.105**	0.183***	0.187***	0.167***	0.114***	0.115***	0.103***
	(0.0363)	(0.0368)	(0.0498)	(0.0321)	(0.0316)	(0.0407)	(0.0264)	(0.0255)	(0.0342)
Observations	708	708	698	705	705	686	710	710	691
Veterans									
Combat	0.130***	0.137***	0.137**	0.206***	0.207***	0.182***	0.134***	0.135***	0.117***
	(0.0400)	(0.0407)	(0.0559)	(0.0355)	(0.0352)	(0.0475)	(0.0295)	(0.0289)	(0.0398)
Observations	620	620	615	617	617	606	621	621	610
Individual Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Parental Controls		YES	YES		YES	YES		YES	YES
Military Controls			YES			YES			YES

Robust standard errors are in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

Table B4
Summary Statistics for Combat Variables

	Full Military	Veterans	Combat Veterans
Total Time in a Combat Zone (months)	5.691	4.890	13.41
	(12.06)	(9.175)	(10.81)
Time in a Combat Zone: 0 - 6 mos	0.113	0.118	0.323
	(0.317)	(0.323)	(0.469)
Time in a Combat Zone: 7 - 12 mos	0.113	0.105	0.288
	(0.317)	(0.307)	(0.454)
Time in a Combat Zone: More than 12 mos	0.160	0.142	0.389
	(0.367)	(0.349)	(0.489)
Engaged in Enemy Firefight(s)	0.171	0.162	0.445
	(0.377)	(0.369)	(0.498)
Total Number of Enemy Firefights			
Enemy Firefights: None	0.214	0.202	0.555
	(0.411)	(0.402)	(0.498)
Enemy Firefights: 1 - 3	0.0669	0.0669	0.183
	(0.250)	(0.250)	(0.388)
Enemy Firefights: 4 - 11	0.0376	0.0350	0.0961
	(0.190)	(0.184)	(0.295)
Enemy Firefights: 12 or more	0.0627	0.0573	0.157
	(0.243)	(0.233)	(0.365)
Wounded in Combat	0.0404	0.0446	0.122
	(0.197)	(0.207)	(0.328)
Killed (or believed they killed someone)	0.123	0.113	0.310
	(0.328)	(0.317)	(0.464)
Witnessed an Ally, Enemy, or Civilian wounded, killed, or dead	0.245	0.236	0.646
	(0.430)	(0.425)	(0.479)
Witnessed an Ally wounded, killed, or dead	0.188	0.177	0.485
	(0.391)	(0.382)	(0.501)
Witnessed an Enemy wounded, killed, or dead	0.138	0.132	0.362
	(0.345)	(0.339)	(0.482)
Witnessed an Civilian wounded, killed, or dead	0.114	0.107	0.293
	(0.318)	(0.309)	(0.456)
Observations	718	628	229

Means are obtained from Wave IV of the National Longitudinal Study of Adolesccent Health. Standard deviantions are in parentheses.

Table B5
Summary Statistics for Risk Tolerance by Sex in Wave V

	Males			Females		
	Full Military	Veterans	Civilians	Full Military	Veterans	Civilians
Risk Loving	0.401	0.392	0.349	0.241	0.242	0.215
	(0.491)	(0.489)	(0.477)	(0.429)	(0.430)	(0.411)
Risk Neutral	0.313	0.313	0.339	0.352	0.342	0.305
	(0.464)	(0.464)	(0.473)	(0.479)	(0.476)	(0.460)
Risk Averse	0.273	0.282	0.291	0.401	0.409	0.462
	(0.446)	(0.450)	(0.454)	(0.492)	(0.493)	(0.499)
Observations	556	479	4,045	162	149	6,105

Standard deviations are in parentheses. Means are generated using Wave IV and Wave V of the National Longitudinal Study of Adolescent Health

Table B6.A
Tabulations of Risky Behaviors (Full Military Sample)

	=1 in Wave IV	=1 in Wave V	=1 in both waves	Switched from =0 in Wave IV to =1 in Wave V	Switched from =1 in Wave IV to =0 in Wave V
Ever been arrested	237	262	198	64	39
Ever spent time in a correctional facility	120	112	69	43	51
Fighting	41	21	3	18	38
Smoker	130	200	79	121	51
Drinker	572	561	479	82	93
Heavy Drinker	117	76	36	40	81
Used Marijuana	375	446	345	101	30
Used other drugs	235	75	32	43	203

Table B6.B
Tabulations of Risky Behaviors (Veterans Sample)

	=1 in Wave IV	=1 in Wave V	=1 in both waves	Switched from =0 in Wave IV to =1 in Wave V	Switched from =1 in Wave IV to =0 in Wave V
Ever been arrested	211	242	181	61	30
Ever spent time in a correctional facility	110	106	66	40	44
Fighting	39	20	3	17	36
Smoker	115	188	73	115	42
Drinker	499	490	416	74	83
Heavy Drinker	111	72	34	38	77
Used Marijuana	335	405	311	94	24
Used other drugs	214	70	32	38	182

Table B7.A
Estimates of Combat Events on Risky Behaviors in Wave V (Full Military Sample)

	Ever been arrested	Reported Arrested	Correctional Facility	Reported Facility	Fighting	Smoker	Drinker	Heavy Drinker	Used Marijuana	Used Other Drugs
Panel A: Combat										
Combat	-0.0201	-0.0629	-0.0363	-0.0356	-0.00311	0.0155	-0.0219	-0.0236	0.00310	-0.0134
	(0.0520)	(0.0525)	(0.0327)	(0.0400)	(0.00369)	(0.0467)	(0.0414)	(0.0247)	(0.0513)	(0.0278)
Panel B: Deployment Length										
Time in Combat (months)	-0.00270	-0.00348*	-0.00114	-0.00164	-0.000363*	-0.000482	0.00156	-0.000466	-0.000432	0.000213
	(0.00173)	(0.00187)	(0.00131)	(0.00158)	(0.000214)	(0.00148)	(0.00124)	(0.000998)	(0.00164)	(0.00101)
Deployment Length:										
7 to 12 months	-0.0961	-0.101	-0.0415	-0.0754	-0.00230	-0.0319	-0.0953*	-0.0277	-0.0639	-0.0175
	(0.0636)	(0.0651)	(0.0395)	(0.0479)	(0.00373)	(0.0590)	(0.0578)	(0.0296)	(0.0655)	(0.0364)
More than 12 months	-0.0531	-0.0770	-0.0631*	-0.0763*	-0.00576*	0.0612	-0.0279	-0.0299	-0.0694	-0.00117
	(0.0592)	(0.0608)	(0.0354)	(0.0449)	(0.00299)	(0.0566)	(0.0503)	(0.0282)	(0.0613)	(0.0343)
Panel C: Enemy Firefights										
Ever engaged in enemy firefight	0.0890	0.0489	-0.0227	0.00897	-0.00140	0.0653	0.0177	0.0104	0.0648	0.000234
	(0.0587)	(0.0585)	(0.0362)	(0.0464)	(0.00410)	(0.0520)	(0.0460)	(0.0291)	(0.0553)	(0.0315)
Enemy Firefights:										
1 to 3	0.110	0.0592	-0.0418	0.0144	0.000371	0.0341	0.0229	-0.00658	0.0959	-0.0469
	(0.0848)	(0.0837)	(0.0504)	(0.0665)	(0.00775)	(0.0724)	(0.0628)	(0.0392)	(0.0764)	(0.0372)
4 to 11	0.226**	0.196*	0.0286	0.119		0.137	-0.0274	0.198***	0.137	0.0668
	(0.101)	(0.104)	(0.0709)	(0.0860)		(0.101)	(0.0819)	(0.0758)	(0.0979)	(0.0637)
12 or more	0.0362	0.00151	-0.0159	-0.0330	0.00318	0.0615	0.0227	-0.0459	0.0560	0.0361
	(0.0856)	(0.0860)	(0.0534)	(0.0660)	(0.00747)	(0.0794)	(0.0695)	(0.0323)	(0.0815)	(0.0489)
Panel D: Exposure to Injury and Death										
Wounded	0.206**	0.166	0.0865	0.111	0.00159	0.0249	-0.0417	-0.0274	0.172*	0.0846
	(0.105)	(0.101)	(0.0697)	(0.0814)	(0.00725)	(0.0829)	(0.0833)	(0.0403)	(0.0956)	(0.0578)
Killed (or believed killed) someone	0.132**	0.0998	0.0426	0.0527	0.000496	0.0772	0.0217	0.0208	0.0536	0.0202
	(0.0645)	(0.0643)	(0.0430)	(0.0518)	(0.00548)	(0.0584)	(0.0494)	(0.0332)	(0.0612)	(0.0350)
Saw an ally, enemy, or civilian wounded, dead, or killed	-0.000362	-0.0472	-0.0422	-0.0522	0.00156	0.120**	0.00509	0.0118	0.118**	0.0245
	(0.0533)	(0.0532)	(0.0329)	(0.0409)	(0.00449)	(0.0499)	(0.0420)	(0.0278)	(0.0512)	(0.0300)
Observations	706	717	715	717	665	717	717	701	714	701

Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table B7.B
Estimates of Combat Events on Risky Behaviors in Wave V (Veterans Sample)

	Ever been arrested	Reported Arrested	Correctional Facility	Reported Facility	Fighting	Smoker	Drinker	Heavy Drinker	Used Marijuana	Used Other Drugs
Panel A: Combat										
Combat	0.00833	-0.0539	-0.0101	-0.0196	-0.00423	0.0509	-0.0575	-0.0118	0.0258	-0.0194
	(0.0571)	(0.0578)	(0.0369)	(0.0444)	(0.00406)	(0.0532)	(0.0460)	(0.0155)	(0.0551)	(0.0306)
Panel B: Deployment Length										
Time in Combat (months)	-0.000468	-0.00184	2.95e-05	-0.000678	-0.000431*	0.00126	-0.000352	0.000115	-0.000599	-0.00160
	(0.00236)	(0.00255)	(0.00175)	(0.00208)	(0.000228)	(0.00249)	(0.00189)	(0.000805)	(0.00250)	(0.00138)
Deployment Length:										
7 to 12 months	-0.0704	-0.101	-0.0157	-0.0618	-0.00421	-0.00654	-0.157**	-0.0185	0.00673	-0.0289
	(0.0722)	(0.0733)	(0.0483)	(0.0560)	(0.00305)	(0.0677)	(0.0667)	(0.0179)	(0.0692)	(0.0380)
More than 12 months	-0.00382	-0.0564	-0.0384	-0.0676	-0.00553**	0.0998	-0.0598	-0.0116	-0.0372	-0.0171
	(0.0661)	(0.0671)	(0.0427)	(0.0501)	(0.00259)	(0.0659)	(0.0581)	(0.0192)	(0.0667)	(0.0353)
Panel C: Enemy Firefights										
Ever engaged in enemy firefight	0.110*	0.0458	-0.0102	-0.00862	-0.000389	0.0735	-0.0341	0.00954	0.0593	0.000833
	(0.0646)	(0.0641)	(0.0422)	(0.0502)	(0.00462)	(0.0593)	(0.0516)	(0.0194)	(0.0594)	(0.0352)
Enemy Firefights:										
1 to 3	0.0825	0.0357	-0.0354	-0.00490	0.00444	0.0136	-0.0183	-0.000214	0.0667	-0.0481
	(0.0903)	(0.0890)	(0.0567)	(0.0703)	(0.00969)	(0.0795)	(0.0695)	(0.0256)	(0.0813)	(0.0399)
4 to 11	0.288**	0.207*	0.0293	0.0872		0.163	-0.0963	0.159**	0.0831	0.0390
	(0.112)	(0.114)	(0.0861)	(0.0932)		(0.116)	(0.0930)	(0.0651)	(0.108)	(0.0668)
12 or more	0.0949	0.0108	0.0187	-0.0389	0.00318	0.0891	-0.0364	-0.0247	0.0974	0.0612
	(0.0984)	(0.0970)	(0.0655)	(0.0738)	(0.00791)	(0.0916)	(0.0829)	(0.0206)	(0.0867)	(0.0572)
Panel D: Exposure to Injury and Death										
Wounded	0.152	0.123	0.0443	0.0507	0.000495	0.0225	-0.0524	-0.0188	0.138	0.0403
	(0.108)	(0.105)	(0.0699)	(0.0811)	(0.00685)	(0.0869)	(0.0867)	(0.0242)	(0.0967)	(0.0546)
Killed (or believed killed) someone	0.148**	0.0776	0.0641	0.0269	0.00267	0.0926	-0.0233	0.0151	0.0457	0.0220
	(0.0720)	(0.0709)	(0.0507)	(0.0566)	(0.00642)	(0.0667)	(0.0561)	(0.0221)	(0.0666)	(0.0392)
Saw an ally, enemy, or civilian wounded, dead, or killed	0.0114	-0.0628	-0.0357	-0.0688	-0.00126	0.157***	-0.0157	0.00414	0.0919*	0.0207
	(0.0581)	(0.0580)	(0.0372)	(0.0443)	(0.00405)	(0.0569)	(0.0465)	(0.0179)	(0.0557)	(0.0335)
Observations	619	627	611	627	588	627	627	612	626	612

Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

APPENDIX C

Imminent Danger Pay Qualifying Areas

Designated Locations		Includes			Effective	
County	**Province (State), City or Region**	**Air Space**	**Land**	**Water**	**From**	**Through**
Afghanistan		X	X		Nov 1, 1988	
Algeria			X		Mar 7, 1995	
Azerbaijan			X		Jun 9, 1995	
Burundi			X		Nov 29, 1996	
Cameroon	Far North		X		Jun 7, 2017	
	North		X		Jun 7, 2017	
Chad			X		Aug 11, 2008	
Colombia			X		Jun 1, 1985	
Congo, Democratic Republic of (formerly Zaire)			X		Nov 29, 1996	
*Cote D'Ivoire			X		Feb 27, 2003	May 31, 2020
Cuba	(Note 5)				Dec 26, 2006	
Djibouti			X		Jul 31, 2002	
Egypt			X		Jan 29, 1997	
*Eritrea			X		Jul 31, 2002	May 31, 2020
Ethiopia			X		Sep 13, 1999	
Greece	(Note 6)		X		Mar 27, 2007	Dec 1, 2017

*Indonesia (City)	Jakarta		X		Jun 1, 2014	May 31, 2020
*Indonesia (Provinces)	Central Java		X		Jun 1, 2014	May 31, 2020
	East Kalimantan		X		Jun 1, 2014	May 31, 2020
	Central Sulawesi		X		Jun 1, 2014	
	Papua		X		Jun 1, 2014	
	Aceh		X		Jun 1, 2014	May 31, 2020
Iran			X		Nov 4, 1979	
Iraq		X	X		Sep 17, 1990	
Israel			X		Jan 31, 2002	
Jordan			X		Jan 29, 1997	
Kenya			X		Jul 31, 2002	
Kosovo		X	X		Jun 22, 1992	
Lebanon			X		Oct 1, 1983	
Libya		X	X		Mar 19, 2011	
Malaysia	Sabah		X		Jun 1, 2014	
Mali			X		Jun 7, 2017	
Mediterranean Sea	(Note 7)			X	Mar 19, 2011	
Niger			X		Jun 7, 2017	
Pakistan			X		Nov 29, 1996	
Philippines	Mindanao		X		Oct 5, 2017	
	Sulu Archipelago		X		Oct 5, 2017	
*Saudi Arabia			X		Sep 14, 2019	

Somalia		X	X		Sep 28, 1992	
Somalia Basin	(Note 8)			X	Dec 26, 2006	
South Sudan		X	X		Jul 9, 2011	
Sudan		X	X		Oct 4, 1993	
Syria			X		Jul 31, 2003	
		X			Sep 21, 2014	
Tunisia		X	X		Mar 19, 2011	
Turkey	(Note 9)		X		Jan 29, 1997	
	(Note 10)	X			Mar 1, 1998	
Uganda			X		Jan 19, 2000	
Yemen			X		May 25, 1999	

NOTES:

1. The designation of a land area encompasses all internal waters, unless otherwise noted. For HFP and/or IDP purposes, the term "internal waters" is defined as waters landward of the baseline, drawn in accordance with international law.
2. The designation of a water area (such as the Persian Gulf) includes the territorial seas of those waters, but not the internal waters of the coastal lands. For example, all waters of the Persian Gulf seaward of the baseline of the coastal states, drawn in accordance with international law, would be included in the Persian Gulf designation.
3. Unless otherwise specifically indicated, airspace is NOT part of the included area. When airspace is specifically included, it will normally be that space directly vertically above the approved land or sea area.
4. This figure reflects all designated areas, which were active within the last six years.
5. Limited to Service members performing duties within the Joint Task Force Guantanamo Bay Detention Facilities.
6. Land area within a 20-km radius from the center of Athens (38° 01' N, 23° 44' E).
7. Water area of the Mediterranean Sea extending from the North African Coast northward into Mediterranean Sea, bounded on the east at: 26° 00' E longitude; extending north to: 34° 35' N latitude; and extending west to: the East Coast of Tunisia.

8. Water area of the Somalia Basin with coordinates:
   - 11°10'N-51°15'E;
   - 06°00'N-48°30'E;
   - 05°00'N-50°30'E;
   - 11°30'N-53°34'E;
   - 05°00'N-50°30'E;
   - 01°00'N-47°00'E;
   - 03°00'S-43°00'E;
   - 01°00'S-41°00'E; and
   - 06°00'N-48°30'E.
9. Excluding Izmir and the Turkish Straits (i.e., the Dardanelles; the Sea of Marmara; and the Bosporus Straits).
10. Airspace: south of 37°45'N; and east of 43°00'E

Source: Department of Defense Financial Management Regulation, Volume 7A, Chapter 10, p. 10-7 – 10-9.

APPENDIX D

Designated Combat Zones

Authority	**Location(s) to include the airspace above**	**Effective Dates**	
		From	**Through**
Executive Order 12744 (The Arabian Peninsula Areas)	▪ Arabian Sea (North of 10 degrees North Latitude and West of 68 degrees East Longitude; ▪ Bahrain; ▪ Gulf of Aden; ▪ Gulf of Oman; ▪ Persian Gulf; ▪ Iraq; ▪ Kuwait; ▪ Qatar; ▪ Oman; ▪ Red Sea; ▪ Saudi Arabia; and ▪ United Arab Emirate	January 17, 1991	
Executive Order 13119	▪ Albania; ▪ The Adriatic Sea; ▪ The Federal Republic of Yugoslavia (Serbia/ Montenegro); and ▪ The Ionian Sea north of the 39th parallel	March 24, 1999	
Executive Order 13239	Afghanistan	September 19, 2001	

Source: Department of Defense Financial Management Regulation, Volume 7A, Chapter 44, p. 44-14.

APPENDIX E

2022 Veterans Disability Compensation Rates

Compensation rates for Veterans with a 10% to 20% disability rating (in U.S. dollars):

Note: If you have a 10% to 20% disability rating, you will not receive a higher rate even if you have a dependent spouse, child or parent.

Disability Rating	**Monthly payment**
10%	152.64
20%	301.74

Compensation rates for Veterans with a 30% to 60% disability rating with a dependent spouse or parent, but no children (in U.S. dollars):

Dependent Status	**30% disability rating**	**40% disability rating**	**50% disability rating**	**60% disability rating**
Veteran alone (no dependents)	467.39	673.28	958.44	1214.03
With spouse (no parents or children)	522.39	747.28	1050.44	1325.03
With spouse and 1 parent (no children)	566.39	806.28	1124.44	1414.03
With spouse and 2 parents (no children)	610.39	865.28	1198.44	1503.03
With 1 parent (no spouse or children)	511.39	732.28	1032.44	1303.03
With 2 parents (no spouse or children)	555.39	791.28	1106.44	1392.03

Added amounts (in U.S. dollars):

Dependent Status	**30% disability rating**	**40% disability rating**	**50% disability rating**	**60% disability rating**
Spouse receiving Aid and Attendance	51.00	68.00	86.00	102.00

Compensation rates for Veterans with a 70% to 100% disability rating with a dependent spouse or parent, but no children (in U.S. dollars):

Dependent Status	70% disability rating	80% disability rating	90% disability rating	100% disability rating
Veteran alone (no dependents)	1529.95	1778.43	1998.52	3332.06
With spouse (no parents or children)	1659.95	1926.43	2165.52	3517.84
With spouse and 1 parent (no children)	1763.95	2045.43	2299.52	3666.94
With spouse and 2 parents (no children)	1867.95	2164.43	2433.52	3816.04
With 1 parent (no spouse or children)	1633.95	1897.43	2132.52	3481.16
With 2 parents (no spouse or children)	1737.95	2016.43	2266.52	3630.26

Added amounts (in U.S. dollars):

Dependent Status	70% disability rating	80% disability rating	90% disability rating	100% disability rating
Spouse receiving Aid and Attendance	119.00	136.00	153.00	170.38

Compensation rates for Veterans with a 30% to 60% disability rating with dependents including children (in U.S. dollars):

Dependent Status	30% disability rating	40% disability rating	50% disability rating	60% disability rating
Veteran with 1 child only (no spouse or parents)	504.39	722.28	1020.44	1288.03
With 1 child and spouse (no parents)	563.39	801.28	1118.44	1407.03

With 1 child, spouse, and 1 parent	607.39	860.28	1192.44	1496.03
With 1 child, spouse, and 2 parents	651.39	919.28	1266.44	1585.03
With 1 child and 1 parent (no spouse	548.39	781.28	1094.44	1377.03
With 1 child and 2 parents (no spouse)	529.39	840.28	1168.44	1466.03

Added amounts (in U.S. dollars):

Dependent Status	**30% disability rating**	**40% disability rating**	**50% disability rating**	**60% disability rating**
Each additional child under age 18	27.00	36.00	46.00	55.00
Each additional child over age 18 in a qualifying school program	89.00	119.00	149.00	178.00
Spouse receiving Aid and Attendance	51.00	68.00	86.00	102.00

Compensation rates for Veterans with a 70% to 100% disability rating with dependents including children (in U.S. dollars):

Dependent Status	**70% disability rating**	**80% disability rating**	**90% disability rating**	**100% disability rating**
Veteran with 1 child only (no spouse or parents)	1615.95	1877.43	2109.52	3456.30
With 1 child and spouse (no parents)	1754.95	2035.43	2287.52	3653.89
With 1 child, spouse, and 1 parent	1858.85	2154.43	2421.52	3802.99

With 1 child, spouse, and 2 parents	1962.95	2273.43	2555.52	3952.09
With 1 child and 1 parent (no spouse	1719.95	1996.43	2243.52	3605.40
With 1 child and 2 parents (no spouse)	1823.95	2115.43	2377.52	3754.50

Added amounts (in U.S. dollars):

Dependent Status	**70% disability rating**	**80% disability rating**	**90% disability rating**	**100% disability rating**
Each additional child under age 18	64.00	73.00	83.00	92.31
Each additional child over age 18 in a qualifying school program	208.00	238.00	268.00	298.18
Spouse receiving Aid and Attendance	119.00	136.00	153.00	170.38

Source: Department of Veterans Affairs. (2022). *2022 Veterans disability compensation rates.* Retrieved December 22, 2021, from https://www.va.gov/disability/compensation-rates/veteran-rates/.